Experiencing the Smart Learning Journey

A Pedagogical Inquiry

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List of Abbreviations

ANT – Actor Network Theory

AR – Augmented Reality

AT – Activity Theory

CHAT – Cultural Historical Activity Theory

CoD – Category of Description

GPS – Global Positioning System

GT – Grounded Theory

ICT – Information Communication Technology

LGC – Learner Generated Content

LMS – Learning Management System

NFC – Near Field Communication

NLP – Natural Language Processing

ML – Machine Learning

MOOC – Massive Open Online Course

PBL – Place-based learning

PECSL – Pedagogy of Experience Complexity for Smart Learning

PoI – Point of Interest (a real world location)

P(n) – Participant (number of)

QCA – Qualitative Content Analysis

SE – System Element

SL – Smart Learning

SLA – Smart Learning Activity

SLE – Smart Learning Environment

SLJ – Smart Learning Journey

SoA – Structure of Awareness

SOLO – Structure of the Observed Learning Outcome (taxonomy)

TEL – Technology Enhanced Learning

VLE – Virtual Learning Environment

VT – Variation Theory

Glossary

Term	Definition or summary
Analytics	A process in which a computer examines information using mathematical methods in order to find useful patterns
Algorithm	A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer
Augmented Reality	A term to indicate a digital augmentation of some object in reality; either layering virtual reality 3-D objects observed in a digital visual interface or by accessing context-aware content by the user at that time and place.
Data	A unit (or units) of digital information
Global Positioning System	Satellite navigation system. 'GPS' is owned by the US Gov., but is also used as a general term for location based mapping.
Hyperlocal	Usually information oriented around a well-defined community with primary focus directed toward concerns of that community
Intelligent Tutoring System	An intelligent tutoring system is a system by which content and learning pathways can be delivered to learners according to their needs, determined in various ways, often by interactions data
Interactive	Interactive usually refers to a digital environment where users can engage in interactivity with the environment
Interface	An interface refers to a digital panel where a user can interact with features or functions
Internet Of Things	A technical infrastructure whereby objects, devices and services can interact with each other via data
Learning Analytics	Interactions data derived from participating in digital learning activities
Machine Learning	Data that is interpreted using algorithms to produce intelligent responses
Natural Language Processing	The application of computational techniques to the analysis and synthesis of natural language and speech
Near Field Communication	The system by which beacons or other digital broadcast sensors are placed to interact with personal or other digital devices such as smart systems (e.g. ring, nest)
Point Of Interest	A point of interest is a place in the real world, a particular location with a feature that may often be augmented digitally
Smart Education	Smart education usually refers to a variety of digital systems that will contribute to a more effective digital learning support for the learner
Smart Environment	A smart environment usually refers to an environment that is enhanced by either sensory or other augmentation digital technologies
Smart Learning	Smart learning can mean learning within a smart city or smart environment context, to be an approach to learning that encourages a more effective and engaged learner and interactions
Smart Objects	Smart objects may be digital or non-digital objects that are augmented with digital features and functions
Smart Pedagogy	Smart pedagogy is a term that may appear in smart learning discourses to discuss ways to enhance the learning experience for a learner in a smart environment
Teaching Analytics	See learning analytics

Definitions compiled with support from Wikipedia, Oxford and Cambridge Dictionaries, literature.

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Abstract

This study investigates smart learning conceptualised as real world journeys formed of a series of geo-spatially relevant points of interest related to a topic of learning, with digital interactions providing access to context-aware content. Using free mobile apps to provide digital augmentation and interactions, two smart learning journeys were implemented, 'Literary London' in London, UK, and 'Malta Democracy' in Valletta, Malta.

Real-world learning environments can increasingly be augmented by technology to support interactive engagement or participant contributions, therefore investigating how we might understand pedagogy in these future smart learning scenarios is useful to guide activity design and potential measurement of effective learning. Phenomenography, the chosen methodology of the study, is novel in the field of investigating smart learning experiences, and places the researcher in the shoes of the participants themselves. This study investigated what may be of value or considered as learning from the participants perspective, and showed that unplanned or incidental learning may be of much value in these kinds of activities. In relation to the research questions, outcomes of the study suggest possible ways to measure the process for and content of effective smart learning, offers a practical pedagogical model of considerations based in connectivist principles to plan for participant experience complexity, and indicates how this might inform design for smart learning.

Twenty-four participants took part in phenomenographic semi-scripted emergent interviews, reflecting on their experiences of participating in a smart learning journey. Interviews were analysed at individual and collective level to discover variation and commonality of experience across all transcripts. This resulted in a series of phenomenographic 'outcome spaces' of relational categories of description for ways of experiencing a smart learning journey. 'Experiencing the Smart Learning Journey', the primary outcome space, consisted of four categories of description, with four levels of experience complexity in each. In order to apply these findings to pedagogical practice, the primary outcome space was considered as four experience relevance structures, to facilitate planning for this kind of experience complexity in activity design. This led to related pedagogical insights and formed the Pedagogy of Experience Complexity for Smart Learning (PECSL). The PECSL is composed of a four-tier model of considerations: the experience relevance structures, related pedagogies, pedagogical relevance structures and further epistemological contexts. Inspired in part by user-centred design, these offer a series of iterative flexible considerations to support scoping,

planning and design of similar smart learning activities. The PECSL tiers can be further aligned with cognitive domain factors using Bloom’s Revised and SOLO taxonomies for potential measurement of the effectiveness of any learning that may be present or possible in an activity, acknowledging implicit as well as planned learning outcomes. This is demonstrated by analysis of learner generated content from participants in the smart learning journeys in this study.

The PECSL does not set out to be a definitive guide to smart learning, as different researchers may discover different aspects of significance depending on the nature and aspects of interest in their study. Every activity, group of participants and group of locations are different and may create different experiences and meanings. While acknowledging these differences, the PECSL may offer a 'thinking and planning roadmap' of considerations to indicate areas of experience relevance, related pedagogical approaches, pedagogical relevance structures and underlying epistemological context to inform decision making in the design and development process of a smart learning activity.

1 INTRODUCTION

1.1 Rationale

Rationale is outlined for scoping a pedagogical inquiry into smart learning activities situated in geo-spatially relevant locations manifesting as ‘smart learning journeys’. This seeks to provide reasoning for decisions made in this investigation and is determined by:

a) The nature of the research questions and of the data required to contribute to research solutions;
b) The role of connectivism and connected pedagogies in contributing to a deeper understanding of smart learning and smart learning activities, and the formulation of any pedagogical guidelines for smart learning activities and environments;
c) Consideration of gaps in current discourse relating to smart learning activities and environments that has led to the formulation of the research questions;
d) Anticipated types of connected learner technologically mediated interactions and their role in smart learning, that may serve to illustrate the technically fluid and changing backdrop of connected smart learning.

1.2 Defining concepts and scope

1.2.1 An introduction to smart learning

This study seeks to investigate the experience of taking part in a smart learning journey. The smart learning journey and its constituent parts are discussed in greater detail in subsequent sections of this work (particularly chapter four). Here it is useful to provide a short outline of what smart learning is, and contexts of smart learning as an activity in a journey environment.

The term ‘smart learning’ is variously described in literature as ‘better, faster learning (Koper, 2014), ‘efficient, effective and engaged learning’ (Spector, 2014) or in more technically orientated ways such as physical environments “with digital, context-aware and adaptive devices” (Isaksson, Naeve, Lefrère & Wild, 2017, p. 79). Smart learning and environments appear inextricably intertwined, often interchangeable as terms. Spector (2014) states that the International Association of Smart Learning Environments[1] “embraces a broad interpretation of what constitutes a smart learning environment”, that “a learning environment can be considered smart when it makes use of adaptive technologies or when it is designed to include innovative features and capabilities that improve understanding and performance” (2014, p. 2). Spector discusses what makes people ‘smart’, and envisions smart learning environments as having features or elements that might support collaboration, intentional learning, “an environment […] (with) at least roughly defined boundaries […] a variety of tools and technologies to support learning”, and “(a) smart learning environment, in keeping with the emphasis on efficacy, is one that is generally conducive to and supportive of learning” (2014, p. 3). Dron observes that “(c)ommon definitions of smart learning environments focus on the tools” (2018), going on to define ‘dumb learning environments’ and ‘stupid learning environments’, considering the smartest environment as one-to-one teaching, “the condition under which learning occurs” (2018, p. 4).

Though defining smart learning remains elusive, some commonalities arise in related discourses, such as personalised learning experiences enhanced by intelligent non-human agents, just-in-time delivery of information, the significance of geospatial relevance for content delivery selection and notions about socio-temporal glocality (Meyrowitz 2005) in the persistent collaborative learning interactions taking place (Lister, 2018). Summing up where we are now at time of writing (2021), attempting to capture defining characteristics appears to continue to be dependent on the perspective of the argument at hand, as “conceptual uncertainty… comes forth from the varying perspectives researchers have taken to define smart learning” (Budhrani, Ji & Lim, 2018). Budhrani et al. examined core conceptual elements in scholarly discourses of smart learning, finding three distinct perspectives: emphasis on smarter technologies, developing the ‘smarter learner’, and citing Kinshuk, Chen, Cheng & Chew (2016) who indicate the need for ‘smarter pedagogies’ (Budhrani et al, 2018, p. 3). Kinshuk et al. state that “(i)n order to provide learners with a learning environment that makes effective use of technological advances, teaching methodologies and learning strategies also require changes” (2016, p. 564). They argue that there is an increasing

[1] IASLE; see http://www.iasle.net/

shift from formal to informal learning, more emphasis on 'micro social' interactions and generation of knowledge, noting that "learning can and does happen in any environment, interaction and conversation that the learners engage in" (2016, p. 567). This last observation echoes Dron's, that models of smart learning environments 'tend to see learning as the achievement of specified learning goals, rather than a complex conversational process that can and usually does lead to much that is of value beyond what is planned", then noting that few models "provide the means to learn from the learners, apart from in predefined ways" (2018, p. 3). The requirement then, for a 'smarter pedagogy' as observed by Kinshuk et al. seems apparent, and supports the positioning of this study, to investigate informal learning that may be happening in interactions, conversations and engagements within the environments that learners operate in.

As I describe in other work (Lister, 2022), learning journeys set in real world places are not new, as location based and mobile learning pedagogies testify. These pedagogies are sometimes concerned with 'just in time' emergent learning (Blaschke & Hase, 2016, p. 29), and focus on learning at work or informal learning based inquiry. Smart learning journey activities are the most recent manifestations of these kinds of activities, and further constitute pedagogies for learning in digitally augmented real world environments with more advanced technologies or 'ubiquitous computing' environments. This attempts to offer the "better, faster learning" of Koper (2014) but perhaps does not always require sophisticated technological infrastructure, only the connectivity of WiFi and the use of a smartphone. Digital augmentation of local features can accurately provide context-aware content and learning, yet are often controlled by the learner autonomously, so are more able to respond to learning opportunities and interactions at that time and place, in the "bottom up, piecemeal manner" that Dron alludes to (2018, p. 3).

In chapter 2 (section 2.1) I discuss some of the different ways that smart learning is pedagogically conceptualised, noting that literature debate is often concerned with how technology interrelates with pedagogy, and the concept of personalised learning as a complex learner ontology (Rezgui, Mhiri & Ghédira, 2014) derived analytics driven experience (e.g. Lorenzo & Gallon, 2019). Some of this debate informs the study for 'connectivist style' approaches to learning (e.g. Karoudis & Magoulas, 2017) and selection of methodology (e.g. Badie, 2018).

1.2.2 Defining smart learning in this study

“Learning to learn, learning to do and learning to self realisation” (Liu et al., 2017b, p. 209).

Liu et al.’s succinct summary of smart learning is utilised in this study to indicate interpretations of learning in the context of an environment that provides 'the motivated learner with what they need' (Siemens, 2006b, p. 119). These concepts will vary in a fluid interpretation of significance as part of the design of an activity, and are interdependent on its location, purpose, aims and the nature of the participants who take part in it.

Though Liu et al. in another publication describe 'learning to learn' as formal education (2017a, p. 48), I suggest here that learning to learn within the context of this study is understood the way Pask (1976) describes teaching people to learn and inducing ‘learning to learn’, noting that gaining versatility for transferring learning from one subject matter to another is a sign of the skill of learning (pp. 139, 144). This supports concepts of transversal skills described variously in UNESCO's Skills for a Connected World (2018), or Lorenzo & Gallon’s (2019) work, further citing Marope, Griffin & Gallagher (2018). Further, Wegerif (2013) characterises ‘education for the internet age’ as "learning to learn, think and thrive in the context of working with multiple perspectives and ultimate uncertainty” (2013, preface), while Papert’s “art of learning” is “learning to learn, think and play” (1993, p. 82). In this study, learning to learn might be considered in these ways, and may be somewhat emphasised as part of effective smart learning, in terms of how participants self-report their experiences of motivation, engagement and value in activity participation.

'Learning to do' is described in Lui et al., 2017a as 'learn to use’, indicating professional, vocational education and training. In the sense of ‘do’ being skills and competencies, one might consider this to be a versatile summary of the aims and purpose of an activity, perhaps having explicit learning outcomes relating to a competency in a topic of knowledge or a practical skill. This might also be thought of in relation to broader aspects of skills, such as ability to use digital tools, or conversance with other related aspects of an activity such as citizen roles and responsibilities, local government systems or health care provision.

'Learning to self realisation' is illustrated by Sultana's (2018) descriptions of ‘developmentalist’ and ‘emancipatory’ approaches to concepts of skills in society. The ‘developmentalist’ focuses on “personal growth and fulfillment [...] to facilitate self-exploration and self-construction”. The ‘emancipatory approach’ seeks to “develop the knowledge that leads to freedom” (p. 65). Self realisation in this study might be thought of in this way, as part of supporting notions of the quality of citizen life in a smarter connected urban environment, such as Vinod Kumar (2019) outlines in his "paradigms of well-being” for smart learning environments, with factors such as relationships with self and community and understanding self more clearly, seeing ourselves in others, self-realisation (p. 43).

1.2.3 What is being investigated

Defining the phenomenon to be investigated in this study

To specify and define the nominated phenomenon of investigation requires acknowledging several features of it. These are briefly outlined below, in pragmatic terms.

The phenomenon - the smart learning activity

The phenomenon of interest to the research is the smart learning activity, defined here as *connectivist-inspired learning activities situated in geo-spatially relevant locations and mediated by technology to enhance learning.*

Situating a smart learning activity in a real world journey

‘Situating a smart learning activity in a real world journey’, for the purpose of this research, means *positioning the smart learning activity in geo-spatially relevant locations: forming a journey of several close by locations that are related to the topic of learning*.

Critical aspects of the phenomenon

Some critical aspects of the phenomenon (Edwards, 2005, p. 100) are derived from prior knowledge and experience of the researcher, within a context of relevant literature, connectivist-style digital tools and system thinking around the complexity of the phenomenon. They have been defined to aid both the semi-structured interview approach, and as a potential analysis lens by which to view experiences of learners. These broad elements are discussed in more depth in later chapters, and are considered to be Place, Knowledge, Collaboration and Technology.

1.2.4 Defining digital tools of a smart learning activity

The following paragraphs provide summaries of mobile apps and web technologies I have personally reviewed and tested that may support the connectivist pedagogical approach and flexible pragmatism entailed in a smart learning activity, in relation to the research questions.

Testing provided hands-on experience of what was available as free mobile apps and technology, and what was possible for learning in a digitally augmented and connected context. Choices benefited from my prior experience and knowledge of software, applications and technologies relevant to this field. Influencing factors for choices of app or platform included considerations for design, functionality, community engagement, learning content hosting and interactions affordances, with learner generated content of particular interest.

Augmented reality apps and immersive learning

Augmented reality can be defined in various ways within educational discourse (e.g. Dunleavy & Dede, 2014, p. 735; Dron, 2018, pp. 2-3; Chen, Liu, Cheng & Huang, 2017, p. 13). Wu, Lee, Chang & Liang (2013) provide a useful analysis, citing Klopfer & Squire (2008), who offer a description of "the idea of augmented reality - how handheld computers can supplement real world interactions, relying on context sensitivity and social interaction to create compelling new media" (p. 209). This reflects in this study, where augmented reality is defined as enabling a 'ubiquitous computing' model where "mediated immersion infuses digital resources throughout the real world, augmenting students' experiences and interactions" (Dunleavy, Dede, & Mitchell, 2009, p. 8).

Dunleavy & Dede note the significance of situated learning as one of two interrelated learning theories (the other being constructivist/interpretivist), for augmented reality and immersive learning. In situated learning theory, "all learning takes place within a specific context and the quality of the learning is a result of interactions among the people, places, objects, processes, and culture within and relative to that given context". This immersive learning context is arguably where, valuable learning can emerge from any combination of these interactions. Dunleavy & Dede note "'immersive' learning experiences within the physical environment, provid(e) educators with a novel and potentially transformative tool for teaching and learning" (p. 736). In the context of successful learning in preparation for future life, "… students "learn how to learn" in a rich environment and then solve related problems in real-world contexts" (p. 737). This further supports understanding of context for Liu et al.'s "learning to learn, learning to do and learning to self-realisation" (2017b) where some emphasis is placed on learning to learn, and may be significant as part of what might be considered as interpretations of effective smart learning in this study. Dunleavy & Dede go on to state that effective instruction in these learning scenarios "can foster learning by providing rich, loosely structured experiences and guidance", emphasising social negotiation, self directed and active learning opportunities to support and facilitate metacognitive learning strategies in the experience" (Dunleavy & Dede, 2014, p. 737). Their work outlines in prescient terms how Kinshuk et al., (2016), Dron (2018) and others increasingly argue for pedagogical approaches that foster real world, engaged, emergent learning in self-directed (autonomous) strategies.

Tools to augment reality for learning have remained fairly constant over the past decade in terms of what is available to ordinary citizens as free smartphone apps, with Aurasma/HP Reveal[2] and Blippar[3] being the two most prominent (neither now available as free apps). Both worked on the principle of image recognition, with additional functionality available in earlier versions. Both have been used widely in various educational research since inception in 2011, for example in school teacher professional development (Holley & Howlett, 2015), higher education student perceptions of AR (Delello, McWhorter & Camp, 2015) or as a tool to learn practical processes (Hobbs & Holley, 2016; Striuk, Rassovytska & Shokaliuk, 2017). Studies may often ask students to develop digital content augmentations themselves.

Augmented reality apps such as Aurasma/HP Reveal and Blippar permit users to find out about their surroundings by accessing context-aware content attached digitally to real-world places or features such as statues, sculpture, doorways or signs. Working in conjunction with a smartphone camera they can trigger interfaces to access digital content for further exploration. HP Reveal was selected for creating these kinds of experiences due to its versatility for interface design to provide interactions for multiple content choice access.

Geospatial data apps

Geospatial data offers benefits to learning in location-based settings by using GPS metadata. DBPedia Places[4] mobile app displays Wikipedia pages associated with GPS coordinates of the mobile device. Alert apps (e.g. Waze[5], Citizen[6]) display and compile places of environmental or safety issues, allowing users to submit their own reports. Early testing of alert apps proved unfruitful due to cost of accounts and limited usefulness. User-learners can benefit from developing community-based maps, (discussed in Lister 2020, 2021d). Using a concept of 'smart learning feedback maps[7]' that display GPS tagged content uploads, I developed and tested a simple prototype using Jotform[8] GPS location form submissions in

[2] HP Reveal (defunct) https://play.google.com/store/apps/details?id=com.aurasma.aurasma&hl=en
[3] Blippar https://www.blippar.com/
[4] DBPedia Places https://play.google.com/store/apps/details?id=com.lauer.dbpediaplacesandroid&hl=en_GB
[5] Waze https://play.google.com/store/apps/details?id=com.waze&hl=en_GB
[6] Citizen https://apps.apple.com/us/app/citizen-connect-and-stay-safe/id1039889567
[7] Smart Learning Feedback Maps http://smartlearning.netfarms.eu/scl-learner-feedback-map/
[8] Jotform is a free or paid form building web app with potentially sophisticated functionality available. https://jotform.com

conjunction with the Sheetsee JavaScript library[9] and Google Sheets geocode scripts[10]. This was not used in the study but contributes to discussion in later chapters and in Lister (2020).

Conversation apps

User uploads and online commenting were considered desirable functionality of learning experiences in this study. Acknowledging privacy issues for user accounts, the study required a secure and private online preferably mobile learning environment, ensuring security of personal data and privacy. After reviewing community platforms such as Disqus[11], Slack[12], Facebook Comments[13] and BuddyPress[14] it was decided that Edmodo[15] offered the best opportunity for commenting in closed, private learning groups, and permitted efficient uploads for learner generated content.

Webpage hosting

An online content management system was needed to host custom content that an activity would require. This could have been hosted in a closed web-based Learning Management System such as Moodle[16] or Blackboard[17], or even in Edmodo. However, HP Reveal worked better when triggering embedded conventional web pages. Therefore, I utilised a self hosted WordPress installation[18], creating the smart learning website[19], this was used to host all original knowledge content authored by tutors for the developed smart learning journey topics. Webpages were only accessible via the AR triggers.

1.3 Aims and Objectives

The aims and objectives of this research are outlined as:

- Research questions and gaps in knowledge
- A statement of the problem and argument, with key quotes

[9] Sheetsee.js http://jlord.us/sheetsee.js/
[10] Geocode https://willgeary.github.io/data/2016/11/04/Geocoding-with-Google-Sheets.html
[11] Disqus https://disqus.com/
[12] Slack https://slack.com/intl/en-gb/
[13] Facebook Commenting plugin https://developers.facebook.com/docs/plugins/comments/
[14] BuddyPress https://buddypress.org/
[15] Edmodo https://new.edmodo.com/
[16] Moodle LMS https://moodle.org/
[17] Blackboard LMS https://www.blackboard.com/teaching-learning/learning-management/blackboard-learn
[18] Wordpress.org https://wordpress.org/
[19] Smart Learning research website http://smartlearning.netfarms.eu/

1.3.1 The research questions

I articulate three research questions, indicating how this study investigates these questions and highlighting the gaps in knowledge that may need addressing. This is followed by contributions to knowledge made by this investigation.

1. How can we measure the effectiveness of smart learning experiences considering both content of learning and process for learning?

Gianni & Divitini (2015) consider smart learning experiences as "a rather complex endeavour" where a mixture of different stakeholders create a "rich learning space", activities often bridging formal and informal learning and often dependent on technological infrastructure to "promote communication”. Zhuang, Tang, Li, & Huang (2017) describe smart learning citizen experiences as "their perceptions, responses and performances to learning resources, learning approaches, in different fields in the city”. Drawing attention to ‘user experience in a technology-rich learning environment’, that ‘people interact with a certain object, and the interaction triggers a variety of factors involved in the experience’, further stating 'experience is both a process and a result, and involves behavior, cognition, as well as emotions and feeling’ (p. 3). It is these experiences that this study is investigating from the perspective of the learner, as self-reported to be of significant awareness to them, within the research methodology of phenomenography. Using the methodology of developmental phenomenography (Bowden, 2000) in a partial elicitation technique responsive interview (after Jarrett, Mouchet, Harvey, Scott, & Light, 2014) may highlight new ways of investigating and measuring this kind of flexible learning.

Gaps:

- Examining learning effectiveness through learner experience variation may demonstrate how to plan for this variation in potential surface to deep learning approaches, discovering some key pedagogical aspects of a smart learning activity manifesting as a journey. This does not appear to be present in literature.
- Measurement of learner experience and learner generated content for effective, flexible, context-aware ‘smart’ learning, for both the process and content of learning is estimated as not present in literature.
- The study may contribute to debate on smarter learning analytics through the concept of learner experience variables data. This is demonstrated by analysing learner generated content using variables comprised of learner experience complexity

variation and equivalent cognitive domain taxonomies. This does not appear present in literature.

2. Can we formulate a practical pedagogical guide for smart learning activities based on connectivist principles?

Though literature exists which examines pedagogical roles in relation to smart learning (e.g. Badie, 2018; Karoudis & Magoulis, 2017; Dron, 2018), it is the nature of the smart learning activity and the investigation of learner experience that is novel here, this being specific to connectivist-inspired, geo-spatially situated activities in real world journeys, as self-reported experience by participants. By situating the learner in places and challenges that create scenarios of natural engagement and discovery (physical, imaginative, creative, sensory), learning can potentially occur on multiple levels. The immersive context that the learner is placed in may elicit the smart learning principles of "learning to learn, learning to do and learning to self realisation", (Liu, Huang & Wosinski, 2017b, p. 209).

Gaps:

- Current smart learning environment literature has not investigated the role of connectivism in a context of pedagogical guidance for smart learning activities.
- Investigating geo-spatially situated smart learning activity pedagogical considerations from the perspective of learner experience variation as a basis for a pedagogical guide is not present in the literature.

3. How does this pedagogical guide inform the design of smart learning?

In this study, the investigation of learner experience specific to connectivist-inspired, geo-spatially situated smart learning activities in real world journeys informs any potential implications in the design for learning.

Gaps:

- Though discussion of pedagogy beyond ICT/ functional frameworks is increasing (e.g. Badie, 2018, ch13), a connectivist-inspired pragmatic pedagogical approach for design of a smart learning activity and environment appears as yet not to have been investigated. Dron (2018) discusses connectivism somewhat, and this study acknowledges his principle of what may constitute effective learning into this project.
- Discussion of design for smart learning 'in the wild' activities relying on free ad-hoc connectivist style smartphone apps and technologies does not appear in the literature.

- Differentiation between smart city learning, smart learning and smart learning environments in relation to how discourse shapes learning design approaches in these differing perspectives is noted as of importance in this study (e.g. Nikolov et al., 2016; Giovanella, Martens & Zualkernan, 2016, in contrast with Karoudis & Magoulas, 2017).

1.3.2 Statement of the problem

Smart learning activities and environments require investigation of new theories and pedagogies by those involved in provision of learning (Hwang, 2014; Gros, 2016a).

1.3.3 Argument

I attempt to formulate a pragmatic pedagogical guide flexible enough for the context-aware "personal, social, distributed, ubiquitous, flexible, dynamic and complex" (Gros, 2016a, p. 2) learning world hinted at by Siemens: "… do we design learning? Or do we design environments in which motivated learners can acquire what they need?" (2006b, p. 119). I investigate what 'effective' smart learning might be in these contexts, using a connectivist-inspired approach. I position the smart learning activity in geo-spatially relevant locations, thereby forming a 'smart learning journey'. The aim of the thesis is to find empirical evidence that supports the following positional statements:

In relation to question one: The smart learning activities that a learner is engaged in, and the subsequent measurement of their experiences, is motivated by establishing notions of what 'effective' smart learning is. Through the work of this study, effective smart learning might be considered as enhancing independent learning in an environment of discovery, dialogue and collaboration, building knowledge for skills, techniques and problem solving in an engaged connected participation.

In relation to question two and three: By situating the learner in places and challenges that create scenarios of natural engagement and discovery (physical, imaginative, creative, sensory), learning can occur on multiple levels. The immersive context that the learner is placed in can elicit the smart learning principles of "learning to learn, learning to do and learning to self realisation" (Liu et al., 2017b)." Learning design is addressed in these participatory pedagogies, as generally to be social constructivist, social constructionist and connectivist in nature, in the context of learner experience variation that emerges from the study.

Concepts of immersive and augmented reality (AR) learning may benefit here from brief further relevant definition. Pombo, Marques, Lucas, Carlos, Loureiro & Guerra (2017) cite Kamarainen et al. (2013), who “specifically point out the unique affordances of AR, as an ‘immersive' interface that enables participants to interact with digital information embedded within the physical environment”. This may refer to AR as a virtual reality visualised interface, rather than augmenting the real world for digital interactions, a distinction made by Dunleavy & Dede (2014) as two forms of AR, "location-aware and vision-based”. In this study I am utilising the first form, location based, not the second, using a mobile app to digitally augment features of real-world locations to provide interactive access to context-related content.

1.3.4 Key quotes in this study

"Researchers and educators need to develop new thoughts about pedagogy based on existing theories, such as constructivism, cognitive load theory and new ones such as connectivism and networked learning" (Gros, 2016a, p.6).

"New learning modes will raise new pedagogic issues, and smart learning is a brand new concept of learning; therefore, researchers or educators may propose new thoughts about its pedagogy based on those existing theories …" (Hwang, 2014, p.11).

"Perhaps even our notion of design is worth rethinking - do we design learning? Or do we design environments in which motivated learners can acquire what they need?" (Siemens, 2006b, p. 119).

Key quotes to define effective smart learning and smart learning environments

“Learning to learn, learning to do and learning to self realisation” (Liu et al., 2017b, p. 209).

“.. a complex conversational process that can and usually does lead to much that is of value beyond what is planned” (Dron, 2018, p. 3).

“…a smart learning environment is one that is effective, efficient and engaging” (Spector, 2014, p. 2).

“Smart learning environments (SLEs) are […] physical environments that are enriched with digital, context-aware and adaptive devices, to promote better and faster learning” (Koper, 2014). topics.

1.4 Outcomes

The key outcomes of this investigation are summarised here, with statements for contribution to knowledge.

1.4.1 Outcomes of investigation

- The phenomenographic outcome spaces derived from a primary and secondary perspective of analysis. These are ‘Experiencing the smart learning journey’, with a single outcome space formed of four categories of four levels of each category, and ‘Experiencing the system elements of a smart learning journey’, with four outcome spaces each with three or four categories, with no further levels.
- The outcome spaces lead to the forming of a four-tier pedagogical model of considerations for smart learning, known as The Pedagogy Of Experience Complexity For Smart Learning (PECSL). This consists of the experience relevance structure, related pedagogies, the pedagogical relevance structure and epistemological context.
- Outcomes are further positioned for:
    - Devising and applying systems of measurement for learning in hybrid flexible autonomous smart learning activities;
    - Adopting a user-centred design approach of iterative PECSL consideration cycles for design of smart learning activities.

1.4.2 Contribution to knowledge and practice

The use of phenomenography as a methodological approach to investigate smart learning activities may be novel for this field. The phenomenographic discovery of learner experience variation in connectivist-inspired smart learning journeys has enabled a four-tier pedagogical model of considerations for smart learning, known as The Pedagogy Of Experience Complexity For Smart Learning (PECSL) to emerge and develop. Consisting of an experience relevance structure, related pedagogies, pedagogical relevance structure and epistemological context, the PECSL offers layers of intertwined considerations rooted in the experience of learners examined at collective level, and derived from the categories of variation in this experience. This model of considerations is a flexible and potentially useful approach to conceptualising, planning, scoping and implementing smart learning activities, particularly those situated as real world journeys. I posit that the contribution to knowledge for this pedagogical model is its basis in collective learner experience, and its hybrid flexibility, placed in a terrain of ad-hoc free smartphone apps, short-life augmented reality enhanced real world locations and connectivist-inspired autonomous participatory activities.

Acknowledging that learning for multiple contexts and purposes can be happening in a smart learning environment, the phenomenographic approach focused on pedagogical inquiry outlined in this investigation demonstrates ways in which learner experience can be examined at collective level for notions of learning effectiveness for both design and measurement of learning in smart learning activities.

Additionally, learner generated content created by participants in these smart learning journeys is assessed using variables derived from a phenomenographic table of experience complexity resulting from the findings of this study, aligned with equivalent Bloom's and SOLO taxonomy factors. I propose that this approach is a novel application of phenomenographic outcome space findings.

1.4.3 Bias, General Ethics and Expert Knowledge

Brief statements of ethical practice, outline on aspects of general bias and ethical permissions are provided here. Considerable discussion on the subject of interview and analysis bracketing (Kvale, 1996, chapter 13; Bowden, 2005, p. 15; Uljens, 1996, p. 121-122; Ashworth & Lucas, 2000) is undertaken in subsequent chapters. Here I provide statements on my position for general bias and ethical considerations.

I then provide information on my own background as a researcher in this field, and how prior knowledge and expertise contributes to the project, and indeed forms part of the data (Uljens, 1996, p. 122; Roisko, 2007, p. 32; Berglund, 2005, p. 62).

Bias

Potential general bias must be declared. I am a former lecturer and senior lecturer in higher education (multimedia and web applications, e-learning academic professional development), thereby potentially having preconceived ideas about knowing, learning, teaching, assessment and the role of students in the learning process. This may influence the interpretation of transcripts or learner generated digital content. However, prior experience may be potentially useful. Marton & Booth declare:

> *"It could be thought that there is room for phenomenographic investigations to be complemented by phenomenological clarification of the experiential grounds of the researcher's reflection on other peoples experiences, as Sandberg (citing in Sandberg, 1994) proposed". (Marton & Booth, 1997, p. 120 footnote)*

Every effort has been made to gather and interpret data as objectively as possible, while acknowledging that interpretations are guided by phenomenographic approaches and orientated towards an educational perspective.

Ethics

Ethics permissions have been obtained for London Metropolitan University Participant Group (1). *Details in Appendix 01.*
Ethics permissions have been obtained for University of Malta Participant Group (2) and Malta Participant group (3). *Details in Appendix 01.*

Ethical Practice

I outline briefly statements of ethical practice applicable to each area of the study.

Of the research as a whole

I have undertaken to proceed in all areas with diligence and professionalism, adhering to ethical requirements and constraints. I adopted an assurance to all participants that I will act at all times taking their privacy and confidentiality into full consideration and not knowingly risk their research data or personal details in any way.

Of the researcher

I have undertaken to practice in all ways as considerately and professionally as I can. I declare that no racial, gender or other demographic bias or prejudice is held by myself in relation to any participant for what they may say or do relating to this study. I have at all times behaved as fairly and equitably as I can to all who have been involved in this study in any role or capacity.

Of the interview

I have undertaken that all interviews have been held under very similar circumstances as far as is possible in practical terms. All participants have been afforded the same opportunities regarding their participation in learning activity journeys and subsequently in participating in interviews. All interviewees have taken part voluntarily. All interviews have been conducted with explicit (signed) permission granted by each interviewee, and with respect and consideration shown towards each person.

Of the data

I have at all times kept data confidential, secure and password protected, on hard drives, both on my Apple Mac laptop and a second Apple Mac computer located at my home (for back up purposes). These machines are regularly scanned for viruses etc and are secure as far as I am able to know.

My position as the researcher

Here I briefly outline my professional past, indicating where prior experience is relevant to this study. Roisko (2007) states:

> *"(w)hen doing qualitative research the researcher is not assumed to be a neutral mechanical data gatherer. Instead, he/she is seen as the main research instrument (e.g. Kvale 1996) […] …instead of trying to close her eyes to the matter the researcher should make her role and position explicit. […] Hence, I next portray myself to give the reader an opportunity to understand my interest in and relationship to the present research" (Roisko, 2007, p. 32).*

My own past is varied. I began working life as a songwriter musician in the music industry, and in so doing had very early exposure to technology and programming. I then spent several years as a market research interviewer, often researching for publications in UK national and international newspapers. As a qualitative interviewer, I carried out semi-scripted interviews via telephone, recording and précising for major industry clients. My interviewing skills resurfaced later in a context of website and app user experience evaluations and client requirements elicitation exercises for medium and large enterprises. Therefore, I have reasonable prior responsive semi-scripted interview experience. Gravitating towards computing, I progressed to freelance web design and new media technology solutions for SME's in London, UK. I then moved into academia after undertaking an MSc in Multimedia Systems as a mature student. After achieving a distinction I was subsequently offered a lecturing role in my university. I lectured for approximately ten years in web and multimedia technologies. I gradually became involved in supporting other academics with their technology enhanced learning practice, then undertaking an MA in Learning and Teaching in Higher Education, achieving a distinction.

My initial exposure to geo-spatial technologies came in the form of Socialight[20], a geo tagging SMS and MMS mobile phone user account network that afforded users the ability to attach SMS messages to geo-tagged locations. It was very ahead of its time. My first (ever) academic presentation was on this topic in 2005, and I had direct contact with the company as they published my self-authored Macromedia Flash animation of how their system worked in a blogpost[21] on their website. I also helped scope a student app concept known as 'Google On the Move' in early 2006, the main thrust of which was utilising mobile phone GPS location coordinates to provide intelligent connections between people and data. Later, academic colleagues and I discussed software that might be used in 'learning journey' discovery settings, such as Mscape[22] and Scavengr[23] (2012). One of these colleagues involved in those early discussions is a part of this study, having co-created and ran the Literary London smart learning journey. In 2013 I scoped a professional geo-spatial mobile app, 'Joynd', that investigated how to integrate NFC functionality in a mobile app for professional networking at conference events.

Summarising with Edwards (2005): "(t)o place the research in context then, my background and assumed knowledge of the phenomenon has proved beneficial in identifying critical aspects of the phenomenon which may have been present in the worldview of some of the various identified categories" (p. 100). Further, Uljens (1996) states "a researcher must always be acquainted with knowledge (theory) in the field that he or she is investigating in order to do a good interpretive job" (p. 122).

1.5 The structure of the thesis

Here I provide a diagram of the flow of thinking developed through each chapter as a brief overview guide for the reader.

[20] Socialight on the payback Machine, circa 2006, showing my blogpost listing. https://web.archive.org/web/20060809190046/http://socialight.com/
[21] My flash animation of the Socialight app, 'The Future of Conversation'. https://web.archive.org/web/20080218193007/http://blog.socialight.com/2006/06/26/47/
[22] Mscape: https://en.wikipedia.org/wiki/Mscape
[23] Scavengr app is now on github https://github.com/NicMcPhee/Scavengr

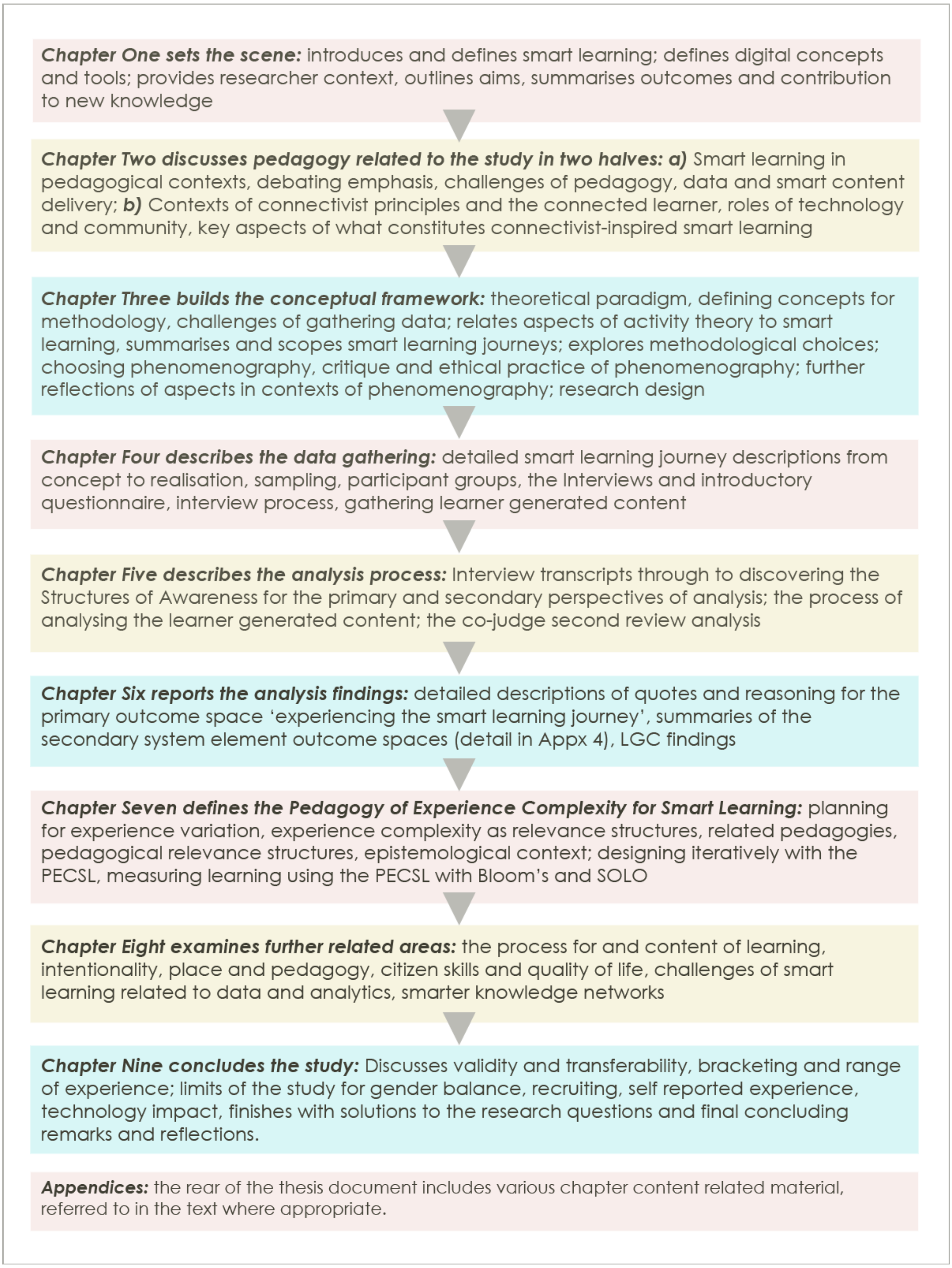

Figure 1 Diagram of Thesis Structure

1.6 Summary, chapter one

Chapter one builds foundation for the study by defining key areas to establish how to progress. I attempted to define smart learning, placing that definition in an interpretation of learning that might contribute to solutions for the research questions. This fed into how I approached the questions by increasing my awareness of key aspects. I examined suitable tools for the technological aspects, contributing further understanding in how to create the kinds of activities suitable for requirements of the research questions.

I reflected on my role and prior experience for the study, my professional ethical position, and have briefly outlined both the questions and the summarised outcomes. Chapter two now examines relevant smart learning literature in pedagogical contexts, further moving on to scoping connectivist inspired learning activities for their potential in smart learning environment scenarios.

2 LITERATURE REVIEW

Chapter two discusses relevant literature in smart learning discourses and connectivist inspired epistemologies for smart learning. I examine literature related to smart learning for pedagogical approaches, challenges to pedagogy, data related and smart learning content knowledge delivery challenges. I go on to examine connectivist-inspired smart learning activities from pedagogical and theoretical perspectives and discuss key aspects of what might constitute a connectivist-inspired learning activity.

Selecting literature

Two areas of literature are selected: to examine pedagogical debates in smart (city) learning, and to examine core literature that may inform concepts of connectivist principles.

To provide context for smart learning and related connectivist principles for activities, relevant terms and concepts are used to search bodies of work through specific databases and and wider afield using Google Scholar, Publish or Perish and Microsoft Academic - often then searching for example ERIC, ProQuest, Web Of Science or Jstor, depending on publication topic. For smart (city) learning, I initially utilised terms or concepts appearing in related systematic literature reviews, e.g. 'learning contexts within technology-enhanced smart city learning research' and 'learning theories and approaches most commonly used' (Gianni & Divitini, 2015, pp. 30-31). I also followed through in work around citizen orientated smart city literature (e.g. Giovanella et al., 2016; Buchem & Pérez-Sanagustín, 2013; Thomas et al., 2016). In this way I formulate understanding for smart city learning and smart learning environments.

I have attempted to select relevant recent publications focusing on learning theory interpretations and pedagogical systems intertwined with technological implementations or concepts. For smart learning, Springer collections particularly served to offer internationally contextualised pertinent and up-to-date work in a variety of analogous learning areas, which have served to provide this study with current contexts for related thinking. These publications may act in some way to broadly represent the terrain relating to pedagogical interpretations of smart learning in smart cities.

Connected pedagogies (Anderson & Dron, 2011) literature is sourced from searches using Google Scholar, library databases or Publish or Perish, and keyword strings (e.g. “participation, engagement, autonomy”, “community, online, digital, learning” or similar). The wider context here considers the scope of ‘connectivist-style’ principles within the historical trajectory of technology-enhanced learning (TEL) that may inform smart learning activities at the time of writing. This is followed by a short section outlining what came to be of significance to understand connectivist-inspired smart learning journey activities and would inform the research design of the study.

2.1 Conceptualising smart learning

Here I discuss the context of pedagogical and technological challenges of smart learning and related activities, attempting to provide a picture of current terrain. Rationale of the study emerges to develop conceptualisations, showing reasoning to form connectivist-inspired pedagogical approaches for smart learning activities.

2.1.1 Introduction

This research concerns smart learning activities in situated locations and environments. Originally focused on learning in 'smart cities', the project evolved to incorporate a broader and more fluid view of smart learning, activities and smart learning environments, as is reflected in recent literature. The difference of perspective can be distinct, yet is also blurred. Literature discourse on learning in 'smart cities' (e.g. Giovanella et al., 2016), focuses on the roles of citizens in smart city environments (Thomas et al., 2016; Mullagh, Blair & Dunn, 2014), and reflects the perspective of a smart city infrastructure, urban planning or issues surrounding urban citizen living in relation to learning. The concept of a ‘smart learning environment' broadens the scope to incorporate any connected environment utilising the wealth of technical applications and networks that may form location-based or geo-spatially tagged learning opportunities. "Smart learning environments (SLEs) have been defined as physical environments "with digital, context-aware and adaptive devices, to promote better and faster learning" (Isaksson et al., 2017, p. 79, citing Koper, 2014). Referring to the definitions of smart learning and environments previously noted in chapter one (Spector, 2014; Koper, 2014), recent work by Dron (2018) differentiates between a centralised and distributed model of a smart learning environment (2018, p. 2) and greater or lesser (harder or softer, 2018, p. 7-8) predetermined impact on learner behaviour and agency. He states that both models “tend to see learning as the achievement of specified learning goals, rather than a complex conversational process that can and usually does lead to much that is of value beyond what is planned” (2018, p. 3). This statement is of significance to this study, as contributes to notions of what may constitute learning effectiveness in the ‘ad-hoc’ smart learning activity experiences being investigated, along with Liu et al.’s “learning to learn, learning to do, and learning to self realisation” (2017b, p. 209).

2.1.2 Pedagogy in smart learning environments

Pedagogical discourse found within smart learning literature manifests in a variety of different perspectives, often situating pedagogical discussion within more technological surroundings. Authors often discuss ways of creating adaptive data driven learning utilising intelligent tutoring systems in personalised ways (e.g. Henning, 2018; Koper, 2014; Hwang, 2014; Liu, Huang & Wosinski, 2017a and many others). Here I briefly critique some work more closely of interest to this study from theoretical or pedagogical perspectives, further summarised in Table 1 to indicate comparison.

The perspective of Nikolov et al. (2016) is the smart city, developing a technologically based pedagogy with considerations for planning and implementation of smart learning environments, “behind which is the convergence of advances and developments in social constructivism, psychology, and technology” (Nikolov et al., 2016, p. 338). Stating that “social constructivism provides a coherent approach to many human activities, including learning design and technology research and practice” (Nikolov et al., 2016, p. 344), they go on to argue that “(b)ecause social constructivism provides a coherent philosophical foundation for learning and instruction, it should be recognised as a pillar of any smart learning environment”, (Nikolov et al., 2016). The major part of their paper concerns implementation of technologies within the planning of a smart city infrastructure. One pedagogical framework is based on Bloom's Revised taxonomy (Anderson & Krathwohl, 2001) in relation to functional affordance of specific technology and applications. Diagrams offer increasingly complex permutations of technology in relation to learning. Badie (2018) espouses 'smart constructivism' as a way of measuring knowledge construction in smart learning environments within the framework of smart education, defined as "an integration of smart objects and systems, smart technologies, smart environments, smart features (smartness levels), smart pedagogy, smart learning and teaching analytics systems" (Badie, 2018, p. 386). His concept seeks to "focus on the development of a conceptual framework for analysing knowledge building in the framework of smart constructivism and over the flow of the learners' understandings". Discussion also includes use of SOLO (Biggs & Collis, 1982) and Bloom's Revised (Anderson & Krathwohl, 2001) taxonomies. Of particular interest is his "conceptual relationship between main components of smart constructivist pedagogy" (Badie, 2018, p. 408) to describe a smart learning environment. Relationships between smart constructivist learning and mentoring are linked by 'desirable strategies' and learning is impacted by conceptions of the world. Henning's "Learning 4.0" (2018) reviews behaviourism, cognitivism, constructivism and connectivism in a context of the digital age, leading to a concept of closing the loop between human and non-human agency for learning. Describing a 'hypercube model' (Henning, 2018, p. 283) technical personalised learning system based on knowledge construction and connected constructivist principles, he goes on to outline a 'future learning model' for Learning 4.0, listing digital, networked, diverse, constructive, media critical, semantically enhanced, adaptive and personalised as key aspects to support a 21st century skills. Karoudis & Magoulas (2017) describe "a layered framework that can link formal, non-formal and informal learning experiences" (Karoudis & Magoulas, 2017, p. 109). Basing their work on a pedagogy-andragogy-heutagogy model in relation to lifelong learning, they argue that "(I)nstructional methodologies for developing lifelong learning skills are mostly based on constructivist theories..." (Karoudis & Magoulas, 2017, p. 110). They consider principles of self-direction, metacognitive awareness and a disposition towards lifelong learning, such as "autonomy, intrinsic motivation, enculturation, discourse and collaboration, and reflection" (Karoudis & Magoulas, 2017, p. 110-111). These factors share much in common with connectivist principles.

Perhaps smart learning models are overly complex in use of terminology and multiple strata. For example, Liu et al. (2017a) describe a smart learning framework that consists of four levels, with three layers in each, with five features in each layer, that seem to overlap each other. Even to describe this framework is a challenge. Though some aspects such as *cognitively explicit* (2017a, p. 41) levels of informal to formal learning are useful, the framework itself might be criticised as being overly thought out, and too complex to fully make sense or practical use of.

Publication	*Theoretical positions*	*Pedagogical strategies*	***Technological/pedagogical relationships*** **IoT integration: Adaptive, monitoring, personalised data, learning analytics**	***Cognitive domain relationships***
Badie, F. (2018). Knowledge Building Conceptualisation within Smart Constructivist Learning Systems	Smart (social) constructivism	Conceptions of learning (Säljö, 1979); levels of understanding; Categories of knowledge; learning and constructing together	Guidance, feedback, hints or tools; right place/ right time based on needs via learning behaviour/performance analysis in online & real-world; adaptive learning status / performance	SOLO: layers of learners' understandings Bloom's revised: clarify categories of knowledge
Nikolov et al.,(2016). Learning in a Smart City Environment	Social constructivism, psychology (cognitivism/behaviourism)	'SECI' four knowledge dimensions model (Socialization, Externalization, Combination and Internalization .	Social, Web 2.0; 'social 3.0' aligned to multiple apps and services; 'Stacking' layers of adaptive tech on to existing LMS towards 'full awareness'; 'transaction tracking and shared data exchange'	Bloom's Revised, closely related to multiple technical apps and services
Karoudis & Magoulas (2017). An Architecture for Smart Lifelong Learning Design.	'Mostly' constructivist; *"Pedagogy, Andragogy, Heutagogy"*	Formal, non-formal, informal learning; self directed, metacognitive awareness, lifelong learning	Cloud based integration of platforms with intelligent tutoring system (service/databases); 'Experience Service Bus' API/IS communication integration; user info modelling	N/A
Henning, (2018). Learning 4.0	Connectivist context, 'recent advances in constructivism'	Personalised knowledge networks with structure and guidance - recommended learning paths & planned behaviour	Reliance on complex intelligent tutoring with micro adaptive integration to manage task and engagement: *Small, indivisible (atomic) Knowledge Object (KO) contributing to large cognitive position*	N/A
Liu et al., (2017a). Characteristics and Framework of Smart Learning	N/A	Anytime, anywhere, in any way, at any pace ('4A') with easy, engaged and effective learning, ('3E', nb. *not* Spector's 3 Es).	Context aware, adaptive, assessment, support, tracking, analytic, organisation and reconstruction.	N/A

Table 1 Example factors of what may constitute smart learning

In a 2014 paper widely cited within smart learning discourse, Hwang lists "interpretations and examination of existing pedagogical theories for smart learning environments" (2014, p. 11) as number two of the research issues in smart learning, as "(n)ew learning modes will raise new pedagogic issues, and smart learning is a brand new concept of learning; therefore, researchers or educators may propose new thoughts about its pedagogy…" (2014, p. 11). Gros (2016a) discusses pedagogical aspects, describing Sharples et al. (2014) take on seamless learning as "when a person experiences a continuity of learning across a combination of locations, times, technologies and social settings" (Gros, 2016a, p. 2). Further, that "learning is fundamentally personal, social, distributed, ubiquitous, flexible, dynamic and complex in nature" (Gros, 2016a, p. 2). This succinctly encapsulates the adaptive hybrid nature of smart learning pedagogy and acknowledges the connectivist concept of learning in the networks. Gros again emphasises that new thinking is required: "…the realisation requires new learning designs based on new pedagogical approaches and a more effective use of technology..." (Gros, 2016a, p. 2).

As stated by Gros (2016a) and Hwang (2014), new pedagogical issues raised by smart learning require researchers to investigate new pedagogical approaches and ways of thinking for supporting effective learning in smart learning environments. In this study, I investigate the learners themselves, as they participate in what I describe as 'future-present' (Ireland & Johnson, 1995; Kitchin, 2019) instances of smart learning journey activities. Using augmented reality for smart context-aware content delivery within a supportive collaborative and creative pedagogy, I seek to add to understanding of these pedagogical issues and approaches for smart learning.

2.1.3 Challenges of pedagogy in smart learning

> *"... the challenge with informal learning is the many different approaches a learner might take (how can we plan and design for it?)..." (Siemens, 2006b, p. 119).*

Smart informal learning may have been happening for some time in the current terrain of smart mobile devices and location aware technologies, pervasive amongst 'urbanised' connected populations (Giovanella et al., 2016; Buchem & Pérez-Sanagustín, 2013). This kind of learning offers opportunities to learn as need or interest dictates, in addition to more formal learning (Liu et al., 2017a, pp. 32, 48). These smart learners are often learning without the support of learning design or formal guidance and yet this may in effect be smart learning as benefits from connected networks of knowledge, learning community integration and (ad-hoc) participatory pedagogies that enable learners to contribute knowledge into these networks. Interestingly, intrinsic motivation to learn in this context remains strong (Dron, 2018, p. 11, 12). The ad-hoc smart learning activities embedded within these environments might be described as "(c)ontext aware and ubiquitous learning (in) a computer supported learning paradigm that identifies learners' surrounding context and social situation to provide integrated, interoperable, pervasive, and seamless learning experiences" (Liu et al., 2017a, p. 32). A significant challenge to any pedagogical approach for smart learning is this fluidity of hybrid reality: short-lived theoretical proposals which are made irrelevant or inaccurate in a short span of time, fluidity in emerging technologies, the transient nature of smart device applications (apps) and platforms and evolving modes of data organisation, communication and generation. Smart learning is at the forefront of this hybrid perpetual beta of technologically mediated learning terrain (Liu et al., 2017b).

While there are often different definitions of smart learning and smart learning environments (e.g. Liu et al., 2017a, pp. 31, 32), common themes do emerge. Implicit is the notion of ubiquitous digital connectivity, enabling the learner to connect in context-aware scenarios to wider networks of knowledge, experts and learning communities via their 'adaptive devices'. These descriptions call for a fluid adaptive pedagogical approach, moving away from fixed learning design as Siemens implies when he asks "...even our notion of design is worth rethinking - do we design learning? Or do we design environments…" (2006b, p. 119). By moving toward a fluid model of learning activity focus and experience with provision for a smarter delivery of required knowledge (p. 54), a pedagogical guide for an effective smart learning activity might be investigated and developed further. In this context of fluid learning purpose, 'evaluating' learning through learning activity effectiveness may be as much about how the learner experiences the activity as a whole as it is about any explicit learning goal or set outcome. As Dron states, smart environment learning is "a complex conversational process that can and usually does lead to much that is of value beyond what is planned", (2018, p. 3). Examining these unplanned of-value outcomes and processes through learner experiences may tell us about aspects of the effectiveness of a learning activity itself in a number of ways we may not have thought of when it was planned. In turn this might challenge ideas about learning aims, outcomes and assessment.

Motivation and purpose might be key factors of effective learning. For example, in simplest terms, learning for a test is perhaps widely assumed to produce different study behaviour and learning approaches (Lublin, 2003) compared to "free-choice learning" (Falk & Dierking, 1998, cited in Packer, 2006), which has no formal result or outcome. The learner autonomy and intrinsic motivation noted by Karoudis & Magoulas (2017, p. 110-111) is further discussed in Dron (2018). Dron argues that "(s)elf-determination theory demonstrates that intrinsic motivation cannot emerge unless a person has a sense of autonomy … against which the traditional classroom model thus actively militates" (p. 11). He describes problems created by the 'old' education system that, as it has sought to solve other problems of prior decades, ends up using reward and punishment to create and maintain extrinsic motivation, intrinsic motivation is lost. It is then harder and harder for a student to rediscover their intrinsic motivation, creating a self-perpetuating problem. "(O)ur intent […] to support the development of lifelong learning […] demands ingenuity in the design of pedagogies that reintroduce greater learner autonomy…", (p. 12). However, in seeking to embrace an autonomous connectivist style learning activity approach, the risk is that learners will feel unsure and therefore unmotivated in their participation and learning.

2.1.4 Challenges of data and smart learning pedagogies

Siemens asks, "(w)hat happens when the knowledge we require is presented to us without having to consciously seek it (artificial intelligence)?", (2006b, p. 55), and outlines the difference between old style archiving with fixed taxonomies, and new style information ‘streams’, saying “(w)e do not yet have the tool that permits ‘stepping into the stream’”, (p.54). Hence, smart learning pedagogies cannot only be about organisation (knowledge content scaffolding), yet are required to be 'a guide to learning'. “A smart learning environment not only enables learners to access digital resources and interact with learning systems in any place and at any time, but also actively provides the necessary learning guidance, hints, supportive tools or learning suggestions”, (Hwang, 2014). Notions of 'big data' may influence both conceptualisations of smart learning in relation to uses of data and technology, and of what constitutes learning effectiveness in relation to ideas about 'smartness' of learning. These challenges impact how pedagogical approaches for smart learning environments are determined in the sense of how pedagogy might best utilise data and knowledge content in approaches to learning designs and types of learning activity, or whether smart learning pedagogies exist separately from these issues. Knowledge content data itself also presents challenges to smart learning in the context of connectivist principles of connectivity, such as personal data security and privacy (Ryberg, Buus & Georgsen, 2012, p. 47), or safe learning online spaces (Anderson, 2008, p. 48).

The potential of smart learning knowledge delivery for multi-tagged related content, with perhaps hierarchical, weighted and even community 'value-rated' factors, for example content tagging (Kopeinik, Kowald & Lex, 2016) delivered on a just-in-time basis (e.g. Schiltz, Truyen & Coppens, 2007) is seen as a desirable outcome for smart learning environments (Zhu, Yu & Riezebos, 2016). How this might be achieved in smart learning poses complex challenges, and whether this impacts notions of smart pedagogy remains to be investigated (e.g. Lister, 2018). Kop (2012) discusses issues surrounding intelligent provision of 'tagged' content for learners, highlighting the importance of serendipity to offer learners’ knowledge they did not actively seek yet is relevant to their knowledge searching. Kop refers to Barabasi's work on network neutrality and the Matthew Effect (as cited in Barabasi, 2003), pertinent to 'level playing field' knowledge provision for learning. “What we find changes what we seek” (Morville & Callender, 2010, p. 87), and change of search direction, either by modified or distinct topic change influences findability, not always in equitable ways to the quality and value of the knowledge itself.

Further, Downes asserts that for connectivism to exist, "the widest possible spectrum of points of view (must be) revealed" (2005b). Knowledge networks have expanded considerably since 2005, both for expert domain knowledge and for social and 'everyday' knowledge, and the recent phenomenon of 'fake news' in the 2016 USA elections (Crawford, 2017), is a new challenge. Along with digital literacy, developing critical thinking skills are now crucial, enabling learners to differentiate between that which is trusted and valid knowledge and that which is not (for example Anderson, 2008; Bonk & Dennen, 2003).

A fundamental issue remains: learners must be digitally connected to the networks of digital knowledge and community for interactions to take place. Anderson & Dron (2011) point this out: “(i)t is noteworthy that connectivist models (of learning theory) explicitly rely on the ubiquity of networked connections between people, digital artefacts, and content, which would have been inconceivable as forms of distance learning were the World Wide Web not available to mediate the process" (Anderson & Dron, 2011, p. 8). That is, without being connected to the World Wide Web, connectivist learning cannot not take place. But what if the hyperlinks are broken? Whilst we may consider connectivist knowledge networks as an ideal solution for digital (and digitised) knowledge repositories, for collection, storage, curation and dissemination, we may not be fully acknowledging the problems posed by such digital repositories (Katz & Gandel, 2008) and ubiquitous reliance on network connectivity.

2.2 The connected learner and smart learning

Next I critically review aspects of theoretical and historical perspectives concerned with the connected learner, connectivist-inspired learning activities and the nature of connected learning in the light of connectivism and further understanding of smart learning activities.

2.2.1 Connectivist inspired smart learning

As previously noted, theory and epistemology may need to evolve in order to fully understand what is happening in the world(s) of the connected smart learner (Hwang, 2014). Connectivism, as a 'theory for the digital age' (Siemens, 2005), referred to by Henning as the “first genuine 21st century model of learning” (2018, p. 281), attempts to account for the processes and behaviours that are present in the agency, mode and mediation of learning in these new digitally connected spheres.

Argument is considered here in the context of smart learning activities that have a *connectivist-inspired* approach. These types of connected learning activities formed the only requirement as a basis for learning design of any smart learning journey activities investigated in this research, potentially permitting optimum flexibility and hybridity. As Siemens stated: "(p)erhaps even our notion of design is worth rethinking - do we design learning? Or do we design environments in which motivated learners can acquire what they need?", (2006b, p. 119).

2.2.2 Connected pedagogy

Chris Dede writes with some foresight in 2005, describing what we might now call digitally networked and mobile learning, though the age of smart phones had not yet begun. He points out clearly the growth of multitasking, multi-interface, communication and search behaviour of the information society learner in "(t)he familiar 'world to the desktop' interface, providing access to distant experts and archives and enabling collaborations, mentoring relationships, and virtual communities of practice." (Dede, 2005, p. 1). He goes on to describe that "mobile wireless devices (MWDs) - such as gaming devices, cell phones, digital music players, personal digital assistants - would access media that are virtually connected to locations (such as street signs linked to online maps), objects (such as books linked to online reviews), and services (such as restaurants linked to ratings by their customers" (p. 12), which is almost exactly what we might think of as smartphone functionality, and smart learning.

If the aim of the study is set out on developing a meaningful and useful pedagogical guide for smart learning based in connectivist principles then the learning activities and consequent experiences afforded by those activities must acknowledge what it means to be a connected learner. As Dede accurately foresaw, the provision of digital access to experts, archives and collaborations with virtual communities is describing connected learning and also much of what might perhaps generally constitute learning in a smart environment. By taking a position of learning activities being connectivist inspired, aspects of learning theory might be examined in the context of the connected learner and of connectivism.

Connectivist-inspired learning activities consist of elements similar to those that Dede describes, and are consistent with the five networked learning activities model illustrated by

Beetham (2012, p. 41), developed from Wilson's (2006) earlier ideas. Connectivist epistemology emphasises interactions, (Wang, Chen & Anderson, 2014), and layers of types of interactions. Downes (2005b) outlines conceptual factors of connectivist experiences, which Siemens reiterates in his defence of connectivism as a new learning theory (2006a). These are:

- Diversity - Is the widest possible spectrum of points of view revealed?
- Autonomy - Were the individual knowers contributing to the interaction of their own accord, according to their own knowledge, values and decisions, or were they acting at the behest of some external agency seeking to magnify a certain point of view through quantity rather than reason and reflection?
- Interactivity - Is the knowledge being produced the product of an interaction between the members, or is it a (mere) aggregation of the members' perspectives?
- Openness - Is there a mechanism that allows a given perspective to be entered into the system, to be heard and interacted with by others?
  (Downes 2005b, in Siemens 2006a)

Interpreted in a context of learning activities, these factors are useful as aims, expectations or goals, but perhaps may be difficult to control as a defined set of persistent phenomena amongst learners. As an overall approach they are possible, and certainly do state an ideal of connectivist (or connected) learning. A practical interpretation formerly found in a webpage created by the Learning Technologies Team at Durham University (2016, now unavailable), distilled connectivist learning pedagogy into autonomy, connections over repetition, communities of practice and digital literacy skills (described as crucial), citing Downes, 2014; Siemens, 2005, and Guerin, Carter & Aitchison, 2015. Dron (2018) highlights the concept of smart learning environment connectivist models, drawing on previous work (Anderson & Dron, 2011) to refer to theories that have arisen since the 1990s, “largely in response to the increase of adjacent possibilities afforded by the growth of the Web,” (2018, p. 13). These were characterized as “the connectivist generation of pedagogies”, with “shared foundations” (2018, p. 13-14), and are considered significant pedagogical aspects of the smart learning activities being investigated in this study.

2.2.3 Connected activities and learners

Examining connectivist-inspired learning activities in relation to theory that underpins relevant discourses, a number of theories and epistemologies make appearance. Exploring knowledge construction, social interactions and the nature of community building in relation to digitally mediated connected learning may be central themes of this work. Criticality is driven by the notion that digitally mediated learning can happen 'any time' (e.g. Scanlon, Jones & Waycott, 2005), is pervasive (McKenna, Arnone, Kaarst-Brown, McKnight & Chauncey, 2013) and ubiquitous (Galloway, 2004; Bonanno, 2011; Hwang, 2014), within a context of digital device proliferation and development of connective technology (Buchem & Pérez-Sanagustin, 2013, p. 3). These dialogues are examined in relation to smart learning situations and their 'sociospatiotemporal' (Marton & Booth, 1997, p. 82) nature. Some historical perspective is taken in examining approaches and their relevance to current possible learning in this context.

Patten, Sánchez, & Tangney (2006) predicted that "the growth of pervasive, ubiquitous, computing will have a large impact on learning", citing Bull, Bull, Garofalo & Harris (2002), who "claim that it is inevitable that every student will have a portable wireless device". Also citing Pownell & Bailey (2000), who "propose that this evolution is part of the fourth wave in the development of technology with very small computers and wireless connectivity delivering 'anyone, any time, anywhere learning'", (Patten et al., 2006, p. 295), they go on to say these might be over optimistic predictions. In hindsight, they underestimate the subsequent technological ubiquity and device proliferation that has occurred in most developed countries since 2002 (ITU Telecommunication Development Bureau, 2019). Seeing "the unique attributes of handheld devices [...] to facilitate learning in a pedagogically sensible manner", Patten et al. take a position of “collaborative, constructionist and contextual” learning design (2006, p. 304). They developed “a framework for categorising handheld educational applications which views the mobile learning design space in terms of both application function and pedagogical underpinning”, (2006, p. 296). Patten at al. note that Naismith, Lonsdale, Vavoula & Sharples (2005) divided applications based upon educational theories that they support as “behaviourist, constructivist, situated, collaborative and ‘informal and lifelong learning’”, (2006, p. 296). Further noting that software can often be "(b)ased firmly on constructionist concepts which advocate that learning occurs ‘especially well when the learner is engaged in constructing something for others to see’ (Papert, 1993)”, (2006, p. 301). They argue “the most educationally appropriate applications currently available are built on a combination of collaborative, contextual, constructionist and constructivist principles”, (2006, p. 304). Constructionist perspectives to learning activities may result in effective participation, embracing "ways in which the web-service-based environment offer(s) potential for learning" (Wilson, 2006 in Beetham, 2012, p. 41).

In contrast, Kizito (2016) frames learning activity design within connectivism. Describing connectivism as an 'emerging learning theory' (p. 19) concerned with the distribution of expertise and intelligence over the network and role of technologies in construction of knowledge, Kizito asks what connectivism can offer learning activity design and practice. She sees the activation of learner participation in interactions as key to formation of different types of networks, including cognitive concepts and social connections, supported by technology. Kizito further notes that constructivism, while acknowledging the interplay of learners, social contexts and problem solving, is not concerned with the "distribution of expertise and intelligence over the learning network" (Kizito, 2016). This is 'the famous claim of connectivism' that "the pipe is more important than the content within the pipe', (Siemens, 2005)", here noted in Wang, Chen & Anderson (2014, p. 2). Further citing Siemens (2006b, p. 79), Wang et al. describe "(w)ayfinding interaction is used to connect the pipeline for knowledge flow" (2014, p. 6). The digital technical network itself is being described as mediating knowledge construction: "in social constructivism a network is social media for interaction, while in connectivism a network is an extension of mind" (Wang et al., 2014, citing Downes, 2007). In many smart learning contexts digital connectivity to information and data networks may be a significant factor of activities. In this study, both networks of people and related prior personal interpretations were as pertinent as relationships to information accessed via the World Wide Web for how participants reported their experience reflections.

In 'What Connectivism Is' (2007), Downes writes: "(a)t its heart, connectivism is the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks. It shares with some other theories a core proposition, that knowledge is not acquired, as though it were a thing. Hence people see a relation between connectivism and constructivism or active learning…" (Downes, 2007). The network(s) and the ability to navigate ('wayfind') around those networks is at the heart of learning in a connectivist way. Downes emphasises that connectivism is 'connectionist', that "(k)nowledge is … literally the set of connections formed by actions and experience" (Downes, 2007). This notion of what knowledge 'is' in connectivism is debated further in chapter seven of this study, but here is highlighting the need for learners to develop critical skills in digital and information literacy, alongside their understanding of how networks work, for what might be found in them. It might be said in basic terms that "billions (of) learning journeys start every day with a Google search" (Dron, 2018, p. 12). It is therefore arguable that connectivist ideas about knowledge and networks have now moved into a ubiquitous pervasive narrative of intertwingled daily life within knowledge networks and activities (Morville, 2014, p. 75), rather than any specific idea about learning.

The relevance of critical thinking and analysis to this kind of connectivist-inspired activity may be considered as a (social) constructivist learning skill, "determined by the complex interplay among learners' existing knowledge, the social context, and the problem to be solved" (Tam, 2000, p. 52). Tam considers "(c)entral to the tenet of constructivism is that learning is an active process" (2000, p. 51). Further citing Woolfolk (1993, p. 485): "(t)he key idea is that students actively construct their own knowledge: the mind of the student mediates input from the outside world to determine what the student will learn. Learning is active mental work, not passive reception of teaching" (Tam, 2000, p. 51). Tam proposes that "(constructivism) encourages the construction of a social context in which collaboration creates a sense of community, and that teachers and students are active participants in the learning process", (Tam, 2000, p. 51). Siemens' table of learning theories (2006a, p. 36) asserts that connectivism differs from constructivism in transfer of knowledge, this occurring through "connecting (adding) nodes" in the network, adapting the "socialisation" of constructivism (Siemens, 2006a, p. 36). In terms of constructivist and connectivist epistemology, these factors may both together account for the active, social learner in human and non-human networks of knowledge. But connectivism regards the knowledge construction in the network as part of the learning, potentially more significant than individual learning. Tam's complex interplay echoes Pask's (1976) 'versatility' and the 'personalised conversational domain' that fosters 'learning to learn'. This may form an important aspect of smart learning in the activities of this study, describing participant internal reflections on interpretations of value and structure for making sense of 'unordered experience' in relation to other experiences (p. 144), also discussed further in Lister (2021c).

Downes (2007) states "in connectivism, there is no real concept of transferring knowledge, making knowledge, or building knowledge. Rather, the activities we undertake when we conduct practices in order to learn are more like growing or developing ourselves and our society in certain (connected) ways" (Downes, 2007). This process of creating networks is considered by Siemens as the act of learning to form information and knowledge, with the 'learning that happens in our heads' as an internal neural network (Siemens, 2006c, p. 5). Ryberg et al. question this as either a 'cognitivist information processing' metaphor dispersed into a socio-technical network, or a basic 'constructivist perspective' where the notion of, e.g. schema is replaced with the metaphor of a network" (Ryberg et al., 2012, p. 50). I revisit this argument in chapter seven in further considerations of epistemological context for smart learning activities. Certainly, this may be of some significance in smart learning if we are to achieve a future facing pedagogy that could deliver knowledge intelligently (smartly), as implied by Siemens (2006b, pp. 55-56). The conducting of practices in order to learn that are "more like growing or developing ourselves and our society" (Downes, 2007) somewhat concurs with Liu et al.'s "learning to learn, learning to do and learning to self realisation" (2017b, p. 209), particularly interpreted as Vinod Kumar's (2019) paradigms of well being for relationships between self and community.

The role of technology to mediate learning

Having considered connectivism as most concerned with the learning in the network itself (and noting that for example, Patten et al. (2006) relate digital affordance with 'pedagogical functionality'), it is relevant to reflect on the role of technology in learning and knowledge building. Do (or can) technological tools and mediations have an active role in the making of meaning and knowledge in learning? The connectivist concept of learning taking place in the network itself may not be as an actor (with agency), but merely as a mediator of process. To examine this further, both Activity Theory and Actor Network Theory may assist in attempting to account for what might be going on in digitally mediated learning contexts. Dron & Anderson describe Activity Theory as a framework for understanding "the complex ways that humans interact with the world", and to "consider not just their mental processes, but their interactions with the entire activity system including, importantly, the physical and mental tools and processes that they use" (2014, p. 50). But Activity Theory does not ascribe 'agency' to tools, but only as "mediators of human actors' intentions, through complex and interrelated systems" (Beetham, 2012, p. 39). However, Actor Network Theory (ANT) may offer further insight. Rooted in 1980s "post-structuralism, the sociology of science and technology, human-computer interaction and feminism" (Fenwick & Edwards, 2010), ANT considers 'knowledge' in material form as "a product or an effect of a network of heterogeneous materials" (Law, 1992). ANT asserts that multiple (asynchronous) actants, both human and non-human, make up the networks of the social world. In this context, "from now on, everything is data", and whether something is 'digital' or not "no longer matters" (Latour, 2005, pp. 133, 134). All elements of this complex networked existence have equal agency, whether human or non-human. Goodyear & Carvalho describe ANT as sensitising us to "the ways in which material objects influence human activity…", but "remain agnostic about some of the key ideas associated with ANT - such as whether it is reasonable to attribute agency to artefacts" (2012, p. 51), though Beetham asserts that "digital media for learning interactions can profoundly change roles and relationships" (2012, p. 44). Whether this last assertion is true within this study is not necessarily clear, as technological mediations were not reported by participants as especially significant of themselves, and therefore did not emerge as being a source of 'meaning', though some mitigating factors were evident (such as if technology 'worked' or not).

Jones (2018) cites Fenwick & Edwards (2010) and Fenwick, Edwards & Sawchuk (2011) in more recent discussion, merging AT, ANT and other social learning theory in 'sociomaterialism' (see also Gourlay & Oliver, 2018), seeing "knowledge and capacities as being emergent from the webs of interconnections between heterogeneous entities, both human and non-human … sociomaterialist approaches offer the prospect …that encompasses people and machines in a symmetrical way" (Jones, 2018, p. 47). In other disciplines these ideas arise with similar considerations. For example, Information Science contends "we are what we find" (Morville, 2014), indicating the influence of the system on the individual's knowledge, perception, understanding and 'wayfinding' of the knowledge journey for the learner. Considerations relating to ANT and the experience complexity of smart learning are further discussed in chapter seven of this thesis.

Community and conversation in connected learning

> *"Only through a relation with other people does man relate to nature itself, which means that labour appears from the very beginning as a process mediated by tools (in the broad sense) and at the same time mediated socially." (Leont'ev, 1981, p. 185).*

Dron & Anderson discuss Activity Theory as "most commonly associated with social constructivism but equally central to understanding connectivist models", and highlight the importance of community, added by Engeström (1987) to Leont'ev's individual and object as a fundamental unit of interaction (2014, p. 50). Of note here is that "(h)uman activity always takes place within a community governed by a certain division of labor and by certain rules", (Engeström, 1987, p. 149). Leont'ev regards man as essentially 'corporeal in nature" (1978, p. 12) and that relationships between him, systems of activities, meanings, labour and tools are socially mediated (1981, p. 192). Further, Leont'ev sees activity as "a process that is characterized by continuously proceeding transformations", which "may lose the motive that elicited it, whereupon it is converted into an action realizing perhaps an entirely different relation to the world, a different activity…" (1978, p. 104). This hints at the changing nature of meta awareness and the motivating factors that affect it. These relationships between 'man' (the learner, in our case) and the social nature of a smart learning activity are highlighted in this study, in that learners often took part as groups, and talked about the value of being together, though they did not often ‘collaborate’, i.e., work together.

While it is interesting to briefly examine Etienne Wenger’s (1998, p. 82) 'shared repertoire' as a characteristic of community coherence, this may have more relevance to digital 'online' community mediated learning and more permanent community groupings. In some types of smart learning activity (for example, regular activities, or activities that form an aspect of wider tasks that groups collaborate in) some aspects of how groups of peers relate may perhaps be similar. In this study, “discourse by which members create meaningful statements about the world, as well as the styles by which they express their forms of membership and their identities as members” (p. 83) is relevant to how groups participated together in the activity, as sets of friends, informal peer groups that had met up to ‘do the journey’. In this sense, meaning is created by members sharing statements that have trust and value associated with them, and are part of participatory (socially) connected learning. In light of historical perspectives that may have some bearing on dialogic aspects of socially or digitally connected smart learning, Laurillard's Conversational Framework (2002) provided a "teaching strategy (that) has been refined into a set of requirements for any learning situation" (2002, Part 2, p. 86), intended for the effective use of learning technologies:

- *It must operate as an iterative dialogue*
- *Which must be discursive, adaptive, interactive and reflective*
- *And which must operate at the level of descriptions of the topic*
- *And at the level of actions within related tasks*

(Laurillard, 2002, p. 86)

Considering this guide may have been intended as support for online conversational exchange, it is of note that it predominantly revolves around ‘the topic’ and ‘tasks’. Laurillard outlines 'constructed' dialogue approaches to learning design and produces diagrams to illustrate processes of iterative dialogue between student and teacher, additionally emphasising specific pedagogical functionality in different technologies such as CD Rom (similar to Patten et al., 2006). However it is her early work in phenomenography that is most intriguing, as she discusses notions of ‘the entire pre-history of a students academic experience’ could affect what they ‘do’ in a learning activity (2002, p. 28). Her early studies investigated approaches to learning using concepts of “Marton’s deep and surface approaches to learning” (p. 28) as analytical constructs, also utilising Pask’s concepts of operation and comprehension. “Pask refers to learning about “why” as comprehension learning and learning about “how” as operation learning and conceives them both as being complementary aspects of effective learning” (Scott, 2001). This certainly assisted in informing my later understanding of both the ‘process for’ and ‘content of’ learning, as well as the notions of the ‘what’ and the ‘how’ in a phenomenographic analysis approach.

But what of the social relationships of learning (or meaning making), as indicated by Leont'ev and Engeström? Social presence is described by Dron & Anderson as "(t)he extent of identification with a community and trusting inter-personal engagement" (2014, p. 46), and is perhaps an essential ingredient of a successful "community of inquiry" (pp. 46, 47). Within online communication, facilitation of discourse by teachers or mentors potentially supports the construction of knowledge in connected networks. Dron & Anderson argue that conversational knowledge construction is essentially social, constructing meaning and relationships and therefore social-constructivist in nature. However, Pask (1980) notes that "(c)ommunication and conversation are distinct, and they do not always go hand in hand". Acknowledging the complexities of instigating (engineering) and sustaining conversation as "concept sharing", he states:

> *"Too much togetherness inhibits conversation ... "(w)hen there is too much togetherness communication acts as a mechanism of isolation rather than a vehicle for dialogue" ... "(t)oo little apparent-togetherness promotes uniform-surrogate-togetherness" ... "... pathologies arise when communication looks like conversation but is not conversational...", (Pask, 1980, pp. 3-4).*

For the purpose of relevance for smart learning, it is perhaps important to state that smart learning activities do not take place exclusively (or even at all) online, in relation to learner-to-learner or learner-to-tutor communications. In this study, ‘real-world’ dialogic relationships to learning and participating emerge as ways of experiencing a smart learning journey. Additionally worth noting is that Scott explicitly clarifies Pask’s conversation theory as “constructivist and dialogical in approach and clearly distinguishes it from other approaches that see teaching as the transmission of knowledge from teacher to learner” (Scott, 2001).

2.2.4 A short (personal) critique of connectivism

Dron & Anderson acknowledge the compelling 'connectionist' nature of connectivism to account for networked learning, yet observe “just as there are many different variations on social constructivism that share the unifying characteristics, so there are variations of connectivism that share the common properties of knowledge emerging from and within a network" (2014, p. 48). From my position of appraising connected learning pedagogies and in searching for what may constitute ‘connectivist principles’, it may be useful to briefly account for connectivist critique, both at the time of its inception, and later, making my own tentative observations. Perhaps the crux of the criticism of connectivism is that learning theory as it existed prior to 2005 explained adequately what was happening to the learner post 2005 and Web 2.0. Multiple authors came to critique connectivism as a theory of learning, both initially (Verhagen, 2006; Kop & Hill, 2008; Kerr, 2007), and later (Anderson & Dron, 2011; Ryberg et al., 2012). Verhagen (2006) strongly argued against connectivism as a learning theory. Siemens then made a direct defence of Verhagen's criticism (2006a), referring to Mergel (1998) who cites Ertmer & Newby's (1993) “five definitive questions ... to distinguish learning theory”: How does learning occur? What factors influence learning? What is the role of memory? How does transfer occur? What types of learning are best explained by this theory? Siemens presents us with a table of comparisons (Siemens, 2006a, p. 36), however his leap from constructivism to connectivism is largely based in digital process actions relating to knowledge access with reliance on technical descriptions of networks (e.g. adaptive patterns, creating nodes). This seems a rather literal argument in my view, and does not take account of some aspects of connectivism that are indeed of real value (though may not concern learning as theory). At the time of writing (2021) these might be viewed now as a prescient awareness about the impact of connected networks of ‘intelligent’ (smart) information, and the potent impact of human digital networks to connect experts and novices in dialogic construction of knowledge. However, this is not ‘learning’, it is processes for learning or to support learning. To assert that connectivism is ‘a theory’ of learning may indeed be a step too far, as Ryberg et al. (2012) make a detailed critique of the problems with connectivism to account for learning. Nevertheless, ‘connectivist’ principles of participation, autonomy, motivation, openness, diversity in social human (digital or not) networks and digital non-human networks are all pertinent to the connected learning of smart activities and environments.

In relation to networks of ‘intelligent’ (smart) information, it may be that over time a learner may no longer need to have knowledge constructed in their own mind beyond knowing it exists in the network, as "learning consists of the ability to construct and traverse those networks" (Downes, 2007). Knowledge is constructed "in perpetual beta" (Garnett & Ecclesfield 2012, p.9), and "that knowledge occurs not only in the minds of individuals; but rather, is supra- and trans- individual and also exists within and between groups" (Carreño, 2014).

Discussion of connectivism in relation to other prominent learning theories for the epistemological context of the smart learning journeys and methodological setting of phenomenography in this study resumes in chapter seven and eight.

2.3 On what may constitute a connectivist-inspired learning activity

The core connectivist principles initially outlined by Downes and then reaffirmed by Siemens are diversity, autonomy, interactivity and openness. These might be further complemented by principles highlighted by Karoudis & Magoulas of self-direction, metacognitive awareness, intrinsic motivation, enculturation, discourse and collaboration, and reflection (, 2017, p. 110-111). This supports the assertions by Dron (2018), Siemens (2006b) and Lui et al. (2017b) of intrinsic motivation and learning to learn, perhaps in a context of both planned and unplanned learning. Additional interpretations of factors that may be of some significance are the transversal and digital skills appearing in concurrent debate that may be required of learners to empower their autonomous participation in smart learning activities, for example the DigComp 2.1 (Carretero, Vuorikari & Punie, 2017) and 'soft' transversal skills (UNESCO, 2018; Lorenzo & Gallon, 2019; Marope et al., 2018). The ubiquitous immersive computing environment (Dunleavy & Dede, 2014) that is increasingly available in urban connected spaces offers rich opportunities for both development of digital skills as well as interactive contexts where learners can participate in activities creatively and in self-directed ways.

Early in the study it was anticipated that online discussion or collaborative work might form part of activities, but susbequently this was not borne out in the way tutors approached their activity designs. Therefore Laurillard's conversational framework, Wenger's community of practice or even discussions about social presence in online collaborative networks were considered less relevant or influential in the study going forward.

Beetham (2012, after Watson, 2006) and Goodyear & Carvalho (2012) have been cited particularly for their acknowledgement of issues relating to assigning learning 'agency' to digital artefacts, to support reasoning for introduction of Actor Network Theory (ANT) to discussion. ANT itself may or may not be useful to account for some learning in some smart learning activities, however in this study I am not seeking to find definitive theories about smart learning to account for how or where learning might be going on. I am investigating how learners themselves report their sense of learning, perhaps in value, motivation and engagement, and how understanding more about their experiences may support planning for those in learning design and flexible pedagogical considerations.

2.4 Summary, chapter two

This chapter attempted to examine literature from two perspectives to assist in formulating methodology and research design. In smart learning discourses I noted areas of relevance for the study, particularly learner motivation and empowerment in Karoudis & Magoulas (2017), and discussion around types and levels of learning in Badie (2018). I noted that within these literature discourses, many epistemological discussions were placed within a ‘social constructivist’ style domain, with shared principles of connected learning.

I then examined further ideas about connected learners evident in literature outside of smart learning debates, from ‘leading thinkers’ and in historical perspective. Connectivist concepts of diversity, autonomy, interactivity and openness (Downes, 2005b) provided a guide, in common with social-constructivist and similar epistemological positions. This led to some discussion on community, interactivity, and further contexts and challenges. I formed some summary points relating to roles of technology and community, then noting the key aspects of what may constitute a connectivist-inspired learning activity.

This further understanding contributed in direct ways for decision-making regarding both methodology and context for a ‘connectivist principle’ interpretation of activities in the study. Chapter three now examines reasoning for choosing the methodology and goes on to describe research design.

3 CONCEPTUAL FRAMEWORK AND RESEARCH DESIGN

3.1 Introduction

Scotland (2012) asks: “What is a paradigm? A paradigm consists of the following components: ontology, epistemology, methodology, and, methods. Each component is explained, and then the relationships between them are explored”, (2012, p. 9). This chapter is devoted to explaining, exploring and relating the components of this study’s paradigm.

Literature informed thinking in various ways as the study took shape from a methodological perspective. Laurillard’s (2002) work introduced me to phenomenography, and I began to research this methodology as a research paradigm to investigate learner experience, further cited by Barnett as the principle research approach into orientations of learning (2007, p. 8). By examining learner experience of the activity as self-reported by participants, smart learning effectiveness might be investigated from the position of the learners (Roisko, 2007, p. 23). Citing Säljö (1979), Badie supports this in contexts of smart learning: "we need to put ourselves into the learners’ shoes and observe the phenomenon of ‘learning’ from their perspective” (2018, p. 395). I anticipated that this approach might permit investigation of learning effectiveness for process and for content, not as individual assessment but as a holistic experience of “learning to learn, learning to do and learning to self-realization”, (Liu et al., 2017b, p. 209). This in turn might assist in understanding and development of pedagogical guidelines for smart learning and subsequent approaches to learning design.

3.2 Theoretical Framework

The theoretical framework of this investigation positions itself from the phenomenographic non-dualistic understanding of the world, that there is only one world, “where there is an internal relation between the inner world and the outer world" (Ireland, Tambyah, Neofa & Harding, 2009, p. 6).

The phenomenographic view of the world is closely related to interpretivism, yet rather than the researcher being an instrument of interpretation - examining the phenomenon themselves, the phenomenographer is examining the relationship between the researched and the phenomenon. Ireland et al. (2009) put it well:

> *"Informed by the paradigm of interpretivism, which involves a non-dualistic ontology and a constructivist epistemology, a phenomenographer does not focus on the phenomenon itself; nor does he focus on the individual experience of the reality and the process involved in creating the conceptions and perceptions of the reality (Crosswell, 2006). Instead the focus is on the relation between the experiences of individuals (within a group and as a group of individuals) and the phenomenon by describing and identifying the relational view of their experience in a given social situation or phenomenon (Marton, 1988)." (Ireland et al., 2009, p. 6)*

Marton reflects in 'Phenomenography' (1994a, 1997) on the similarity between the phenomenographic interview method and Husserl's phenomenological method, as "participants in the research are invited to reflect on their experience of the phenomena dealt with. They are supposed to adopt an attitude which is similar to that of the philosophers who exercise the Husserlian method of phenomenological research" (Marton, 1994a, p. 9, 1997, p. 99) as "the researcher (interviewer) is not studying his or her own awareness and reflection, but that of their subjects, (Marton, 1994a, p. 9, 1997, p. 99). Marton explains this Hursserlian similarity thus:

> *"There is interesting parallel here to the phenomenological method as described by Edmund Husserl. Phenomenology too makes human experience its research object. It is however a philosophical method, an enterprise in the first person singular. It is the philosophers themselves who reflect on their way of experiencing the world, or rather specific phenomena in the world. It is not introspection, they are not trying to look into themselves, they are looking at the world, but they are trying to step out of "the natural attitude", in which one's way of experiencing the world is taken for granted. By "bending back" one's awareness - in a manner of speaking - its focus becomes one's way of experiencing something. It is a similar shift that the phenomenographic interview is trying to bring about in the person who is the subject of the interview." (1997, p. 99)*

Phenomenography contends that all phenomena are experienced within a structural (how) aspect and a referential (what, meaning) aspect, forming a structure of awareness (Marton & Booth, 1997, p. 98). The structure of awareness is also described as being made up of an internal and external horizon (1997, p. 87). Gurwitsch's (1964) model is acknowledged by many as a basis for these ideas (e.g. Cope, 2002; Sjöström & Dahlgren, 2002, p. 341;

Pramling, 1996, p. 83; Bowden & Marton, 1998, p. 33), “Gurwitsch (1964) suggested that awareness is made up of three overlapping areas: the margin, the thematic field and the theme”, (Cope 2002, p. 68).

Marton (2000) discusses the structure of awareness related to Gurwitsch’s example of reading ‘text’:

> *“Gurwitsch (1964) makes a distinction between the object of focal awareness, the theme, and those aspects of the experienced world which are related to the object and in which it is embedded, the thematic field. In the present example, the text is the theme and issues such as pedagogy, phenomenography, phenomenology and questions of qualitative research methodology in general, belong to the thematic field. […] Furthermore, there are things that coexist temporally and spatially with the reading of the text, such as the room where the reader is sitting, the reader’s marital worries, etc. All that coexists with the theme, without being related to it by dint of the content or meaning, Gurwitsch calls the margin.” Marton (2000, p. 110).*

Borrowing from phenomenology terms for conceptual framing (Marton & Booth, 1997, p.87), “that which surrounds the phenomenon experienced, including its contours we call its external horizon. The parts and their relationship together with the contours of the phenomenon we call its internal horizon” (p. 87). To emphasise, they quote Aron Klug,[24] who states: “ One does not see with one’s eyes, one sees with the whole fruit of one’s previous experience” (p. 83). Additionally, Marton & Booth argue “a situation is always experienced within a sociospatiotemporal location - a context, a time and place - whereas a phenomenon is experienced as abstracted from or transcending such anchorage”, (p. 82).

The position of the researcher as interpreter of the world of the researched is considered to risk potential influencing the understanding of the phenomenon being investigated and experienced, and therefore a great deal of importance is placed on bracketing, the reductionist epoche of Husserl (Cohen, Manion, & Morrison, 2007, p. 23). Crotty, (1998), discussing closely related phenomenology, states: “…if we lay aside, as best we can, the prevailing understandings of those phenomena and revisit our immediate experience of them, possibilities for new meanings emerge …” (Crotty, 1998, p. 91). Going on to clarify that “(t)his presumes that there are things themselves to visit in our experience, that is, objects to which our understandings relate… (t)hat there are indeed such objects is what the notion of intentionality proclaims and it lies at the heart of phenomenology”, (p. 91). Further citing Husserl (as cited in Husserl, 1931, p. 245), to define intentionality as “a concept which at the

[24] Klug is a 1992 Nobel laureate in chemistry. He took part in a Swedish TV discussion, used as data in a study by Marton, Fensham & Chaiklin (1994).

threshold of phenomenology is quite indispensable as a starting point and basis." Crotty further reflects that intentionality 'in the context of constructionism is an "essential relationship between conscious subjects and their objects" (Crotty, 1998, p. 92), additionally stating elsewhere that "all understandings, scientific and non-scientific alike […] are all constructions" (p. 25). I discuss bracketing in some depth in chapter five (and elsewhere) in relation to my own procedures, noting also the problems and potential impossibility of implementing a strict epoche are argued by many (e.g. Ulyens, 1996; Ashworth & Lucas, 2000; Roisko, 2007).

Significantly, phenomenography distinguishes between individual and social constructivism (Marton & Booth, 1997, p. 204; Bowden, 2005, p. 11), rejecting both these positions to adequately explain how we come to know about the world (Marton & Booth, 1997, pp. 12, 204). Further, Marton & Booth reject social constructionism (Ireland et al, 2009, p. 6,), as this is also 'dualistic', with an inner and outer person-world relationship (Marton & Booth, 1997, pp. 12-13). Crotty distinguishes constructivism and constructionism as:

> *"Constructivism describes the individual human subject to engaging with objects in the world and making sense of them. Constructionism to the contrary denies this is what actually happens at least in the first instant. Instead each of us is introduced directly to a whole world of meaning. The mélange of cultures and subcultures into which we are born provides us with meanings." (Crotty, 1998, p. 92)*

Marton & Booth note "important differences" between phenomenography and individual constructivism, "which sees knowledge as being an individual construction", and social constructivism, "which sees the social, the cultural, the situational outside the individual as the fabric of knowledge", (1997, p. 139). They contest that this cannot give a satisfying account of the individual experience, because it is dualist. Their argument for the phenomenographic ontological position is that learning takes place when something changes in the world as experienced by the individual, that this position is therefore non dualist, there is only one world, that of the world as experienced by each individual (1997, p. 139). This is the 'constitutionalist perspective' non-dualist position of phenomenography (Wright & Osman, 2018; Prosser & Trigwell. 1999, p. 13, 139; Marton, 1996a, pp. 172-177).

These conceptual positions are inter-related in this study, and act as a guide for methods, analysis and interpretation of findings. Phenomenography is the selected methodology of this study, and as such it informs the paradigm of the research design. Epistemological positions in the context of phenomenography and of the phenomenon of investigation are discussed in depth in chapter seven and further in chapter eight.

3.3 Conceptual Framework

3.3.1 Influencing factors in literature for research approach

The debates concerned in chapter two were divided into two halves, those that represent current smart (city) learning, and those that contribute to concepts of learning activities that share ‘connectivist’ principles of connected learning - e.g. autonomy, multiple opinions, social connections, motivation and openness.

Early key literature that formed understanding for scoping possible smart learning journey activities with connectivist-principles are listed below. These factors were discussed informally with the tutors who led their activity designs, who could interpret factors in relation to what they thought relevant to the activity they wanted to design.

- The key quotes (chapter 1), particularly from Liu et al. (2017b), Dron (2018), Siemens (2006b) for learning to learn, do and self-realisation, for both planned and/or unplanned learning, environments for motivated learners;
- Karoudis & Magoulas (2017), for 'self-direction, metacognitive awareness’, and 'autonomy, intrinsic motivation, enculturation, discourse and collaboration, and reflection’;
- Badie (2018), relating to citing Saljo's (1979) learning conceptions (early phenomenographic work), and use of SOLO and Bloom’s Revised taxonomies;
- Spector’s (2014) concepts of features to promote engagement, effectiveness and efficiency;
- Patten et al.(2006) aspects of social constructionism in relation to technological functionality;
- Siemens (2006a, 2006b) and Downes (2005b) connectivist concepts of diversity, autonomy, openness, interactivity;
- Additional considerations from Meyrowitz (2005), and then Traxler (2015), for concepts of sense of presence in place;

Literature regarding use of learning taxonomies and relationships to this study

It is noted that within smart learning pedagogical literature, Badie (2018) makes use of both SOLO and Bloom's Revised taxonomies, and Nikolov et al. (2016) make use of Bloom's revised in relation to technological affordances and pedagogical interactions. Lorenzo & Gallon (2019) refer to their own interpretation of Bloom's in relation to UNESCO digital skills (p. 56), also referring to Marope et al. (2018). This complemented my own observation of potential for employing Bloom's Revised in a similar way to the DigComp 2.1 (Carretero et al., 2017) for broad and flexible equivalency of learning factors.

Further, in terms of connectivist principles, Wang, Chen and Anderson (2014) relate the connectivist concepts of way-finding and sense-making to levels of Bloom's Revised taxonomy. O' Reardon et al. (2016) make extensive use of Bloom's Revised and SOLO taxonomies, to evaluate aspects of learning in online scenarios. Their work appears to somewhat complement connectivist principles in relation to similar online Massive Open Online Course (MOOC) style learning environments rather than perhaps real-world smart learning environments. However their employment of these taxonomies was inventive in relation to measurement of learning.

Using Bloom's Revised and SOLO taxonomies have precedent in phenomenographic studies. Newton & Martin (2013) contrast phenomenographic categories of variation with Bloom's and SOLO scores in relation to assessment of undergraduate student science education. Cope (2002) and Taylor & Cope (2007) use phenomenography in relation to aspects of the SOLO taxonomy. Marton & Svensson also refer to SOLO in a positive light (1979, pp. 477, 480). Correlation and contrast of Bloom's Revised or SOLO taxonomies and phenomenographic conceptions of learning appears in various other literature (e.g. Selwyn, 2011, pp. 3, 4; Marton, 2014; Lin & Niu, 2011).

3.3.2 Defining concepts and challenges

The data gathering and analysis in this study seek to "engage with the student's lifeworld" (Ashworth & Lucas, 2000) in the smart learning activity, gathering data from the learner through interview and learner generated content, to attempt to define and evaluate learning effectiveness in smart learning activities.

The territory of investigating learners participating in smart learning activities is quite new. If literature exists that may demonstrate methods for measuring and evaluating learning effectiveness of smart learning activities from the perspective of learners and pedagogy, and not perhaps that of goal orientated analytics or technical platform implementations, it is as yet hard to find. Phenomenography has been selected as the most suitable methodology to adopt within this novel context of pedagogical inquiry, because it examines learner experience, and the variation of it (Marton & Säljö, 1976). The experience variation of learners in the smart learning activity is of most interest, as by placing findings from this participant-learner focused data in a context of relevant pedagogies, some pedagogical understanding of smart learning may be achieved.

3.3.3 Gathering relevant data

The phenomenon of interest to the research is the smart learning activity, situated as a real world journey. The research questions require data to contribute to multiple strands of the research: ways to measure potential learning effectiveness and to contribute to possible formulation of a connectivist inspired pragmatic pedagogy for smart learning activities that may in turn impact design of those activities.

Two areas of data have been nominated as relevant and useful to attempt to solve the research questions, interviews and learner generated content (Pérez-Mateo, Maina, Guitert & Romero, 2011). Using a phenomenographic approach for carrying out interviews and analysing data, I explore the nature of participant learner experiences for variations and commonalities, and the relationship these have to considerations of learning effectiveness in a smart learning activity situated in a real world context – the smart learning journey. Additionally, any (digital) content created by learners as part of interactive engagement in a smart learning journey has been reviewed using applied phenomenographic findings in conjunction with the Bloom's Revised (Anderson & Krathwohl, 2001) and Structure of the Observed Learning Outcome (SOLO) (Biggs & Collis, 1982) taxonomies, for indications of learner experience and potential of learning effectiveness. This somewhat mimics 'assessment', and can be correlated with the collective experience variations of learners.

3.3.4 Defining smart learning journeys

To define further the smart learning journeys in this study, here I provide a brief outline of each of the journeys that were created and then investigated. This aids understanding for the reader in relation to the relevance of subsequent discussion regarding the nature of an activity and systems thinking to support definition of broad aspects of these activities.

Two different yet similar smart learning activities conceptualised as real-world journeys were created and then investigated for this study. Each was formed of several Points of Interest (PoI) related by topic in a close locality that together formed a 'smart learning journey'. These activities were located in London, UK and Valletta, Malta. Points of interest were augmented with digital interactions using ad hoc free smartphone apps and technologies, permitting participant access to context aware content. Apps used were HP Reveal, Edmodo and Google MyMaps. Knowledge content was created and hosted on a custom website, supplemented by other digital knowledge commons content. Participants were requested to create their own content relating to their participation in the journey and upload to Edmodo group areas. All activity participants took part voluntarily in their own time, and did as much or as little of the journey as they chose. Often, though not always, participants took part as a group. These journeys are described in greater detail in chapter four, sections 4.1.1 and 4.1.2.

3.3.5 Relating activity theory to a smart learning journey

A challenge of investigating a smart learning journey activity is the complexity of the "inextricably intertwined" situation and phenomenon (Marton & Booth, 1997, p. 83) of the activities themselves and the environments that they are situated in. I was consequently drawn to reflect further on the potential relevance of Activity Theory (AT) in relation to my study and smart learning journeys because of Berglund's work, who combined AT and phenomenography. Berglund (2005) states that "(a)n activity system basically describes the interaction between a subject, an individual, and an object. The activity is directed towards the object. Through this interaction the object is transformed into an outcome." (2005, p. 47). Going on to describe the interplay of tools, community, rules and division of labour, summing up with "(a)n activity can be modelled as an activity system, consisting of these components", (Berglund, 2005, p. 47). Berglund asserts in earlier work (2001) that "while activity theory, as it normally is used, gives a view of the learning as seen from the outside, phenomenography looks at learning from the inside", (Berglund, 2001, p. 8). He intended to "study the experience of 'learning in a context'. In other words, the view in my *(Berglund's)* research is the view of a learner, "'from the inside': The experience of learning in the experienced context",(2001, p. 9, my italics). This articulates that the phenomenographic approach is to investigate from the inside, in a context of an activity. This echoed in my own study, and though Berglund's study combined phenomenography and activity theory - I am not doing that - his observations contributed to my interpretive understanding of some of the findings for the secondary outcome spaces of the system elements of a smart learning journey.

I also noted that Dron & Anderson (2014) described AT as "central to understanding connectivist models". It seemed pertinent to consider their interpretations of AT in relation to connectivist principles of learning in contexts of activities. They determined the 'binding concept' of an activity as "concerned with subjects doing things, typically together, engaging in activities through mediating objects or tools" (Dron & Anderson, 2014, p. 50). They go on to state that an activity system provides "a way of understanding consciousness as a social phenomenon that extends into and is inextricable from the world" (p. 51). And further, to consider the outlying environmental context as "it makes no sense to treat an isolated person as a unit of analysis: the physical, cultural, and technical world that he or she inhabits is as much a player in any activity as the mental processes of the individual who engages in it" (p. 50). This aided in describing the concepts of participants acting in a smart learning journey environment and appears to complement Marton & Booth's "inextricably intertwined" situation and phenomenon (1997, p. 83). Early in the study these reflections about AT assisted my thinking to help determine broad areas of relevance for the investigation, so as to define interview strategies and aspects of the study. This led me to subsequently consider the smart learning journey as a 'system'.

3.3.6 The smart learning journey activity as a system

Reflecting on the nature of activity in a smart learning journey, I came to a realisation that the layered set of potential interactions I wished to investigate in participants may need some support in how I approached interviews, so as to obtain 'the right kind of data' (Cohen et al., 2007, p. 356). This section briefly describes my process for designing interviews through a broad system thinking approach, which also led to the second perspective of analysis, to support validity and communicability of findings.

Scoping the smart learning journey as a system

Bringing a systems thinking approach of elements, interconnections, functions and purposes (Meadows, 2008) to the smart learning journey activity permits the intricate balance and relationships that exist between the different elements of a smart learning activity situated in a journey to come to light, and any influences that might be present from one element area to another to be examined as either separate or an integrated whole. This is the central reasoning of the secondary perspective of analysis, the system elements of a smart learning journey.

The system elements are nominated as 'Place', 'Knowledge', 'Collaboration' and 'Technology', and attempt to amplify what is involved in the smart learning activity situated in a real world journey from these delimited perspective viewpoints. These ideas further developed an earlier model from the author of interactions with content, digital tools and community (Lister, 2017, p. 242), combining to describe in broad taxonomy terms aspects of what is experienced and interacted with by a learner in smart learning, both activity and environment. Spector's (2014) factors of what constitutes smart learning and smart learning environments concur with these conceptualised elements, and align with the methodology of the research to enable examination of effective learning for 21st century connected learners (e.g. Anderson 2008; Liu et al., 2017b, p. 209).

First systems thinking iteration

The first systems thinking iteration envisaged 'people' and 'activities/tasks' as elements, along with 'tools' and 'places'. However, 'people' could be intrinsic to every element, purpose and interconnection. Therefore, 'people' as a primary element was removed and reconfigured as 'Collaboration', a broad way of accounting for what people generally 'do' in a system. 'Activities/Tasks' were also realised to be potentially intrinsic to all elements, so were removed as a primary element. Figure 2 shows the first system iteration.

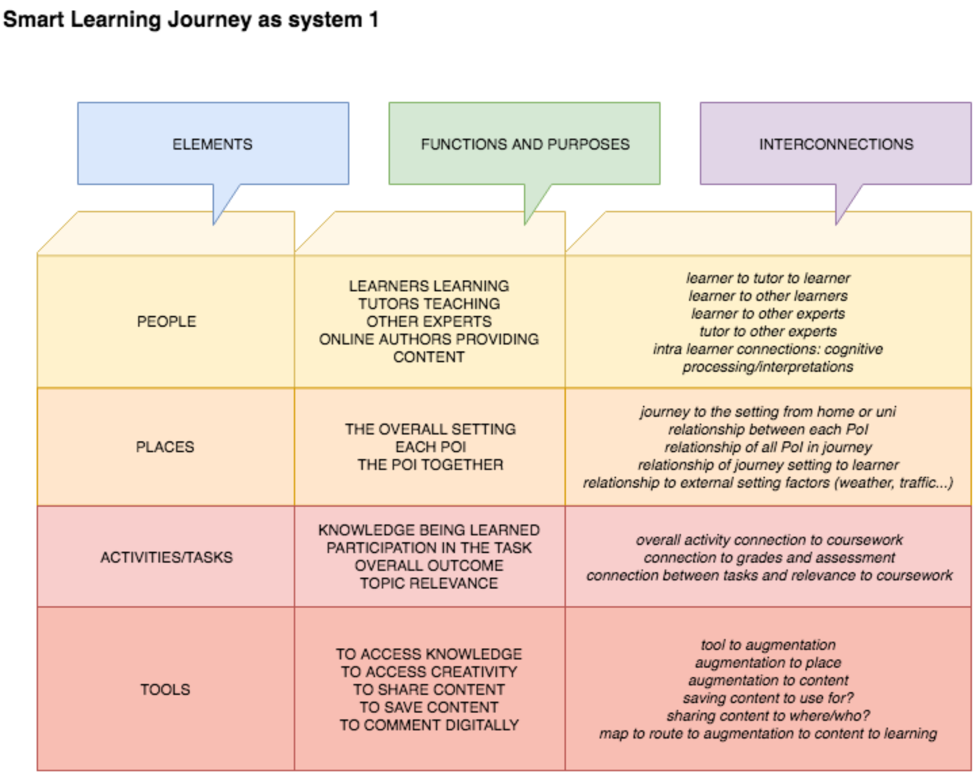

Figure 2 The smart learning journey as a system, iteration 1

Second systems thinking iteration

The second iteration brought understanding of the elements in a more clarified form. Reflecting further on ‘content, community and tools’ (Lister, 2017, p 242) meant that ‘place’ (a broader concept than ‘places’, that being too limited in scope) and ‘knowledge’ (content and learning) were added as explicit elements. Elements became Place, Knowledge, Collaboration and Technology, as seen in Figure 3. This flowed more meaningfully, with functions, purpose and interconnections appearing naturally from these four elements.

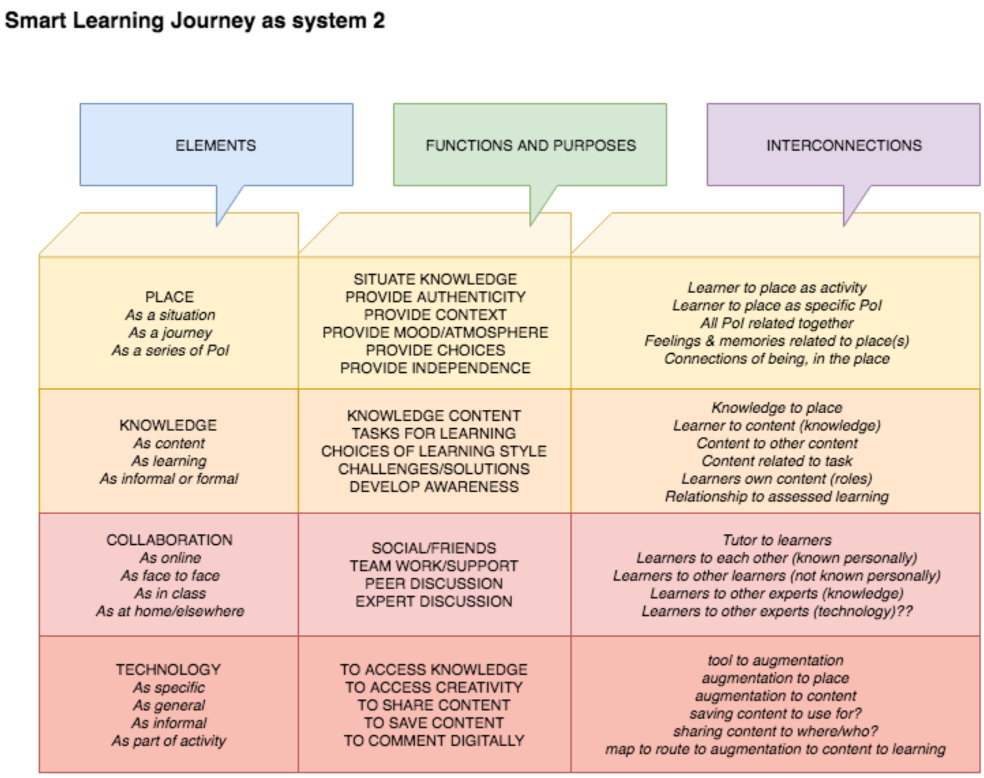

Figure 3 The smart learning journey as a system, iteration 2

An interdisciplinary conceptual ‘systems’ thinking approach to the phenomenon was therefore broadly adopted, and applied to both the interview itself, the introductory questionnaire, and led to four additional outcome spaces of experience variation, beyond the outcome space for the activity as a whole. The functions and interconnections of the elements were not adopted in detail, as this was a conceptual model only, to support how to think about separate elements of a smart learning activity, to aid interview and research of the phenomenon.

3.4 Methodological approach

Following sections will unpack my reasoning for selecting phenomenography in relation to other possible choices.

3.4.1 Choosing Phenomenography

Phenomenography is nominated as the methodology of this study, to measure effectiveness of learning through the variation of learner experiences, and how participants might experience learning as self-reported to me.

The research is placed in a qualitative research paradigm, seeking to analyse without using mathematical means (Strauss & Corbin, 1998, p. 11, in Imenda, 2014). Placing the research within a mixed methods (quantitative/qualitative data) paradigm is inappropriate as no numerical or statistical analysis was done, though small amounts of data is somewhat ‘quantified’ by using taxonomy classifications in learner generated content analysis. This was interpreted qualitatively in the sense of "corroborating evidence collected through multiple methods... to locate major and minor themes." (Creswell & Miller, 2000, p. 127). This process was inductive and iterative, building understanding through context and association of similarity for concepts and factors of significance.

3.4.2 Selecting a methodology

Initially I considered three different methodological approaches, grounded theory, qualitative content analysis and phenomenography. Grounded theory offered at least some possible useful approach because of the iterative analysis of data and focusing on where data of interest may be sourced. Theoretical sampling, often iteratively changing according to developing themes, and analysis of intent of a respondent, i.e. not confining to manifest content (Foley, Timonen, Conlon & O’Dare, 2021) appeared too broad, and without sufficient bracketing of suppositions by the researcher. I was not seeking to establish an overarching theory of smart learning and felt this would be inappropriate, as smart learning, and particularly the phenomenon of investigation, the smart learning journey, was a very flexible and fluid concept. I felt it would therefore be inappropriate to even attempt to create theory about smart learning, or make any assumptions about it.

Qualitative content analysis offered another approach whereby rich interview data might be analysed through an iterative constant comparison method to reduce data to develop themes of significance. However this also appeared to be prone to bias and assumptions. Hsieh &

Shannon (2005) define qualitative content-analysis as “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (p. 1278) and may include abstractions about the latent (underlying meaning) of interview text, not only it’s manifest content (Graneheim & Lundman, 2005). In this study I am not seeking to explain why a participant might be thinking or saying something, merely that they are. It is only their self-reported experiences that are of interest, not my assumptions about them. Bowden puts this very clearly: “(t)he primary way of minimising such *(researcher bias)* is to base all analysis on the transcripts: if it is not in the transcript, then it is not evidence” (Bowden, 2005, p. 15, my explanatory italics).

The research questions indicated some need for investigation of ‘connectivist’ style connected learning, yet other aspects of the research questions needed further clarification. Of note was what ‘effective learning’ might constitute within context(s) of a smart learning journey. Additional aspects of interest to the study were in conceptualisation of a pedagogical guide and impact on learning design. This indicated that the role of the learner as a ‘user’ in the development of these ideas appeared to be significant and brought to mind my past professional experience in user requirements gathering and user experience evaluations for website or other digital application development. Roles of users within micro user-journeys and macro experiences of an entire application appeared relevant as a general positioning of this research project. Whilst I had no real assumptions about what smart learning journeys with augmented reality interactions might mean in reality, nevertheless the roles of users within these contexts seemed paramount. I sought to see through the eyes of the participants and put myself in their shoes to gain a more authentic understanding of the possible variation of how a smart learning journey might be experienced. Therefore phenomenography appeared to be the methodology that seemed the most appropriate (e.g. Badie, 2018, p. 394). Though this possibly posed challenges for how data might be incorporated into any pedagogical understanding, these challenges were likely to be similar to how user requirements or experience data feed into a user-centred design approach. This understanding formed as I progressed in the project and was not clear at the start, though I had an idea of it. Some reasoning for my choices and thought processes were:

- Permit the possible discovery of what may be regarded or thought of as aspects of learning to learners, and how they reported it, either explicitly or implicitly
- Contribute to understanding of value, motivation and engagement in urban connected

environments

- For the researcher to see the experience of a smart learning journey through the eyes of the participant
- To find ways of describing experiences in SLJs
- To contribute to further pedagogical understanding of connected learning in SLAs
- Contribute to possible ways of designing SLA in real world settings, possibly adapting UCD approaches

3.4.3 Grounded Theory and Phenomenography

Phenomenography may be related to Grounded Theory (GT) as both are inductive, but have differing aims and purpose. GT mostly seeks to form new 'substantive' (i.e. transferable, rather than generalizable) theory, "because of the overwhelming substantive interest of grounded theory researchers", (Strauss & Corbin, 1994, p. 274). GT emphasises 'conceptual density', the richness of conceptual development and relationships, rather than emphasis on thick descriptions where emphasis is on description rather than conceptualisation (p. 274). In phenomenography, interest is in understanding the variation of experienced phenomena by those who experience them, focusing primarily on the experiences themselves, with descriptions being significant. Another key difference may be in the analytical position taken by the researcher. Kaapu, Saarenpää, Tiainen & Paakki assert that "(i)n many other methods the first-order perspective is mainly used, for example in ethnography and grounded theory … in phenomenography the second-order perspective is in use" (2006, p. 3). Phenomenography often adopts a position of an analytical framework based on an emergent structure of awareness (Cope, 2004) after an appropriate amount of data has been gathered, whereas GT seeks to account for comparisons and categories while continuously gathering data using a theoretical sampling approach, refining emerging theory, as shown in Cho & Lee (2014, p. 9, Figure 1).

Though "(p)henomenography is not a method in itself, although there are methodical elements …", (Marton & Booth, 1997, p. 111), Kinnunen & Simon (2012) outline differences and similarities in procedures and analysis, positioning both GT and phenomenography as 'methods' to aid direct comparison. Noting both are based on a "non-positivistic view of knowledge" and are inductive and iterative in approach to data analysis process, they see "(t)he greatest difference between the two methods is in the type of research questions they are aimed at" (p. 212). Theoretical sampling, considered a core attribute of the GT method (Foley et al., 2021) is the collection of data according to selected concepts or target sample participants. GT is iterative and non-linear, "(s)pecifically, data collection and analysis are parallel in grounded theory, and the procedure is neither linear nor sequential" (Cho & Lee, 2014, p. 9), that is, "(d)ata collection and analysis proceed in tandem and ongoing analysis steers the course of the inquiry in grounded theory" (Foley et al., 2021). Concepts are coded and categorised, informing further recognition of relationships and formulation of over-arching theory. This process employs a constant comparison technique, continuously re-examining data concepts and relationships for 'precision and consistency' (Cho & Lee, 2014). GT uses the open, axial and selective coding method to analyse data. In phenomenography focus is on variation of 'perceptions/ conceptions/ experiences', and (citing Strauss & Corbin, 1990) GT is "an action-focused method (aimed) at constructing a theory/model that 'has to show action and change'", (Kinnunen & Simon, 2012, p. 213). Going on, that GT "provides a step-by-step guideline how the analysis could be done. The paradigm model helps the researcher to construct the results (the stories)", whilst "(p)henomenography does not have similar structured guidelines but gives the researcher more discretion in how to conduct the analysis", (p. 213). These aspects make GT a very different analysis approach to phenomenography. Phenomenography collects data and then analyses it, iteratively, does not take account of a priori categories, does not make assumptions about significance of meaning in data to change direction of sampling, and does not develop theory from data (though findings might be applied to further theoretical development).

Kinnunen & Simon acknowledge that both GT and phenomenography permit discovery of "something truly unique by not restricting the researcher with prior theories or models", but this "does not mean that the results of phenomenography or grounded theory studies could not or should not be placed into a larger context of existing pool of knowledge after the analysis process is completed…", saying it "should be done when possible, (o)therwise there is a danger that we never get to accumulate our knowledge on phenomena" (Kinnunen & Simon, 2012, p. 212). In this study, the aim is to develop understanding about the variations of experiencing the phenomenon of interest, a smart learning journey activity, as self-reported by learners in interviews, using a 'developmental phenomenographic' approach. This contributes to deeper reasoning for the forming of pedagogical guidelines for smart learning. This is not proposed as the essence of the phenomenon, as would be a phenomenological position, or a theory of smart learning, as would be GT. Roisko's (2007, pp. 85-86) table of approach comparisons for phenomenography, phenomenology and GT indicates these differences in aims.

Though similarities do exist between GT and phenomenography, it may be argued that the second order perspective interpretations of a 'structure of awareness' (Cope, 2002, 2004) analysis process are what make phenomenography truly distinct. This was a strongly contributing reason for selecting phenomenography.

3.4.4 Qualitative Content Analysis and Phenomenography

Qualitative content analysis (QCA) is "any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings" (Patton, 2002, p. 453). This can be either an inductive or deductive process. Deductive content analysis is referred to by Hsieh & Shannon as a directed approach to analysis to confirm existing theory or a theoretical framework, and assists in determining initial coding schemes or relationships between codes (Hsieh & Shannon, 2005, p. 1281). Inductive content analysis is iterative and open to interpretations, and "includes open coding, creating categories and abstraction" (Elo & Kyngäs, 2008, p. 109). Open coding means that "notes and headings are written in the text while reading it" (p. 109), to form what Patton refers to as a codebook, for "figuring out possible categories, patterns, and themes" (Patton, 2002, p. 453). He goes on: "(t)his is often called 'open coding' (Strauss &Corbin 1998:223) to emphasize the importance of being open to the data" (p. 454), remarking on GT emphasis of becoming immersed in the data - being *grounded* - "so that embedded meanings and relationships can emerge" (p. 454). This bears some relation to phenomenography in terms of not using predetermined categories, of making notes and being immersed in the data, yet differs in that decisions about 'meaning' and significance might be made earlier in the process, and are abstracted into subjective categories compiled by the researcher. Additionally, coding can analyse both manifest and latent content of communications: "manifest content means the researcher codes the visible and surface content of text, latent content means that the researcher codes the underlying meaning of the text" (Graneheim & Lundman, 2004, in Cho & Lee, 2014). In other words, the researcher makes abstract interpretations about why something may be happening, for example, which again is very different to the phenomenographic method. In phenomenography, categories of description are developed by the researcher, yet are emergent and consist of the experience variation as noted in the transcripts - the manifest content only - described by Bowden as "if it is not in the transcript, then it is not evidence" (Bowden, 2005, p. 15). Explanations for why participants might say things are explicitly discouraged in phenomenography, as "the researcher is oriented toward describing what constitutes the experience under investigation, rather than attempting to explain why it appears as it does" (Sandberg, 1997, p. 210).

I felt that though QCA (like GT) could offer some relevance to the study, it was not as well suited as phenomenography, principally because it was not a ‘second order’ perspective, requiring the researcher to put aside all first order observations and interpretations, and step into the shoes of the researched to see through their eyes.

3.4.5 Why phenomenography?

Phenomenography appears to be the principle methodology for 'inquiring into students orientation towards their learning' (Barnett, 2007, p. 8), it is “an approach to - identifying, formulating and tackling certain sorts of research questions, a specialisation that is particularly aimed at relevance to learning and understanding in an educational setting." (Marton & Booth, 1997, p. 111).

Phenomenography seems to be favoured as a methodology to employ for examining user experience of technologically mediated learning scenarios (e.g. Booth, 2008; Koole, 2012; Edwards, 2005; Alsop & Tompsett, 2006; Cutajar & Zenios, 2012; Cutajar, 2014, 2012, 2016, 2017; Reeves, 2014; Souleles, Savva, Watters, Annesley, & Bull, 2014). Additionally, phenomenography is utilised in the investigation of ‘user experience’ in relation to technical applications or technologically mediated interactions (e.g. Kaapu, Tiainen, & Ellman 2013; Kaapu & Tiainen, 2010, 2012; Abdi, Partridge, & Bruce, 2013; Zoltowski, Oakes, & Cardella, 2012; Cheng, 2018). This had some influence that phenomenography would be a useful choice of methodology for this study.

These studies appeared relevant to my reasoning for selecting a suitable methodological approach. For example, Souleles et al. (2014), examined art and design student experiences of using iPads and described the phenomenographic approach as allowing for a “bottom-up investigation, ie, from the perspective of learners”. Kaapu & Tiainen (2010) investigated experiences of consumers and their understanding of virtual product prototypes, “to get an idea of users’ subjective experience”, aiming to “support customers’ participation in product design process”. These studies reflected the aims of my own research, therefore phenomenography was considered to be a ‘good fit’ for investigating user (learner) experiences of smart learning activities. Using a bottom-up approach to obtain learners’ subjective experience so that it might input into smart learning design pedagogical considerations seemed a useful idea.

Marton defined phenomenography as a "relatively distinct field of inquiry", that "aims at description, analysis and understanding of experiences" (1981, p. 180). Arguably considered a founder of phenomenography (Richardson, 1999; Tight, 2016), he sought to differentiate between two types of research question about learning: "why do some children succeed better than others in school" with "what do people think about why some children succeed better than others in school" (Marton, 1981, p. 1-2).

> *"These two ways of formulating questions represent two different perspectives. In the first and by far the most commonly adopted perspective we orient ourselves towards the world and make statements about it. In the second perspective we orient ourselves towards people's ideas about the world (or their experience of it) and we make statements about people's ideas about the world (or about their experience of it)." (Marton, 1981, p. 2)*

Therefore, Marton distinguishes between these perspectives as the first order being concerned with what the world is, the second order being concerned with what people think it is or experience it as. This second order perspective taken by the researcher in phenomenographic analysis was a deciding factor in my choice. This study is not concerned with "metaphysical beliefs and ideas about the nature of reality and the nature of knowledge" which do not "come first" in phenomenography (Svensonn, 1997, p. 164). It is interested in the differences, commonalities and variations (Åkerlind, 2005a, p. 6, 2005b, p. 322; Cope 2004, p. 3; Marton & Booth, 1997, p. 119) for individual and collective experience of smart learning, and of the learner's experience of learning effectiveness.

> *"Phenomenography is focused on the ways of experiencing different phenomena, ways of seeing them, knowing about them and having skills related to them. The aim is, however, not to find the singular essence, but the variation and the architecture of this variation by different aspects that define the phenomena" (Marton & Booth, 1997, p. 117)*

To recognise emerging relationships of learning experiences and effective learning in a smart learning journey activity enables development of understanding the "structure of relevance" (Marton & Booth, 1997, pp. 143, 202) between pedagogical thinking, learning experience variation and characteristics of learning effectiveness. This may illustrate emerging pedagogical practices to promote effective learning in smart learning environments, optimising an experiential 'space of learning' with a "potential for understanding, seeing, and acting in the world", (Tsui, 2004, p. 139). To further reflect on my decision-making, I compiled a table of comparisons (Table 2), somewhat after Roisko (2007, pp. 85-86) and Dunkin (2000, p. 140).

Comparison	Phenomenography	Qualitative Content Analysis	Grounded Theory
Aims of methodology	"Mapping the qualitative different ways in which people experience, conceptualise, perceive, and understand various aspects of, and phenomena in, the world around them" (Marton, 1986)	"A research method for subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005) "Concerned with meanings, intentions, consequences and context …" (Elo & Kyngäs, 2008, p. 109)	"To develop inductively derived theory that is grounded in the data" (Kinnunen & Simon 2008) "GT is a general methodology for developing theory that is grounded in data systematically gathered and analysed. Theory evolves during actual research ... through continuous interplay between analysis and data collection" (Strauss & Corbin, 1994)
Scope and intent of analysis	To describe, not explain - "If it is not in the transcript, it is not evidence" (Bowden, 2000) Analyses data for commonality and variation in a structure of awareness analytical framework (Cope, 2004) "Every transcript, or expression of meaning, is interpreted within the context of the group of transcripts or meanings as a whole, in terms of similarities to and differences from other transcripts or meanings" (Åkerlind, 2005b)	To correlate, explain, interpret, condense and abstract Typically inductive, to discover "patterns, themes, and categories in data. Findings emerge out of the data, through the analyst's interactions with the data" (Patton, 2002, p. 453)	To correlate, interpret, explain and form theory "Data collection and analysis proceed in tandem and ongoing analysis steers the course of the inquiry in grounded theory" (Foley et al., 2021) Constant comparative analysis "ensures that the coding process maintains its momentum by moving back and forth between the identification of similarities among and differences" (Willig, 2013)
Methods of sampling (units of analysis; participants)	"…the basic unit of phenomenography is experiential, non-dualistic, an internal person-world relationship" (Marton, 1995, p. 172) "Phenomenographic data maybe obtained by various methods but the interview is the most common." (Walsh, 2000, p. 19) Purposive sampling and possible 'critical cases' … selected based on the judgement of the researcher (Collier-Reed & Ingerman, 2013)	'Unit of analysis: a person, program, organisation, classroom … community, state or nation ... interviews or diaries in their entirety or sections of …' (Graneheim & Lundman, 2005) Purposive, representative sampling; inductive or deductive analysis; creating categories and abstraction (Elo & Kyngäs, 2008)	(Qualitative GT) analyses naturalistic data; relying on "line-by-line coding of the data in order to identify 'meaning units" (Willig, 2013) "Moves from purposive sampling… to sampling for concepts that are emergent in the data … " (Foley et al., 2021)
Research question (when to use)	"The approach is directed towards understanding the relationship between a student and a phenomenon in the world" (Collier-Reed & Ingerman, 2013) "An approach to identifying, formulating and tackling certain sorts of research questions, a specialisation that is particularly aimed at relevance to learning and understanding in an educational setting" (Marton & Booth, 1997, p. 111). Phenomenographic studies are also undertaken in fields other than learning (e.g. Sandberg, 2000, Kaapu & Tiennen, 2009)	Concepts or categories to build up a model, conceptual system, conceptual map or categories (Elo & Kyngäs, 2008) "Research using qualitative content analysis focuses on the characteristics of language as communication with attention to the content or contextual meaning of the text" (Hsieh & Shannon, 2005) For making replicable and valid inferences from data with the purpose of providing knowledge, new insights, a representation of facts and a practical guide (Elo & Kyngäs, 2008)	To formulate (often) substantive theory (Strauss & Corbin, 1994, p. 274) "Conscious pursuit of key concepts in data generation signals that a researcher has begun to theoretically sample … and it is the relationships between these concepts that may ultimately constitute theory" (Foley et al., 2021)

Table 2 Pragmatic comparisons of Phenomenography, QCA and GT

3.4.6 Critique of phenomenographic methods and procedures

Phenomenography seems to have ontological and epistemological challenges (Sandberg, 1997, p. 207; Richardson, 1999, p. 66) and problematic issues relating to the ontology and potential limitations of language as a method of gathering authentic 'experience' data (Säljö, 1997, p. 176) as "phenomenography - in its non-constructivist ambition - seems to accept the constitutive role of language in human life", and further, "… in what sense do the utterances that people respond with in phenomenographic interviewing relate to 'ways of experiencing'?" (p. 177). However, Kvale, citing Gadamer, then Shotter, contends that we are "we are conversational beings for whom language is a reality", that "we constitute both ourselves and our worlds in our conversational activity. For us they are foundational. They constitute the usually ignored background within which our lives are rooted" (Shotter, 1993, p. vi, in Kvale, 1999, p. 104).

Bowden (2005) proposes use of standard interview statements and few questions (p. 12) to permit the experience of the phenomenon to emerge naturally from the participant. This is implied to maintain more rigour and validity in the analysis process, however may be arguably born of a positivist (Scotland, 2012, p. 11) attitude to data gathering, discussed variously by Kvale (e.g. 1996, pp. 230-231). Kvale is concerned that qualitative interview based research does not "get caught in the positivist straightjacket on the other side and lose the lived therapeutic relations in a multitude of statistical correlations…" (1996, pp. 79-80).

Phenomenographic approaches for interview transcript analysis are open to a wide range of interpretation (Harris, 2011), and attempt to categorise experiences into related 'strata' that can either be predetermined or not, and hierarchical, or not. Categorisation of meanings has long been used for analyzing qualitative material (Kvale, 1996, p. 199), though is "a positivist emphasis on quantification of facts in the social sciences" (p. 199). Kvale believes that "(r)ather than trying to escape the conversational circle - as was attempted by positivist approaches to the modern social sciences with the scientist as an external observer, ideally a visiting man from Mars - the challenge is to expand our understanding of the human world through a dialogue within the human conversational reality", (Kvale, 1996, p. 297).

There appears to be no phenomenographic step-by-step process available, and that indeed may be a) to its advantage and b) common to other qualitative interview transcript based methodologies (e.g. indicated in Creswell, 2009, pp184-185). Cope (2004) probably offers the best advice on analysis procedure, with a good system of structure of awareness analysis and communicability, along with others like Ashworth & Lucas' advice on interviews, empathy and bracketing (2000). Åkerlind's (2005c, 2005d) practical attitude about what you should 'do' regarding interviews, and Bruce's (1994a) levels of complexity for measuring experience meaning in relation to her research topic are also useful. Harris (2011) has much to say on analysis procedures. I have used Edwards' 2005 study, along with Cope's 2004 work, where levels of presence and complexity are used to measure aspects of experience in relation to topic of interest, which complements work by Bruce et al. (2004a) in a structure of awareness interpretation.

There is no real consensus between phenomenographers as to how related categories of experience variation come about. The 'true' method promoted by Marton and Säljö (1976) is of researching approaches to learning and of using predetermined hierarchical surface to deep learning categories of variation. However avoiding predetermined categories is now preferred, to let them emerge from data (Ashworth & Lucas, 1998, 2000; Reed, 2006), as "there is no way of knowing the extent of the variation that has been captured during the interviews" (Reed, 2006). Walsh (2000) considers the dilemma of constructing or discovering emergent categories as being quite problematic, particularly in terms of the role of the researcher. Conflict exists between phenomenography as a methodology specifically for investigating learning approaches (Marton & Säljö, 1976), and phenomenography for investigating how people 'experience the world around them', which is a much wider remit than to remain strictly focused on learning, for example in Bowden, 2000, p. 2 (quoting Marton, 1986, p. 31). Kaapu & Tiainen (2012) allude to a "non-educational context, which is a new applied field for phenomenography", (2012, p. 4).

In her meta-analysis of fifty-six phenomenography studies, Harris (2011) outlines differences between phenomenographic researchers of how the thematic field (Gurwitsch, 1964) is interpreted, and the terms used to denote the inner and outer focus of awareness. Harris' paper serves the useful purpose of demonstrating how the terms for structure of awareness, referential and structural elements or the phenomenographic terminology of 'the what and the how' can be articulated in multiple ways (additionally listing many useful studies). Harris seems to arrive at the conclusion that phenomenography is not weaker because of these variances, stating "(w)hile this paper is not advocating for a prescriptive definition as to what a context or perceptual boundary is (as this will vary based on the phenomenon under study), this review makes it clear that authors should define and explain their use of this framework.", (Harris, 2011, p. 116). A possible criticism of some of the work discussed is that some researchers are less articulate in describing how they interpret the focus and awareness of their analysis framework. Also of note is that even while some articulation is rather lacking, it may not reflect the quality of the study, as Roisko (2007) or Berglund (2005) perhaps amply demonstrate.

3.5 Interviews in a context of phenomenography

Phenomenographic interviewing seeks to establish the relationship between the interviewee and the phenomenon (Marton & Booth, 1997, p. 129; Bowden, 2005, p. 15). In this study, the nominated phenomenon is the smart learning activity situated in a journey, with ‘certain aspects of it being of specific interest to the research’ (Marton & Booth, 1997, p. 132).

Bowden (2005, p. 12) believes an interviewer should ask a minimum of (standardised) questions and offer little guidance on a topic, citing a case study concerning a physics project where complex topics were not specifically mentioned in the interview at all (Bowden, 2000, p.8). This approach purports to increase opportunity for the interviewee to fully voice their experience reflections, keeping focus on the relationship between the interviewee and the phenomenon, as “(i)t is imperative that the researcher’s own relation to the phenomenon and to the subjects be controlled so as to avoid distorting the research outcomes” (Bowden, 2005, p. 14). However, multiple interpretations of a question is a variable in itself, and while we may assume the researcher means the same thing when asking the same question (word for word) to each interviewee, does the fact that each interviewee may interpret it differently affect the validity of their voiced reflections? Certainly, as noted previously, other researchers including phenomenographers have acknowledged the issue of attempts to bring a ‘positivist approach’ to an interpretivist paradigm (Rubin & Rubin, 2012, p. 37; Säljö 1996, 1997; Kvale, 1996, p. 211). Yet Bowden does acknowledge that other phenomenographers “may engage in more extensive dialogue during the interview” (Bowden, 2000, p. 10). In this study, I have taken the stance of responsive interviewing, as it “emphasizes flexibility of design and expects the interviewer to change questions in response to what he or she is learning” (Rubin & Rubin, 2012, p. 27). The nature of the questions do not change, but the contexts or order that they appear and how they are posed can change according to each interviewee’s perceptions and areas of interest, as “both interviewee and researcher play an active role in shaping the discussion, leading to a congenial and cooperative experience in which the interviewee comes to feel understood, accepted, and trusted as a source of reliable information”, (Rubin & Rubin, 2012, p. 26). Other researchers appear to support this approach: Roisko writes about her procedure, often relating to these issues with similar conclusions to my own (2007, pp.105-124), citing Marton (1994a) amongst others (e.g. Sjöström &Dahlgren, 2002; Booth, 1992; Berglund, 2005; Cope, 2004). Roisko sums up her position as: “I was alert to what had been said on the topic by several authors of phenomenographic research but I certainly adapted their ideas for the purpose of my own research and the phenomena of interest.” (2007, p. 107). Many others have further relevant supporting commentary on adaptive approaches to interviewing (Edwards, 2005, pp. 82; Atiq, Haney, DeBoer & Cox, 2016, p. 3; Ireland et al., 2009, pp. 7, 8; Berglund, 2005, p. 62).

3.5.1 Phenomenographic conversations in this study

Within the context of phenomenography, I consider the conversational partnership as “the researcher or interviewer work(ing) together with the interviewee to bring forth his awareness of undertaking the task, a state of meta awareness…” (Marton & Booth, 1997, p. 130). I briefly discuss interviewing diverse cohorts of students about their experience of participating in a smart learning journey activity. Practical issues of language, articulacy, confidence, cultural assumptions or perceived ‘academic hierarchy’ may all impact the conversational relationship between interviewer and interviewee. I have sought to delve into the lifeworld (Ashworth & Lucas, 2000, p. 307) of the learner as they participate in a smart learning journey, and interviewees share both implicit and explicit meaning in their discussions. This mutually constructed meaning is their reality, as previously noted by Kvale (1999, 1996, p. 37; Shotter, 1993, p. vi).

Referring to the phenomenological method of Husserl, where “the philosophers themselves … reflect on their way of experiencing the world” (Marton, 1997, p. 99), Marton indicates “participants in the research are invited to reflect on their experience of the phenomena dealt with. They are supposed to adopt an attitude which is similar to that of the philosophers who exercise the Husserlian method”, (Marton, 1997, p. 99). I suggest that young student participants may not always be fully able (or willing) to articulate their deeper reflections, are sometimes less confident, and need more coaxing to be assisted to discover them in order to draw them out. This can result in fragmentation of discourse, and a greater or lesser contribution from the interviewer to encourage reflection from the interviewee. Marton & Booth refer to this spectrum of reflections in interview dimensions (1997, pp. 130, 131), and Trigwell (2000, p. 68) also acknowledges similar problematic aspects of interview process. When Bowden states “we had all of the input at the beginning of the interview…” (2005, p.

19) he implies his interviewees were articulately forthcoming. He goes on to state that "in some phenomenographic interviews a number of inputs may be made in a planned way at various points of the interview" which may indicate he is aware that some interviewees may not be so ready to deeply reflect on their experience of a phenomenon. Bowden's 2005 study involved academic (Bowden, 2005, p. 16) "experienced and very experienced 'active' researchers" (Green, 2005, p. 39). One might fairly deduce that these academic participants were "blessed with considerable self confidence" (Bruce, 1994a) to articulate their thoughts and feelings in some reasonable depth. In this study, these factors were sometimes not present in young learners, though they show themselves in the more mature participants.

From a critical perspective there can be moments in interviews in this study where the line between probing and prompting is briefly crossed, but it is argued here that these are rare and difficult to avoid in such circumstances, and are mostly acknowledged and moved into further discussion in the interview. Bowden (2005, p. 31) highlights potential ethical questions if pressure to dig deeper for reflections goes too far. In this study I feel that retaining respect and empathy for interviewees throughout interviews has been achieved. It should be noted that as interviewing in the study progressed, the technique for interviewing improved as well as student cohorts exhibiting more confidence and an increased level of self-directed emergence so that later interviews involve very little talking by me, the interviewer.

3.5.2 Establishing what the interview is about

To encourage an interviewee to fully reflect on broad aspects of interest to the study, some 'trigger questions' (Trigwell, 2000, p. 68; Roisko, 2007, p. 136) were formulated that referred in general terms to locations, technology, the journey and so forth, to be asked if these topics did not emerge naturally. These might then be followed up to probe further for deeper reflective reasoning and feelings. Francis (1996) refers to the need to indicate 'prompt trails' to show how and why interviewees may have been 'led' down a path of inquiry, where the interviewer digs deeper for data of interest that may not have been uppermost in the interviewee's mind (Francis, 1996, pp. 38-39). Though a good idea, I would suggest this is difficult and time consuming to achieve, however transcripts themselves serve as a record of levels of prompting and probing in the detailed data and process of uncovering experience reflections. Each interview varies in nature, while still covering ground relevant to the study, and the analysis of each quote must fully take into account the authenticity of the quote, putting aside and bracketing overly prompted quotes.

I needed to move past what a learner 'did', and ask *why* they did things, why they thought things and how they thought about things. Åkerlind (2005c) makes this point, defining 'what' questions relating to what a participant did, and that phenomenography goes "… beyond 'what' questions ('what did you do?') to 'why' questions ('why did you do it that way?')", (Åkerlind, 2005c, p. 65). Bruce (1994a), citing Säljö (1979), makes a related though different point, highlighting an alternate interpretation of 'what' questions. "Clearly the phenomenological rules of bracketing, description and horizontalization need also to be applied when designing interview tasks and/or questions. For this purpose 'what' questions are sometimes claimed to be most useful, for example 'what do you mean by learning?'", (Bruce, 1994a, pp. 51, 52). Bruce is therefore referring to 'what made you do that?', rather than 'what did you do?', a distinctly different meaning to that of Åkerlind. So context of 'what' is everything.

Säljö (1979) provides further question examples as "how do you usually set about learning?": "why do you think some people are better at learning than others?"; "what do you actually mean by learning?" (1979, p. 445). Using 'how' is therefore useful, and asking what learners 'mean' when they use certain terms or expressions; the example that asks about why the interviewee may think 'some people are better at learning than others' is of particular interest. Sometimes I ask questions about what an interviewee might think about other learners, for example why other learners do not participate online, or whether they find it helpful or not to learn within collaborative scenarios. This 'hypothetical' questioning is referred to by Åkerlind: "…What is important in a phenomenographic interview is not the examples of practice per se, but the way that the interviewee thinks about those examples, i.e., what they think the examples illustrate about the phenomenon being investigated", (Åkerlind, 2005c, p. 66).

By using these "various interview techniques" (Bowden, 2005, p.13) discussed by Marton & Booth (1997, p. 126), the aim of interviews has been to maintain an emergent inductive approach as much as possible. This minimises predefined aspects and supports interviewee freedom of expression, permitting data to emerge from participants in ways potentially not previously known or thought about by the researcher. This allows participants to think aloud, be doubtful or pause (Sjöström & Dahlgren, 2002, p. 341). Acknowledging that the smart learning journey activity is a complex layering of these intertwined aspects, Ashworth & Lucas comment on formulating the topic of research and subsequent interview focus:

> *"… the topic for investigation in the research has to be formulated somehow in the researcher's mind, and the research interviews have to be introduced to the interviewee as being `about' something. […] The researcher and researched must begin with some kind of (superficially) shared topic, verbalised in terms which they both recognise as meaningful. If we tried to bracket this, the conversation would be directionless … " (Ashworth & Lucas, 2000, p. 299.)*

Trigwell (2000) describes doing interviews 'in sections' (p. 67), at twenty minutes each, all within a single interview. He indicates clearly nominated topics for each section, to obtain data of interest to his study, and indicates that "(i)t is possible to do the analysis by section, provided the sections don't overlap too much…" (p. 67). Trigwell provided early reasoning for my attempt to delimit areas of experience of the activity, and consequently aided interview design and approach, including design of an introductory 'ice-breaking' questionnaire (which was not analysed). I also noted others who discuss more specific topic questioning to obtain useful data for the research, such as Francis (1996, pp. 38-39), Roisko (2007, pp. 106-107), Berglund (2005, p. 62), Uljens (1996, pp. 121-123). Returning to Kvale, "emphasis on the crucial role of the person of the researcher does not imply a neglect of techniques and knowledge", (1996, p. 106). Though interviews were largely very emergent, broad areas of experience of the phenomenon were predefined in order that aspects of interest in the phenomenon were investigated (Trigwell, 2000, p. 67). This establishes "what the interview and research are about" for the researcher and the interviewee (Ashworth & Lucas, 2000, p. 299, Bowden, 2000, p. 9), and contributes to the purpose of answering the research questions. Critical aspects of the phenomenon (Edwards, 2005, p. 100) can be defined by the researcher's own experience (Uljens, 1996, p. 121-122; Roisko, 2007, p. 107) as well as factors found in literature (for example Spector, 2014). Being aware of these positions, I employed these approaches, adapted to my own study.

3.5.3 Establishing empathy

To gain insight into experiences about complex aspects of the smart learning activity, it was essential to gain trust and good rapport with interviewees, the diverse student cohorts who may not always be confidently articulate. Establishing empathy was considered highly significant, as Kvale states "(t)he outcome of an interview depends on the knowledge, sensitivity and empathy of the interviewer" (1996, p. 105). Establishing empathy and trust in a fruitful "conversation partnership" (Ashworth & Lucas, 2000, p. 302; Rubin & Rubin, 2012, p. 26) "encourages open, honest, and detailed replies" (Rubin & Rubin, 2012, p. 26), and therefore deeper reflection from the interviewee (Marton & Booth, 1997, p. 130).

A conversational partnership permits the interviewee to talk more freely and explore their own reflections, and the researcher to appear engaged, maintain focus yet remain aloof in terms of any judgement or opinion. It is not a perfectly equal partnership, as "(t)he researcher determines the research problem and asks most of the questions, while the conversational partner provides most of the answers. However, what the conversational partner says shapes what the researcher subsequently asks; and in responsive interviewing, the researcher customizes questions for each interviewee…" (Rubin & Rubin, 2012, p. 26). This process is what uncovers experience reflection, to the benefit of the research and with the researcher continually watchful. "If the interviewer – interviewee relationship were to break down, then the loss would be to the research effort; avoidance lies in the interviewers sensitivity to the potential of the relationship and the interviewers ability to prepare and maintain it", Marton & Booth, 1997, p. 131).

3.5.4 Bracketing

While "(i)n essence, the interview should be regarded as a conversational partnership", the researcher should however "consciously silence his or her concerns, preoccupations and judgements" (Ashworth & Lucas, 2000, p. 302). Bracketing, "the need for the researcher to set aside his or her own assumptions", (p. 297), is a very important consideration, not only of the interview process, but to achieve some level of rigour and validity for the whole approach and planning of the investigation, and most especially the analysis of data.

Consider again that the smart learning journey activity is a fairly novel concept. This novelty may be to advantage in the investigation of it, in as much as it might therefore have some notional *objectivity of investigation* by virtue of prior research being either rare or even non-existent. Yet, presuppositions and assumptions of the researcher do still exist, potentially all of which "would deleteriously affect (…) hearing of the student's experience." (Ashworth & Lucas, 2000, p. 298). This researcher bias, from both within and of the phenomenon of investigation, and also separate though related to it, may be impossible to completely bracket (Ashworth & Lucas, 2000, p. 299; Cope, 2004, p. 4).

In the case of this researcher, possible indirect preconceptions or assumptions may exist in areas such as knowing, learning, teaching, assessment and the role of students in the learning process, as briefly listed previously under 'Bias', in chapter one. Direct assumptions or presuppositions relating specifically to investigating smart learning activities may exist in areas such as learning design, type of tasks, role in unit of study, relevance to topic of learning, relationships to students (within the higher education hierarchy), and cultural differences between the researcher and the interviewee. Ashworth & Lucas (2000) provide two useful tables for consideration of bias. Examining their "pragmatically-oriented list, indicating some of the kinds of presupposition that the educational researcher should recognise" (p. 298) helped to identify what may be at risk of assumption or preconception for myself as a researcher and what I am investigating in this study (Appendix 03, Table A). A second table from Ashworth & Lucas', with "Practical Guidelines for the Conduct of Phenomenographic Research", helped to focus on areas of potential iterative improvement for processes (Appendix 03, Table B).

While Ashworth & Lucas would argue "…we cannot suspend our commitment to certain guiding notions. But we must hold these tentatively lest they subvert the very aim of entering the lifeworld" (Ashworth & Lucas, 2000, p. 299), they also believe that "the achievement of empathy with the experience of the student can greatly assist the process of bracketing" (p. 299). For example, verbal acknowledgement of possible bias can highlight alternate interpretations of a situation or aspect of the phenomenon, thereby making it possible to reflect on it more deeply. Conversely, absence of some 'natural' conversational signals can hinder natural exploration of experience reflections, as Ireland et al. (2009) elaborate: "… certain behaviours, enlisted in the name of 'bracketing' […] appeared to have a very negative influence on (participant) accounts, creating an 'unnatural conversation' where research participants seemed to become defensive. For example, not laughing at their jokes […] quickly shut down enthusiasm for the topic…", (Ireland et al., 2009, p. 7). I tended to often respond with "that's interesting" or similar, to encourage all participants no matter what they had said.

3.5.5 Issues of the conversational partnership

My personality and experience in interviewing

Rubin & Rubin encourage researchers to interview according to their personality, in relation to the interviewee, as "(i)nterviewing works best when you adopt a style that both fits you and makes interviewees comfortable. How much chat you engage in, how you react to contradictions or inconsistencies, how much sympathy you express, depends on your personality as well as the needs of the interviewee", (Rubin & Rubin, 2012, p. 97). In this study I have often been able to create a rewarding, fruitful and relaxed atmosphere that results in rich emergent data and reflective discussion, sometimes remarked on as such by the interviewee, e.g. P18 "it was very chill", or P19 "I think I said more than I thought before, by coming…”. Whilst I do have prior experience of interviewing, there is never a guarantee that a participant fully relaxes and talks freely.

In earlier interviews I tend to interrupt the interviewee, potentially resulting in curtailing description. Conversely, it results in the interviewee clarifying and exploring their thoughts, or emphasising what they wanted to say. I sought to reduce this in later interviews, as “interviewing skills should be subject to an ongoing review and changes … (f)or instance, stylistic traits which tend to foreclose description should be minimised”, (Ashworth & Lucas, 2000, p. 299).

In a bid to encourage less forthcoming interviewees, I sometimes talk too much. Though not ideal, it can produce results, and an interviewee will finally begin to talk. A good example of this ‘therapeutic discourse’ (Marton & Booth (1997, p. 130) is P2, who came to the interview and immediately stated they only had 15 minutes and that they had not ‘done the journey’. Early in the conversation P2 expressed specific cultural issues that may or may not have impacted their participation in the learning activity as they saw it, but finally opened up to give rich useful transcript data about aspects of the activity that are valuable to the study.

Very occasionally, conversational challenges became slightly tense, though this is rare (e.g. P5). Again, it is like a therapeutic session and risk is involved, as “making the interviewee aware of his own thoughts and breaking down or bypassing his defences can be painful, though necessary”, (Marton & Booth, p. 130). Bowden hints that this could challenge the ethics of the research if the interviewee becomes uncomfortable, (Bowden, 2005, p. 31). I made every effort when questioning became more difficult or the conversation faltered to withdraw slightly to a more relaxed position.

Discussing factual aspects

Factual aspects of conversations are clarified. Though this could be interpreted as a presupposition on behalf of the researcher (for example, if they know what GPS is), I regard this as clarifying ‘what the interview is about’ (Ashworth & Lucas, 1998, 2000), rather than influencing a student positively or negatively in relation to their knowledge. Reed mentions “establishing a ‘shared definition’” of technical concepts (Reed, 2006, p. 5). These interjections happen in conversations to assist a participant in their understanding, without ‘biasing’ reflection or thoughts, and might be described as natural social construct of meaning, in the sense of “how groups of people collectively elaborate their ideas”, (Raskin, 2002, p. 19). Their understanding or absence of it in relation to technological functionalities is evident in conversations and is taken into account for 'meaning' reflection relating to a "participant's assumptions about the 'causes' of their experience", (Ashworth & Lucas, 2000, p. 298).

3.6 Further reflections in contexts of phenomenography

Next I discuss issues in the study within contexts of phenomenography: the nature of conceptions and experiences in relation to what I am investigating; notions of learning effectiveness; and relevance of Variation Theory to this study. I follow with justification for approach to applying phenomenographic findings to analysis of learner generated content, and a short outline of working with Bloom's Revised (Anderson & Krathwohl, 2001) and SOLO (Biggs & Collis, 1982) taxonomies in that context.

3.6.1 On conceptions and experiences of the phenomenon

After considered reflection I realised I needed to fully establish what was being investigated and examined, in phenomenographic terms. The fundamental question to ask is: "Am I examining learners conceptions of a smart learning activity, or am I examining learners experiences of aspects of a smart learning activity?" I am setting out to do a lot of the latter and somewhat of the former as a consequence of the latter. That is, I am investigating experiences of participating in the smart learning journey, a specific past event, rather than conceptions of it, though conceptions (or hypothetical idealisations) may arise from experiences of participation and further discussion and reflection. Roisko (2007) makes a similar distinction in clarification of her phenomenon of investigation. Highlighting how conception and experience seem interchangeable in various phenomenographic studies, she states:

> *"From the point of view of the present study the distinction between the two terms "conception" and "experience" is of great importance because my aim is not to investigate the conceptual features of certain limited subject matter, but rather the sense-related features of experiencing learning holistically. Thus, […] there remains no need for further argumentation for using the terms "experience" or "ways of experiencing" to denote my unit and object of investigation. I will work with Marton's (1996a) and Marton and Pong's (2005) guidance by applying the terms "experience" or "way of experiencing" throughout the study to denote the object of research." (Roisko, 2007, p. 91)*

Marton & Pong's guidance for using "experience" or "ways of experiencing" is defined as "how you experience a certain feature of an object is a function of what you compare the object in question with", citing Gibson & Gibson (1955), Garner (1974) and Bransford & Schwartz (1999). In this study, experiencing the discernment of variation of a smart learning activity manifests in multiple ways expressed both explicitly and implicitly in the transcript data. I am examining experiences of an actual event and the parts of it, and in consequence potentially also discovering overarching 'conceptions' in both general and 'hypothetical' contexts, after Åkerlind, 2005b, p. 66, or Säljö's (1979) example questions. From this position I have attempted to establish clarity, evidenced reasoning and justification for how I am going about the collection and analysis of data.

3.6.2 Interpretations of learning effectiveness

In this study, learning is examined from the perspective of the learner, and the experiences of participants offer clues about what may constitute aspects of learning to them. As such, it "does not even try to distinguish actual (real) learning from perceived learning", (Roisko, 2007, p. 23). My epistemological assumption of what may constitute effective smart learning is summed up by Liu et al.'s "learning to learn, learning to do and learning to self realisation" (2017b, p. 209). This broad position is further supported by Dron (2018), who thinks of learning in a smart learning environment as "a complex conversational process that can and usually does lead to much that is of value beyond what is planned" (2018, p. 3). Marton & Booth indicate the significance of learner focus on 'more global aspects of learning' (1997, p. 141), the larger picture into which a learning activity is situated, as key factors in the experience of the learning activity, and consequently on the experience of effective learning. Additional guidance is found in Spector (2014), who states that "(i)n a general sense, a smart learning environment is one that is effective, efficient and engaging" (Spector, 2014, p. 2), pointing in directions such as efficient technology and user experience to mediate learning. The effectiveness of the process for learning must therefore be acknowledged, as the mediation of technology, interfaces, task progression and interactions all affect approaches and outcomes of learning (e.g. Kop & Fournier, 2013; Karaksha, Grant, Nirthanan, Davey & Anoopkumar-Dukie, 2014). This broad interpretation of potential learning effectiveness permits examination of what learners themselves may consider to be justified as learning, and discussion of whether emerging characteristics of indicators for effective smart learning can be established.

Early phenomenography interpreted learning effectiveness using predetermined categories of variation based on deep and surface learning approaches. Richardson cites Säljö's five qualitatively different hierarchical conceptions of learning (Richardson, 1999, p. 56) as the increase of knowledge, memorizing, the acquisition of facts, procedures, etc., which can be retained and/or utilized in practice, the abstraction of meaning and as an interpretative process aimed at the understanding of reality. However, more recent phenomenographic thinking suggests that using predetermined categories of experience variation tends to potentially bias analysis, therefore emergent categories are encouraged, whether hierarchical or not (e.g. Ashworth & Lucas, 2000). It is so in this study that categories of experience variation emerge from the interview data and are then examined for characteristics of effective learning. Jones and Asensio argue that "(p)henomenography has explicitly evaluative aims" (Jones & Asensio, 2001, p. 315), highlighting issues around learning effectiveness relating to the variation of student interpretations of instructional design and learning assessment. Discussing the problem of understanding faced by students when interpreting course documents, they argue it "suggests that the phenomenographic emphasis on variation could have implications for the evaluation of networked learning environments" (Jones & Asensio, 2001, p. 320). This may also be relevant to evaluation of smart learning environments.

3.6.3 Relevance of Variation Theory in this study

It is useful to briefly examine 'Variation Theory' (VT), a further development of the phenomenographic methodology (Åkerlind, 2015), in light of this study. Beginning with definitions, I attempt to clarify the position of the study in relation to aspects of VT that may be of some relevance.

Orgill (2012) provides a definition of VT as "a theory of learning and experience that explains how a learner might come to see, understand, or experience a given phenomenon in a certain way. In variation theory, it is assumed that there are critical aspects of a given phenomenon that learners must simultaneously be aware of and focus on in order to experience that phenomenon in a particular way". Wright & Osman (2018) describe VT as offering "a pedagogical tool for teachers to identify necessary perceptual conditions for learning about a specific content. Variation Theory builds on the phenomenographic notion of learning as qualitative change in awareness of a particular content" (pp. 261-262).

Definitions describe learning as the aim for learning (and teaching) some knowledge content or skill as specified by an instructor, in a context of the subsequent potential variation of experiences of learners to learn it, or to apply it. Discussion revolves around ‘objects of learning’ and mechanisms by which learners can focus their awareness in most effective ways on ‘critical aspects’ of those objects to learn and apply them (Åkerlind, 2015, p. 6). These ‘intended’ objects of learning (Marton, 1981; Marton, Runesson & Tsui, 2004) are the domain of the instructor, however, it is clear that learners have intentions too about what they might wish to learn (Greeno & Engeström, 2014), and this may be of more or less relevance depending on the context of the learning (i.e. formal or informal, for example). Greeno & Engeström refer to this as the ‘vital object of interest’, the fourth quadrant of an object of learning, after the intended, enacted and lived aspects (Marton et al., 2004; Bussey, Orgill & Crippen, 2013, pp. 12-13). I discuss this in considerably more depth in chapter eight in the context of the process for and content of learning in a SLJ, however here I refer to this in the context of the relevance of VT.

The main purpose of VT appears to be for learners to learn content that is predefined, for example through lesson plans (Lo, Marton, Pang & Pong, 2004, p. 192; Marton & Pang, 2006). In the context of broad flexible concepts of smart learning, often for citizen participant informal activities, this may act somewhat against the connectivist principle of autonomy. However, it may not be this simple, as VT describes an object of learning further, being both a direct and an indirect object. The ‘indirect’ object is the way learners approach the application of what is learned, “the capability to be developed, which refers to the nature of the intentional act in relation to the object” (Wright & Osman, 2018, p. 263). Marton & Pang (2006) describe the direct (object) being “defined in terms of content, such as demand and supply, language tones, irony, and so forth” and the indirect as “the kind of capability that the students are supposed to develop” (p. 194). Some aspects of the indirect object of learning that are related to direct intended learning objects may be of relevance to smart learning activities. They may be considered by participants as of value, or lead to finding value in related contexts, and this may merit further more detailed discussion outside of this work (as space is limited). Whether intended by an instructor or ‘merely’ of vital interest to the learner (thereby potentially unintended), an object of learning perceived as such by a participant in a smart learning journey has elements of intentionality in a broad, perhaps indirect sense. As I discuss in chapter eight, intentionality towards learning is exhibited in participant experience utterances, in terms of mental acts that are “directed towards something, something beyond themselves” (Wright & Osman, (2018, p. 260). This can fulfil elements of the lived object as well as be related to intended (or unintended) indirect object, but for purposes of this discussion, can be considered as outside the remit of VT.

It is important to note that no emphasis was placed on any intended object of learning in the activities being investigated in this study, though there were tasks and knowledge content, this was not obligatory or assessed. Rather, the study was more curious about what may form vital objects of interest to the learner in a smart learning journey, and the context of value or engagement that may constitute aspects of learning. If this study had been examining intended objects of learning - that is, considering the 'apprehended content' (Marton, 1981, p. 184), defined by learning outcomes and assessed by some means, VT may have more relevance. As no content was being formally assessed and participants were encouraged to act autonomously in all respects of their participation in the activity, they were not explicitly directed to any action regarding content, tasks or amount of journeys to be completed. All aspects were entirely left to them.

In summary, VT has some related aspects of relevance to this study albeit in different contexts to how they may be intended within the world of VT. VT seeks to mitigate the awareness of learners toward nominated content and critical aspects of experiencing it in certain ways, whereas in this study nominated content is provided as a general topic of an activity (but perhaps not the only possible topic), and any aspects or changes in experience complexity of participants emerge naturally in autonomous ways.

3.6.4 Working with learning taxonomies

Learner generated content (Pérez-Mateo et al., 2011) created by digital interactions of participants in SLJ activities offered opportunities for gaining understanding about the nature and effectiveness of learning. Potential for alignment with phenomenographic dimensions of learner experience variation might provide clues about ways to measure some aspects of this LGC learning. However, assessing learning in conventional ways was felt to be inappropriate to this kind of ad-hoc non-obligatory autonomous activity.

Inspired initially by O' Riordan, Millard & Schulz (2016), who sought to "explore the potential of content analysis (CA) methods that are founded on pedagogical theory" (2016, p. 2), I considered Bloom's Revised taxonomy (Anderson & Krathwohl, 2001) and the Structure of the Observed Learning Outcome (SOLO) taxonomy (Biggs & Collis, 1982), placed in a context of phenomenography. Newton & Martin (2013) showed precedent for utilising these taxonomies with phenomenography, contrasting phenomenographic categories of variation with Bloom's and SOLO scores in relation to assessment of undergraduate student science education. Cope (2002) and Taylor & Cope (2007) use phenomenography in relation to aspects of the SOLO taxonomy. Marton & Svensson also refer to SOLO in a positive light (1979, pp. 477, 480). Other relevant work offered further justification for investigating use of cognitive domain taxonomies in this study. Nikolov et al. (2016) use a derivative Bloom's taxonomy, demonstrating use in relation to smart learning environments and technology, forming part of smart learning experiences and learning outcomes, also seen in the work of Badie, (2018) for types and levels of learning. Karaksha et al. (2014) analyse learning tool impact on surface and deep learning achievement using the SOLO taxonomy as a measurement scale of learning outcomes (2014, p. 2). Wang, Chen & Anderson (2014) describe connectivist relationships to Bloom's Revised taxonomy, matching levels of interactions to equivalent levels of Bloom's. This assists in thinking about cognitive engagement at different levels of a digitally mediated, interactive and participatory connectivist-inspired experience.

3.6.5 Bloom's Revised & SOLO taxonomy systems

Short summaries of both these learning taxonomies follow, with some reflections in the context of phenomenography and this study.

A summary of Bloom's Revised taxonomy

Krathwohl describes the Bloom's taxonomy as "a framework for classifying statements of what we expect or intend students to learn as a result of instruction", and remarks on the need for a "means of facilitating the exchange of test items" between institutions as the reason for why the original Bloom's taxonomy came about (2002, p. 212). The taxonomy provided a way of standardising levels of learning, using an inclusive relational hierarchy of categories.

Krathwohl notes that Bloom saw the original taxonomy as "more than a measurement tool", listing amongst other aspects, a "common language about learning goals" and a "panorama of the range of educational possibilities against which […] any particular educational course or curriculum could be contrasted". That is, an articulation of the range of depth or complexity that might surround an aspect of learning (p. 213). It is Krathwohl's revised version of Bloom's taxonomy that articulates the cognitive process dimension and this has become widely known and applied. A summary outline of the Bloom's Revised cognitive process dimension is shown in Table 3:

Descriptor	Levels of understanding
Remember	Recognizing Recalling
Understand	Interpreting Exemplifying Classifying Summarizing Inferring Comparing Explaining
Apply	Executing Implementing
Analyse	Differentiating Organizing Attributing
Evaluate	Checking Critiquing
Create	Generating Planning Producing

Table 3 Summary of the Cognitive Process Dimension of Bloom's Revised Taxonomy (from Krathwohl, 2002, p. 214)

Using Bloom's Revised in this study

Krathwohl notes that not every process is exactly hierarchical in complexity, as there is overlap, but that if "one were to locate the "center point" of each of the six major categories on a scale of judged complexity, they would likely form a scale from simple to complex" (p. 215). It is in this sense that the cognitive dimension scale of Bloom's Revised has been widely used, and is also used in this study. There will be overlap and blurring between some cognitive process conceptual equivalences, yet overall there is a logical hierarchy. In Appendix 3, Table J, I have provided some of the reasoning and concepts for how equivalence was 'thought through'. Making use of additional articulation of Hounsell's 'Arrangement, Viewport, Argument' (2005, pp. 111, 113), I adopted a broad overlapping equivalence for each level of experience complexity, further discussed in chapter five, analysing the learner generated content.

The example seen in the DigComp 2.1 citizen digital skills framework (Carretero et al., 2017) is another application of Bloom's Revised taxonomy to provide a broad and overlapping cognitive domain equivalence in a range of skills and competencies. This is used throughout the framework as a mechanism for evaluating levels of skill, knowledge and competence. Used as a cognitive domain equivalence for depth and complexity of implicit (or explicit) learning in a smart environment, Bloom's Revised can assist in articulating how experience complexity might be interpreted for designing a smart learning activity, and in potential measurement of aspects of learning that may be going on. Rather than employing this taxonomy as a system to measure what we "intend students to learn as a result of instruction" or placing "heavy emphasis on objectives requiring only recognition or recall of information" (Krathwohl, 2002, pp. 212, 213), it can act as a model for how measurement might be implemented or approached, depending on the topic and type of activity concerned.

A summary of the SOLO taxonomy

In discussing aspects of qualitative models of assessment, Biggs (1995) refers to "the techniques of phenomenography […] that usually reveal layers of understanding of the target concepts: a hierarchy of conceptions that can be used to form assessment targets" (Biggs, 1995, p. 6). Acknowledging the general requirement to 'define increasingly higher quality' in terms of aspects such as increasing complexity of structure, abstractness, originality and other factors, he goes on to state that these "may be classified" (p. 6) using the Structure of the Observed Learning Outcome (SOLO) Taxonomy (Biggs & Collis, 1982). The relationship between SOLO and cognitive development is strong (indicated in Table 4), showing the hierarchy of SOLO descriptors against matching cognitive development stages (pp. 24-25). In broader contexts, the hierarchy has been employed in many studies since its inception, for many contexts of topic and learning.

Descriptor	**Capacity**	**Relating operation**	**Consistency and closure**
Pre-structural	Minimal response confused	Bound to specifics	No felt need for consistency
Unistructural	One relevant datum	Can only "generalise" with one aspect	No felt need for consistency closes too quickly jumped to conclusion can be very inconsistent
Multi structural	Isolated relevant data	Can "generalise" in terms of a few limited and independent aspects	Has feelings for consistency can be inconsistent closes to soon isolated fixations all data can come to different conclusions with same data
Relational	Relevant data plus interrelations,	Can generalise within given or experienced context using related aspects	No inconsistency within given system but closure is unique so inconsistencies may occur when goes outside the system
Extended abstract	Relevant data plus into relations plus hypotheses. Alternatives.	Can generalize to situations not experienced	Inconsistencies resolved no felt need to give close decisions conclusions held open or qualified to allow logical possible

Table 4 Summary of SOLO descriptors with features of structural learning complexity (from Biggs & Collis, 1982, p. 25)

Biggs & Collis propose “learning quality depends on […] features intrinsic to the learner, such as his motivation, his developmental stage, his prior knowledge of the area, and so forth” (1982, p. 17). This supports usefulness in the context of a hierarchy of experience complexity equivalences, acting as a model for interpretation of potential complexity for learning in a given activity. The SOLO taxonomy complements Bloom’s in that the category descriptors can be interpreted broadly and can adapt in various ways appropriate to design of activity. They offer an alternative or can be combined for design or for assessment strategies.

O’ Riorden et al.’s (2016) descriptors (Table 5) for both taxonomies were particularly useful to understand potential for general equivalence in a similar way to how the DigComp 2.1 had employed the Bloom’s Revised taxonomy.

<table>
<tr><td>BLOOMS Revised</td><td></td><td></td><td>SOLO</td><td></td><td></td></tr>
<tr><td rowspan="2">0</td><td rowspan="2">Off-topic</td><td rowspan="2">There is written content, but not relevant to the subject under discussion.</td><td>0</td><td>Off-topic</td><td>There is written content, but not relevant to the subject under discussion.</td></tr>
<tr><td>1</td><td>Prestructural</td><td>No evidence any kind of understanding but irrelevant information is used, the topic is misunderstood, or arguments are unorganised.</td></tr>
<tr><td>1</td><td>Remember</td><td>Recall of specific learned content, including facts, methods, and theories.</td><td>2</td><td>Unistructural</td><td>A single aspect is explored and obvious inferences drawn. Evidence of recall of terms, methods and names.</td></tr>
<tr><td>2</td><td>Understand</td><td>Perception of meaning and being able to make use of knowledge, without understanding full implications.</td><td>3</td><td>Multistructura l</td><td>Several facets are explored, but are not connected. Evidence of descriptions, classifications, use of methods and structured arguments.</td></tr>
<tr><td>3</td><td>Apply</td><td>Tangible application of learned material in new settings.</td><td rowspan="2">4</td><td rowspan="2">Relational</td><td rowspan="2">Evidence of understanding of relationships between several aspects and how they may combine to create a fuller understanding. Evidence of comparisons, analysis, explanations of cause and effect, evaluations and theoretical considerations.</td></tr>
<tr><td>4</td><td>Analyse</td><td>Deconstruct learned content into its constituent elements in order to clarify concepts and relationships between ideas.</td></tr>
<tr><td>5</td><td>Evaluate</td><td>Assess the significance of material and value in specific settings.</td><td rowspan="2">5</td><td rowspan="2">Extended abstract</td><td rowspan="2">Arguments are structured from different standpoints and ideas transferred in novel ways. Evidence of generalisation, hypothesis formation, theorising and critiquing.</td></tr>
<tr><td>6</td><td>Create</td><td>Judge the usefulness of different parts of content, and producing a new arrangement.</td></tr>
</table>

Table 5 Combined taxonomies with descriptors from O’Riordan et al., 2016

3.7 Research Design

This section provides a summary of the research conceptual model and research design.

3.7.1 Conceptual Model

The conceptual model of the research consists of the following elements and stages shown here.

<table>
<tr><th>Stage</th><th>Description</th></tr>
<tr><td>The problem</td><td>Measuring the effectiveness of 'smart learning' to potentially formulate a practical pedagogical guide based on connectivist style principles, considering how this guide might inform the design of smart learning.</td></tr>
<tr><td>Ontology and Epistemology</td><td>Informed by the paradigm of interpretivism, a non-dualistic stance asserting that there is only one world, "where there is an internal relation between the inner world and the outer world" (Ireland et al., 2009, p. 6) for the participant.</td></tr>
<tr><td>Methodology</td><td>(Developmental) Phenomenography (Bowden, 2000)</td></tr>
<tr><td>Methods</td><td>Examination of learner experience through interviews
Examination of digital learner generated content</td></tr>
<tr><td>Analysis</td><td>Analysis of interview data
The primary outcome space of the learning journey as a whole with emergent categories of description for experience variation of a smart learning journey
The secondary outcome space consisting of the four system elements of place, knowledge, collaboration and technology to demonstrate an alternate perspective of analysis
Analysis of learner generated content, combining Blooms Revised and SOLO taxonomies and integration with a system of learning experience variables derived from the experience complexity of a smart learning journey, from the primary outcome space</td></tr>
<tr><td>Outcomes</td><td>The primary outcome space of "Experiencing the smart learning journey"
The secondary outcome spaces of "Experiencing the system elements of a smart learning journey"
Potential ways of measuring effective smart learning
The Pedagogy Of Experience Complexity For Smart Learning
Overview of design implications</td></tr>
<tr><td>Discussion & Conclusions</td><td>Smart Learning and Experience Complexity
Relevance of the work in real world scenarios and smart learning cities
Validity of the research
Limitations of the study
Solutions to the research questions</td></tr>
<tr><td>Implications</td><td>How pedagogical guidelines may impact smart learning activities 'in the wild'
Support for citizen digital skills and literacies
Suggestions for measuring experience through digital interactions for richer learner analytics</td></tr>
</table>

Table 6 Conceptual Model based on approach by Imenda, 2014, Roisko, 2007

3.7.2 Research Design Summary

In order to find solutions to the research questions, I am investigating the nominated phenomenon, a smart learning journey activity, that is, a smart learning activity in geo-spatially relevant locations: forming a journey of several close by locations that are related to the topic of learning.

- Informed by an interpretivist paradigm, I adopt the non-dualist qualitative research approach of Phenomenography (Ireland et al., 2009, p. 6; Marton, 1996a, pp. 172-177).
- I have scoped the phenomenon of investigation, the smart learning journey, through research into relevant suitable technologies, connectivist-inspired learning activities, and within the context of my own prior professional experience as a multimedia academic and researcher (Uljyens, 1996, p. 121-122; Edwards, 2005, p. 100; Roisko, 2007, p. 32).
- To facilitate aspects of this process, I have defined some broad critical aspects (Edwards, 2005, p. 100) of the phenomenon, manifested as system elements. These are Place, Knowledge, Collaboration and Technology.
- Smart learning journeys are implemented in two countries, for two different topics.
- University student participants are drawn from different subject disciplines at European Qualifications Framework Level 6 and 7.
- I interview participants of ‘smart learning journeys’ to explore the variation of their experience, using a responsive (Rubin & Rubin 2012), conversational partnership (Ashworth & Lucas, 2000, p. 302) within a phenomenographic approach. Interviews are semi-scripted, open and emergent, with broad focus on the system elements of the phenomenon.
- I undertake two perspectives of analysis, viewing the data through alternate lenses to discover commonality and variation of experience that may contribute to measuring learning effectiveness and pedagogical understanding based in connectivist principles.
- I examine learner generated content (Pérez-Mateo, 2011), created as part of activity participation, using applied phenomenographic outcomes in conjunction with Bloom’s Revised and SOLO taxonomies, to “use the findings to affect the world I live and work in” (Bowden, 2000, p.3).

- To build validity and communicability for the analysis process I seek to use "disconfirming evidence" of critique and challenge, and "thick, rich descriptions" (Creswell & Millar, 2000, p. 128) of procedures and outcomes of analyses.
- I employ a thorough co-judge (Booth, 1992, p. 68) second review analysis procedure provided by another researcher.
- Through a combination of phenomenographic findings, reflection and discussion I build an empirically based, pedagogical and theoretically underpinned picture for learning in a smart learning journey activity. This came to be known as the 'Pedagogy of Experience Complexity for Smart Learning'.

3.8 Summary, chapter three

This chapter has attempted to describe my reasoning and understanding for my choice of methodology, the selection of research instruments and overall design and approach. Phenomenographic interviews offered a useful way by which I could put myself "into the learners' shoes and observe the phenomenon of 'learning' from their perspective" (Badie, 2018, p. 395). I further examined interviews within the phenomenographic context, later adding a critique of my own interview practice. I considered investigation of learner generated content (LGC) a potentially useful way of looking at how to measure learning by employing cognitive domain taxonomies alongside my phenomenographic research approach (and subsequent findings).

I defined and delimited what I was investigating: the phenomenon, and the ways of interpreting it, and the smart learning activity as a journey, and as a system. All of these aspects informed a greater foundation of reasoning to plan the stages of research design, and how to go forward into the next stage, gathering data - the interviews and LGC.

4 DATA COLLECTION

In this chapter I describe the process by which I gather all data. Beginning with descriptions of the smart learning journeys that learners participated in, followed by the overall interview process for transcript gathering, and obtaining the learner generated content.

4.1 Description of smart learning journeys

Here I provide full descriptions of the two smart learning journeys that were developed as the basis for this research. I place the smart learning journey in a brief conceptual context followed by describing each of the journeys themselves in some detail.

Developing the concept

The 'smart learning journey' concept used in this study has particularly arisen out of the closely related CyberParks' (e.g. Bonanno, Klichowski & Lister, 2019) research project. In the Cyberparks research, real-world points of interest (PoI) are embedded with smart sensors that offer trigger points to access geo spatially relevant content via a bespoke augmented reality (AR) smartphone app, the WAY CyberParks app.[25] PoI were a series of connected locations, forming a 'journey'. Early in the project the WAY Cyberparks app was considered as a possible technical solution, however was not thought to be suitably connectivist-inspired in nature for the creative participatory activities of interest to this study. As a result of that realisation a decision was made to use ad-hoc free technologies already available in Google Play or the Appstore so as to create experiences similar to the Cyberparks concept, with AR based real world learning experiences. This provided realistic examples of what any tutor was freely able to achieve in the current technology landscape, permitting authentic learning activities to be developed that did not rely on any special funding or app development.

[25] Google Play store: https://play.google.com/store/apps/details?id=com.mobility.waypark
Apple Store: N/A

The two smart learning journeys that were developed for this study were similar in approach though I was not explicitly prescriptive as to what the journeys should be like when I initiated working with the tutors who assisted me. I only asked that tutors provide ideas for a theme, locations that were relevant to the learning, relevant content, and tasks that they would like their students to participate in. This meant that journeys were essentially ‘designed’ by the tutor, not by me, the researcher, to retain a strong element of authenticity.

4.1.1 Literary London

BA English Literature and Creative Writing, London Metropolitan University.
Mr.Trevor Norris, Course Leader.

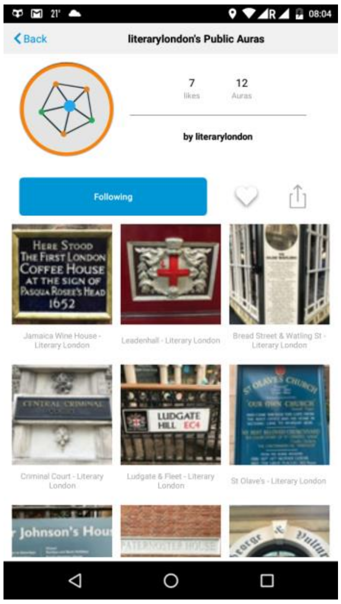

Figure 4 The Literary London HP Reveal channel

The ‘Literary London’ smart learning journey was developed by Trevor Norris, with technical implementation by me (AR, webpage development, map development). There were in total ten augmented reality Points of Interest, along a route of approximately 2,500 metres. All content was written or selected by Mr Norris. Supplementary content was additionally provided along the route that was not part of location AR augmentations. Augmented reality was developed using the HP Reveal (formerly Aurasma) Studio, which permitted me to develop AR ‘interfaces’ consisting of a series of icon buttons that the user could click to access knowledge content types (webpages or rich media) as well as the map showing where the learner was at that time. Screenshots (Figure 5) show how this appeared in the smartphone screen to the user when they accessed the AR trigger image using the HP Reveal app camera, after they had followed (subscribed to) the Literary London AR channel (Figure 4).

Figure 5 screenshots of the AR interfaces, Literary London

Points of Interest

The Points of Interest (PoI) are listed in full in Appendix 02, together with associated webpage content links. Webpage content was only accessible via AR trigger interface links.

The ten PoI were as follows:

A. Part One
    1. Saint Olave’s
    2. Leadenhall
    3. The Jamaica Wine House
B. Part Two
    1. The George and Vulture
    2. Saint Mary Woolnoth
    3. Bridge Street and Watling Street
C. Part Three
    1. Paternoster Row
    2. Ludgate and Fleet
    3. The Old Bailey
    4. Dr Johnson’s house

The map of the Literary London route is shown in Figure 6. This was created using Google MyMaps.

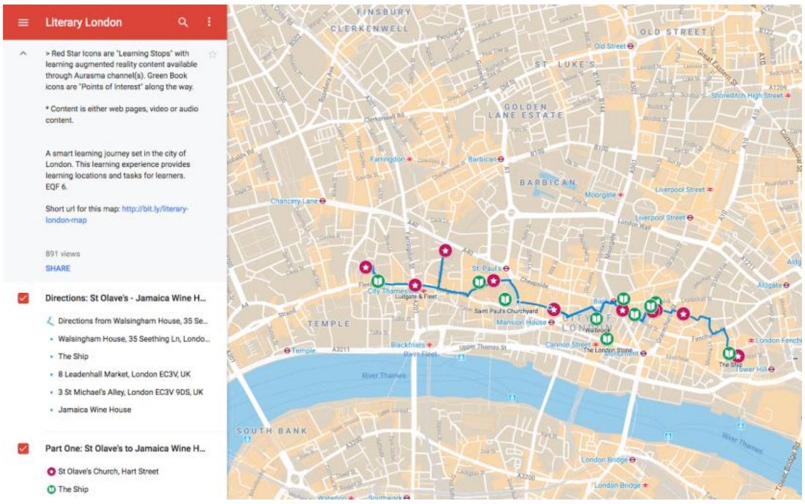

Figure 6 Google MyMaps map of the Literary London route

Summary of tasks

After some discussion about the investigation, Mr Norris created groups of students and loosely based tasks around activity task types discussed in Beetham (2012, p. 41, after Wilson, 2006). Student participation was formative and not assessed as part of any formal submission. Tasks were not obligatory but were suggested as being a useful way to take part in the journey. Tasks and groups were assigned via the Edmodo app, which also provided the online group discussion and sharing space for task content generated by learners. The assignment is available in full as Appendix 02.

4.1.2 Malta Democracy

Bachelor of Education and Masters in Teaching & Learning, University of Malta.
Dr. Philip Bonanno.
International Masters in Adult Education for Social Change, University of Malta.
Prof. Carmel Borg.

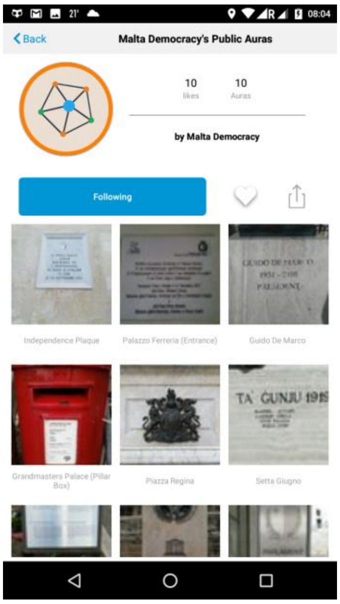

Figure 7 The Malta Democracy HP Reveal channel

The ‘Malta Democracy’ smart learning journey was developed by Dr Bonanno, along similar lines to the Literary London smart learning journey, with slight modification. My role was again to implement the technological aspects (AR, webpage development, map development). There were in total ten augmented reality Points of Interest, along a route of approximately 600 metres on Republic Street, Valletta, Malta. Dr Bonanno developed the theme and content of the journey, and selected all the PoI to be augmented.

Again I used HP Reveal Studio to create AR icon interfaces, here using a slightly simpler design, streamlining content choices. Knowledge content types included webpages or rich media. Screenshots (Figure 8) show how these interfaces looked to participants who accessed them via the HP Reveal smartphone app camera. We experimented with attempting to provide access to the Edmodo group directly from the AR trigger but this proved ineffective so for later participants the Edmodo icon was removed.

Figure 8 Screenshots of AR interfaces for Malta Democracy

Points of Interest

The Points of Interest (PoI) are listed in full in Appendix 02, together with associated webpage content links. Webpage content was only accessible via AR trigger interface links.

The ten PoI were as follows:

1. UNESCO column at entrance to City Gate, Valletta
2. Parliament columns, entrance to parliament building
3. Entrance information plaque, Palazzo Ferreria
4. Great Siege Monument
5. Guido De Marco statue & Law Courts
6. Piazza Republica, aka Piazza Regina
7. Entrance to St Georges Square
8. Independence day plaque, Grand Palace walls
9. Republic Day plaque, Grand Palace walls
10. Sette Guigno memorial statue

The map of the Malta Democracy route is shown in Figure 9. This was created using Google MyMaps.

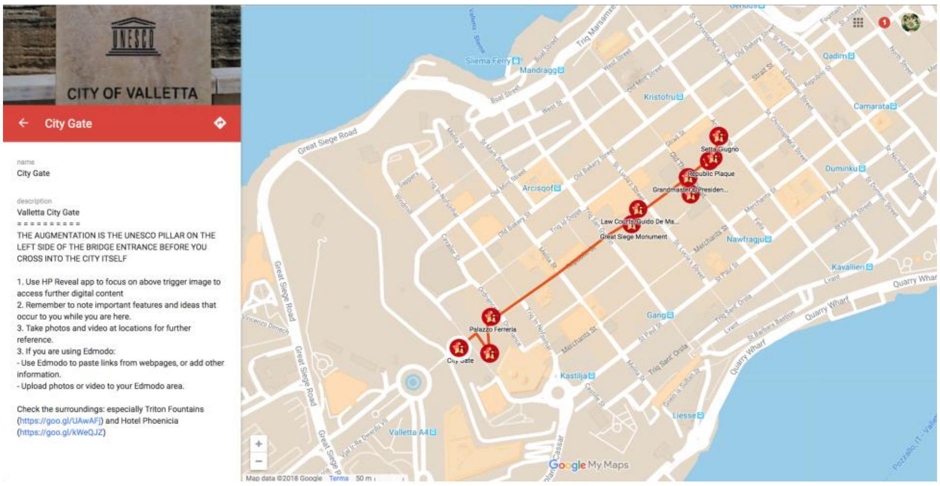

Figure 9 Google MyMaps map of the Malta Democracy route

Summary of tasks

Dr. Bonanno took an approach of providing task questions being assigned to each PoI, and requested that the tasks themselves were accessed via the augmentation content at each PoI, rather than provided in a separate document on Edmodo. Tasks were presented in an AR content panel, accessed via an icon, as part of the augmented content choices.
Tasks were closely aligned with each location, with two of the PoI not having tasks associated with them. There was no obligation to do the tasks, they were intended as discussion starters or suggestions for informal requirement to create content in relation to ‘answering the questions’. Student participation was formative and not assessed as part of any formal submission. Task response content generated by learners was uploaded to the Edmodo app, which also provided the online group discussion and sharing space. Eight sets of task questions were suggested by Dr Bonanno, these are available in full in Appendix 02.

4.2 The Interviews

The interview is the principle instrument by which I obtain data about how learners experience their participation of a smart learning journey. The interview approach I used was designed and carried out in the context of a phenomenographic ‘therapeutic’ session, as outlined by Marton and Booth (1997, p. 130). Kvale (1996) believes interviewing is an art, and that the role of the researcher is paramount:

> *"An emphasis on the crucial role of the person of the researcher does not imply a neglect of techniques and knowledge. For an artist, a mastery of the different techniques of oil painting, watercolors, and pencil drawing, as well as knowledge of the laws of perspective and of color contrast, arc preconditions for a mastery of the art of painting. A work of art cannot, however, be produced by merely following methodical rules; the primary instrument remains the artist, with his or her sensitivity and creativity. Art is a genre that can serve as an inspiration for interview inquiries" (Kvale, 1996, p. 106).*

4.2.1 Interviews in this study

I begin by outlining the relationship between the interview and the phenomenon of investigation in this study, the smart learning journey activity. Draft early pilot testing is then briefly described, followed by the scoping of the instruments, the ice-breaker questionnaire and the structure of the semi-scripted interview. I follow with the recruiting of sample groups, describing participant cohort demographics, cultural dimensions and the context of pedagogical study in participating institutions. This is followed by in depth descriptions of the interview session process. The chapter closes with description of the sourcing of learner generated content from participants in the smart learning journey activities. .

The interview and the phenomenon

Initial planning of how to conduct interviews led to the need to establish how to standardise the interview procedure while also permitting a natural and emergent flow. I needed to investigate the phenomenon and critical aspects of it, looking for pedagogical perspectives of interest, to permit collection of useful data but avoid influencing the interviewee in how they responded to any of these areas of focus.

The phenomenon of interest is stated in more detail in chapter one, but summarised again here:

The phenomenon - the smart learning activity, situated in a real world journey

> The phenomenon of interest to the research is the smart learning activity, defined here as *connectivist-inspired learning activities situated in geo-spatially relevant locations and mediated by technology to enhance learning.* 'Situating a smart learning activity in a real world journey', for the purpose of this research, means *positioning the smart learning activity in geo-spatially relevant locations: forming a journey of several close by locations that are related to the topic of learning*.

Critical aspects of the phenomenon

'Critical aspects of the phenomenon' (Edwards, 2005, p. 100) are derived from prior knowledge and experience of the researcher, within a context of relevant literature (Spector, 2014; Koper 2014; Dron, 2018), connectivist-style digital tools and system thinking (Meadows, 2008) around the complexity of the phenomenon. Aiding both the semi-structured interview approach, and as secondary predefined outcome space analysis areas. These broad elements are considered to be:

- Place
- Knowledge
- Collaboration
- Technology

4.3 Interview process

This section documents the process of carrying out the interviews for this study:

- Pilot testing and interview context
- Instruments
- Sampling
- Sample groups
- Description of participant group context
- Interview sessions

4.3.1 Pilot testing and interview context

In early 2017 simple pilot investigations were carried out to determine the nature of the phenomenon of investigation (the smart learning journey activity), the most suitable technology and to establish the most productive ways of approaching and structuring interviews. In hindsight, this work prepared me well for the technological approach I took, and for the varied cohorts of undergraduate and postgraduate students I focused on as my sample groups.

Though I had considerable past experience in interviewing, both in market research contracts and in user experience studies for website or digital application development and evaluations, I wanted to find out how people would react in interview type scenarios when talking about ‘smart learning’, and how best to frame discussions. Additionally I felt I needed to know how people might react to the technology and scope of a smart learning activity.

Pilot investigations were undertaken with two Maltese nationals who volunteered to help with the project. Both were employed at senior management level within the education sector in Malta, therefore had professional experience and knowledge of the educational landscape in Malta. Both were under thirty-five years old and were University of Malta alumni. They assisted in the project in a personal capacity, and did not represent their employers in any official way. Of note, I had a prior working relationship with one, in an academic professional capacity. We worked on a large scale website development project at London Metropolitan University, UK, for interface design, client requirements and user experience elicitation. This gave us useful shared experience of evaluation and user testing.

Testing Process

1. Initial discussion and some testing of technology choices as follows:

- Installation of apps and ‘ease of use’ testing for Aurasma (now HP Reveal).
- Gave a small exercise going to the Paul Boffa statue or St Francis church in Valletta, Malta, to access AR content
- Review of Edmodo together
- Review of Google Maps usage and familiarity
- Discussion of other social media for learning opportunities with Maltese participants

I then carried out two informal interview style discussions with both the volunteers to test out interview approaches and types of questions about the activity itself. Discussions were not recorded, but notes were taken by me. Sessions were about fifteen to twenty minutes duration and explored how these kinds of conversations ‘felt’ and what they meant. The first approach attempted a very open and non-specified questioning, the second was more specific. This included more open-ended sections, more like a website evaluation interview, but with space and probing about feelings, memories, context. They opted quite strongly for the second option, as meaning was clearer, what they were being interviewed about seemed clearer, and was also reported as ‘more rewarding’.

2. Interview practise run as follows:

First session: completely open ended, with only the widest types of questions:

- Tell me what you experienced while out at the Paul Boffa statue, or St Francis church sign;
- Tell me how you went about it, and what you thought about the experience;
- Tell me about your surroundings, and emotions;
- Followed up by ‘what else’, ‘why’ and so forth.

Second session: more nuanced, with more cluster questioning (Berglund, 2005, p 62; Sjöström & Dahlgren, 2002, p. 341), gentle prompt areas

- Tell me about the place, surroundings and the statue (or sign at the church);
- Tell me about the weather or other factors you might think of;
- Tell me about the people you may have been with, or who else might have been around (friends, passers by etc.);
- Tell me about the technology, how you got on with it, how you felt about it;
- Tell me about the content you found at the statue - webpage links to history of Paul Boffa and the Auberge de Castille (prime minster residence etc.);
- Tell me more about … (Memories, similar experiences…).

I finally settled on a combination of the two approaches, taking some note of the open-ended ideas from the first session, but incorporating them into the sections of the second session. We all agreed that this would be a good way to proceed, bearing in mind I could iterate improvements as I went along.

Something made clear to me by these early sessions was that asking about ‘a smart learning activity’ in itself seemed an unclear question to an interviewee and set a negative tone to the conversation. It can also rely on what an interviewee may know about it from past knowledge or experience, for example sessions in class, or other guidance materials. It may have sounded like I was testing them, that there might have been a correct or incorrect answer. I was interested in their actual experiences and any conceptions and reflections arising from their experiences, and I did not want to sound like I was assessing them in any way.

4.3.2 Instruments

Introductory Questionnaires

A multi choice questionnaire with general learning journey activity questions was presented to all participants. The intention was to ‘kickstart’ interviews and provide focus for the interviewee in a standardised way. Nearly every participant filled this in at the beginning of the interview session, but one or two had filled in an online version (using Jotform[26]). The completed online submission (printed out) or paper questionnaire was consulted briefly with the participant to lead into the interview itself. It provided an easy way to get the conversation going. The completed questionnaires were not consulted after interviews, or analysed in any way. They served no other purpose than to get the interview going. (Please see Appendix 01 for standard questionnaire.)

Interviews (Semi-scripted)

In this study the principal instrument for gathering data is the interview. Interviews included general flexible and emergent questions about the recollections a learner had for the activity they took part in, and the learning experiences and further reflections they felt relevant to their experience. An approach was taken to probe for the four broad elements of the smart learning activity that formed the questionnaire: place, knowledge (including content), collaboration and technology, if the did not emerge naturally, which they often did. Participants were asked to give opinions on reasoning and feelings associated with their decisions, actions, feelings and content. Additionally, learners were asked to review or think about their own digital content uploads and interactions in Edmodo, if these were present.

A framework was used to guide the interview without forcing a tight structure, which would not have suited all participants. This provided me with an approach to guide the interview where necessary. In most cases, the interview progressed very fluidly and topics emerged quite naturally.

Interview Sections		
Section Time	Section Instruction/guide	Further notes (mine)
CONSENT	Explain the research and gain consent, complete the consent form	Ask if there are any uncertainties or queries
PRELIM 10 min	Questionnaire completion, general chat	Note any main themes
A 5 min	Go over questionnaire with participant, noting a few things, encourage the participant to get used to referring to the topics	Note points that are of interest to the participant
B 10-15 min	Focus on the whole journey, the activity as a whole. *Allow emergence of themes,*	Noting/possible: Places, locations, friends, feelings, moods, weather, memories,

[26] Jotform is a free or paid form building web app with potentially sophisticated functionality available. https://jotform.com

	look for empathy and trust - ASK "In your own words…."	discovery, adventure, tour, tech, phones, other…
C 10-15 min	*(Return to questionnaire if necessary)* Focusing on each element area and drill down. Probe further in participants own emphasised interest	Location/Place Content/Knowledge Collaboration Technology
D 5 min CONCLUDE	Allow for learners own 'hierarchy of significance' on these, a summary	Ask them to say in their own words their importance factors and sum up

Table 7 Plan for interview structure

Interview Ethics

All materials are available in Appendix 01.

- Example instrument for questionnaire. All participants were given the same questionnaire.
- Consent form and Information Sheet, University of Malta.
- Ethics permissions, University of Malta, including second approval for modified procedures.
- Consent form and Information Sheet, London Metropolitan University.
- Ethics permissions, London Metropolitan University.

4.3.3 Sampling

Numbers of respondents for research totalled 24 for all sample groups, suitable for a phenomenographic study. Reed cites Trigwell (2000, p. 66) who "argues that between fifteen and twenty people is the ideal number to interview... that 'ten to fifteen would be the minimum to create a reasonable chance of finding variation in the range'", (Reed, 2006, p. 6). Smith (2010) quotes Marton & Booth (1997, p.125) who state that "...a phenomenographic study always derives its description from a smallish number of people chosen from a particular population", and "Sandberg (2000, p.13) suggests that the number of different ways a phenomenon is experienced reaches saturation after twenty interviews" (2010, p. 100). Yates, Partridge & Bruce (2012) indicate "…there is no prescriptive sample size for a phenomenographic study" but it needs to be "of sufficient size to gather suitably rich descriptions of people's varying conceptions about the phenomenon of interest" (p. 103). Further citing Trigwell (2000) and Bowden (2005) they confirm sample size should "be sufficient to allow for finding variation in conceptions" and "ensure that the amount of resulting data remains manageable" (Yates et al., 2012, p. 103).

Purposeful sampling (Patton, 2002; Reed, 2006, p. 6) with an element of convenience (Edwards, 2005, p. 22, Souleles et al., 2014, p.4) was employed to recruit voluntary participants for this study. Smith cites MayKut & Morehouse (1994, p.45), that "(p)urposive sampling increases the likelihood that variability common in any social phenomenon will be represented in the data, in contrast to random sampling which tries to achieve variation through the use of random selection and large sample size", (Smith, 2010, p. 99). Purposeful (or purposive) sampling is considered as "(s)electing information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry, that's the term purposeful sampling. Studying information-rich cases yields insights and in-depth understanding rather than empirical generalisations" (Patton, 2002, p. 230). In this case, it is argued that the nature of the degrees and student cohorts offered such an opportunity. I assert in chapter 8 that these groups represent various relevant stakeholders: future educators; those who may be involved in citizen learning initiatives, creative facilitators of such activities, general multi-cultural citizens of urban environments, lifelong learners. In this sense their experience is that of early adopter participants in experiencing these kinds of smart learning activities.

Limits to recruitment and sampling are discussed in chapter nine, 'Limits of the study'.

4.3.4 Sample groups

Student cohort academic and group details

Factual information is provided for the three university student cohort groups included in the research, drawn from a variety of educational, international and cultural backgrounds. This is followed by descriptions of participant group conditions for context of the situated activity, nature of participation, context of the educational study and detail of voluntary recruitment. Groups have been defined according to cohort and subject discipline.

PG1. London Metropolitan University BA final (3rd) year students of Mr Trevor Norris. 'Post 1992' UK university undergraduates studying BA English Literature, or a joint BA English Literature and Creative Writing. Students were taking the Literary London module. n=6

PG2. University of Malta, student cohorts of Dr. Philip Bonanno. BEd and both MA degree students take elective modules in Technology Enhanced Learning. (n=9)

PG2a Final year (4th) BEd students. (n=3)

PG2b Year one Teaching and Learning MA students. (n=3)

PG2c Year one Teaching and Learning MA students. (n=3)

PG3. University of Malta, International Master in Adult Education for Social Change MA, students of Prof. Carmel Borg. Students were taking the Developing a Curriculum in Adult Education module. (n=9)

Table of demographics

Participant group	**Study level**	**Degree title**	**Journey title**	**Semester**	**No. of participants**	**F**	**M**	**Participant codes**
PG1	BA	English Literature, Creative Writing	Literary London	Autumn 2017/Spring 2018	6	5	1	P1-6
PG2a	BEd	Education (with subject specialism)	Malta Democracy	Spring 2018	3	2	1	P7-9
PG2b	MA	Teaching & Learning (with subject specialism)	Malta Democracy	Spring 2018	3	3	-	P10-12
PG2c	MA	Teaching & Learning (with subject specialism)	Malta Democracy	Autumn 2018	3	1	2	P13-15
PG3	MA	International Masters in Adult Education for Social Change	Malta Democracy	Spring 2019	9	8	1	P16-24

Table 8 Demographics of participants

Summary

Total: n24

Age range: 20-35

Gender: 19 Female, 5 male.

Nationality and cultural background:

PG1 London based international multi-ethnic, multicultural cohort

PG2 Maltese students

PG3 International, multi-ethnic, multicultural cohort

4.3.5 Description of participant group context

Context of student cohorts, voluntary participation, the activity purpose and role in their learning is outlined below.

Participant group 1 (PG1) London Metropolitan University students (n=6)

Final year (3rd) undergraduate students studying a module called ‘Literary London’, where students tour Whitechapel and the City of London learning about authors in various local locations over different periods in history as part of the English Literature and Creative Writing BA degrees at London Metropolitan University, UK. This module was a collaborative effort between departments in the School of Art, Architecture and Design and Sandy's Row Synagogue, London, E1. It offered a rich opportunity to research smart learning activities with literature students. The learning journey itself was designed by Trevor Norris, technically implemented by me, and based on his existing content for the Literary London walking tour in and around St Paul’s Cathedral in the City of London. Details of the activity are provided early in this chapter.

Participation in the research was voluntary, and made explicitly clear that research was not connected to student assessment. A relevant consent form, information and recruitment sheet were provided. Students were recruited during the semester of Autumn 2017. Interviews were mainly conducted face to face on campus at London Metropolitan University early in 2018, with one conducted using Skype later in 2018. All interviews were recorded.

Participant group 2 (PG2) University of Malta students (n=9)

Final year (4th) undergraduate and post-graduate students who were studying Technology Enhanced Learning modules as part of their BEd and MA Teaching & Learning degrees at the University of Malta. Classwork topics included smart learning, and the potential for teaching various topics using this approach. To give students direct experience of smart learning, they were requested to take part in the Malta Democracy smart learning journey. The journey itself was designed by Dr Bonanno and technically implemented by me. This cohort is further subdivided into 3 groups, 2a (undergraduate BEd), 2b post-graduate (MA Teaching & Learning) and 2c post-graduate (MA Teaching & Learning). Details of the activity are provided early in this chapter.

All participation in the research was voluntary, and made explicitly clear that research was not connected to student assessment. A relevant consent form, information and recruitment sheet were provided. Students were recruited and interviewed during the Spring and Autumn 2018. Interviews were conducted face to face on campus at University of Malta. All interviews were recorded.

Participant group 3 (PG3) University of Malta students (n=9)

A second cohort of students from the University of Malta participated in the Malta Democracy smart learning journey, as part of their student induction week activities. These were an international cohort of post-graduate students drawn from a variety of home nations, undertaking the International Master in Adult Education for Social Change MA. This degree is held under the Erasmus Mundus Joint Master degree scholarship scheme. The first semester takes place in Glasgow, UK, the second in Malta and the third in Tallinn, Estonia. Students also either attend summer school at the University Sains Malaysia or else work as researchers at the UNESCO Institute for Lifelong Learning in Hamburg. Students take three study units hosted at the University of Malta. The study unit participating in this research was ‘Developing a Curriculum in Adult Education’, taught by Professor Carmel Borg. Prof. Borg requested that students take part in the Malta Democracy smart learning journey to give them an opportunity to experience first hand the potential of utilising such approaches to implement learning initiatives for informal citizen learning.

Participation in the research was voluntary and made explicitly clear that research was not connected to student assessment. A relevant consent form, information and recruitment sheet were provided. Students were recruited and interviewed during the semester of Spring 2019. Interviews were conducted face to face on campus at University of Malta. All interviews were recorded.

The cultural dimensions of the participant groups

The three cohort participant groups were a widely differing set of nationalities and potential cultural influences. Up to fourteen different nationalities or cultural backgrounds were present in the groups. In Group one, from London Metropolitan University, five distinct different national or cultural identities were represented. Group two, from the University of Malta, all the students were Maltese. Group three were students enrolled on an International Masters programme studying a single module at University of Malta, and included seven different nationalities and a possible nine different cultural identities. Nationalities across all the cohorts included American Vietnamese, Canadian (White), British Asian, Irish-German, Kazakh, Puerto-Rican, Irish Republic, Mexican, American White, British White, Swiss, Salvadorian and Maltese.

Cultural differences, along with gender or other demographic differences are considered to be artificial constructs in phenomenographic study so are less important that in other qualitative research (Collier-Reed, 2013). Cultural differences can only be considered significant in this study if participants talked about their cultural identities as impacting their experience of participation in the activity. Indeed, in some of the transcripts participants talked about aspects of the smart learning journey that prompted them to have discussions relating to their own and others in their peer group's perceptions of cultural differences about parliament, soldiers or a sense of 'openness' about government. Whilst this highlighted issues around relevance structures and deeper epistemological contexts for cultural interpretations of environment, the discussions themselves were interpreted in their focal awareness as part of the more complex experience variation of 'discussing' (category B). The content of the discussions indicated how meaning was being made or associated with significance of activity experience for the participant.

Related context of pedagogic study in the two institutions

The nature of pedagogical study and higher education culture between the two universities is very similar, with University of Malta being based on the UK system of higher education and the equivalence of the Malta Qualifications Framework[27] with the UK National Qualifications Frameworks[28]. Of note, all subjects at all levels are taught in English at the University of Malta. The approach of teaching and learning, formative feedback, student input into curricula and general student life is very similar. As a practicing academic at both institutions the systems seemed very closely aligned.

- In the London cohort group I did not teach or know the student cohorts at all.
- In the Maltese and International cohorts my teaching of students was between four and eight hours of study unit time.

4.3.6 Interview sessions

Formulating Questions

Questions were initially inspired by Edwards' (2005) questionnaire instruments, provided in her thesis appendices. These gave guidance such as 'tell me in your own words…", 'describe what you did', 'tell me more about xxx', 'how do you feel about xxx?', 'what do you remember about xxx?', 'how did you find xxx?' and similar. Referring to key

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[27] Malta Qualifications Framework https://ncfhe.gov.mt/en/Pages/MQF.aspx
[28] National Qualifications Frameworks of the UK https://en.wikipedia.org/wiki/National_qualifications_frameworks_in_the_United_Kingdom

phenomenographic literature (Åkerlind, 2005c; Bruce, 1994a; Säljö, 1979; Ashworth & Lucas, 2000), I developed my own flexible responsive approach that allowed experiences to emerge as naturally as possible. I additionally considered the elicitation techniques developed by Vermersch (1999) and used by Jarrett et al. (2014) and Jarrett & Light (2018) to examine specific past events in a context of phenomenography.

Standardised introduction and general context

Each session began with the participant being given the research information sheet to read through and keep if they wished, so that they were fully conversant with the purpose and scope of the research. They were then presented with a consent form to read through and sign. The multi-choice questionnaire was then presented, with 12 questions covering the four core topics of the activity - locations, knowledge (content and learning), collaboration and technology. The questionnaire acted as a guide to what the interview was about, so that topics were standardised for everyone and made known to the interviewee. It also helped to 'break the ice', and get the interview started by helping to focus the mind of the interviewee on their experience, attempting to maintain a non biased approach to areas of focus. It was rarely referred to in most interviews, though clarified focus if necessary. The questionnaire was not analysed. Interviews were responsive and flexible, using a semi-scripted approach, loosely following the topics covered in the questionnaire. An elicitation interview technique (for example, Jarrett & Light, 2018) inspired some aspects of the interview procedure as interviews examined a past event, whilst still investigating potential thoughts, ideas, feelings and hypothetical contexts of the activity.

Interview preamble

> *"The researcher and researched must begin with some kind of (superficially) shared topic, verbalized in terms which they both recognize as meaningful" (Ashworth & Lucas, 2000, p.299).*

The interview always began in a similar way with a summary explanation of the research, and an informal preamble to put the interviewee at ease and go through why we were both there. Though preamble varied slightly depending on the interviewee, responding to their queries or jokes for example, it covered the topics being researched, the encouragement to speak freely, that it was 'not a test', that there were no wrong or right answers, that the researcher (me) was not expecting any particular types of responses, and that it was 'not only about their learning', that it was about 'everything that happened' or that they felt or thought about. This was important, as in the context of higher education and the nature of student/staff relationships

(Marton & Booth, 1997, p. 131), there was a risk that interviewees may have felt duty bound to react positively, give ‘good’ feedback, and so forth, or that they might have felt they were being assessed. I tried therefore to make sure interviewees could feel free to be as critical or not, as they saw fit, and to express thoughts and ideas that occurred to them. It was also important to establish natural communication rather than a quizzing approach, to encourage empathy and the conversational partnership of Rubin & Rubin (2012, p.26).

I began with a cluster of questions (Roisko, 2007, p 110; Berglund, 2005, p 62; and Sjöström & Dahlgren, 2002, 341). This permitted the interviewee to take their own path in terms of how they related to the overall activity, the place and locations, what was meant by them, their feelings, any prior knowledge or memories, what was most significant or interesting, why being there made a difference, or did not make a difference.

Interview process

As interviewer, I adapted conversational responsive techniques for each interviewee, encouraging more reflection and fuller responses. The interview would explore the interviewee’s trains of thought or what an interviewee found of interest to talk about. So while all topics were covered, this allowed for interviewees to find some topics of more interest than others, and that some interviewees were more articulate and forthcoming than others. For example two interviewees in Group 1 did not go on the smart learning journey, yet wanted to participate in the research to give their views and reflections, so the direction of the interview was different to had they participated in the activity, yet covered similar ground. In Group 2, ‘giving the right answer’ seemed slightly more prevalent in some participants. I worked harder to establish trust and encourage more truthful and honest reflections from interviewees without them fearing reprisals as a result of what they said, rather than providing what they thought were expected as responses. Group 3 were perhaps the most motivated and interested of the three groups. Whilst they may have been the most critical of some aspects of their activity experience they were also the most confident and articulate, and possibly the most interested in this kind of learning journey activity. Therefore, interview duration for this group was between forty to sixty minutes, with me doing a lot less talking.

Interviews were iteratively improved and modified according to monitoring presuppositions and assumptions of the researcher, foreclosing interviewee responses, gaining trust, building empathy (Ashworth & Lucas, 2000; Kvale, 1996, p.105) and continual development of understanding (Kvale, 1996, pp. 100-101) for each cohort. Each group fed forward to the next in terms of some of these changes, while also requiring new interview adaptations to accommodate more specific cohort culture and contexts. This helped to 'improve' the interviews, while not changing them so significantly that they became a different study. Rather, they adapted to each cohort to obtain deeper and more relevant data. When an interviewee was not forthcoming, or found it difficult for some reason to reflect or articulate thoughts, I persisted and used the 'therapeutic session' techniques summarised by Marton & Booth (1997, Chapter 6). The interview sometimes did take on the resemblance of a therapeutic session, as much as a conversation.

4.4 The Learner Generated Content

An additional data source of digital learner generated content (Pérez-Mateo et al., 2011) created by learners as part of their participation interactions provided useful context and supporting analysis with interview data. Analysing learner generated content (LGC) had two purposes, to see how learners might experience the creative and participatory nature of generating content as part of their smart learning journey activity, and to investigate potential ways to measure this type of content.

Learner generated content (LGC) is that content residing in the apps, platforms and networks that the learner has created during a learning activity. Comparable to a digital footprint of their experience, it might be comprised of discussion commenting, shares of content or comments, images or video created and uploaded, or found selections of web page hyperlinks relevant to task requirements. This differs somewhat from learner analytics, these being more concerned with tracking and measuring clicks or time on page (Fournier, Kop, & Sitlia, 2011, p.2).

LGC was uploaded to the Edmodo app as part of activity tasks. Tasks requested digital content be created to encourage participation, autonomy and a creative pedagogical approach. This also permitted discussion of that content during interviews with the interviewee who had created or contributed in some way to it. In all cohort activities, an amount of digital learner content was generated, though this amount did vary considerably between groups. Some of this content was collaborative, some was not. The LGC that was available for analysis by those who agreed to it comprised mainly of photographs, but some textual content was uploaded as documents, responding to activity questions or similar.

4.5 Summary, chapter four

This study posed several challenges that may have become obstacles to gathering useful data. Development of the activities themselves involved detailed planning in preparation. Tutors needed to be found who were willing to develop this kind of activity for their students to participate in, who might volunteer to be interviewed about it afterwards. Technologies needed to be nominated, locations found, then ideas, topics and content established. However, steadily the study took shape. As I began to gather data I was conscious of whether or not I was fulfilling the requirements of phenomenography during interviews, and reflected considerably about this.

This chapter has sought to describe these challenges and has outlined the activities themselves, the sample groups and the way the data was captured. I have attempted to show what was done and why, and how this led to the data that was then analysed.

5 DATA ANALYSIS

This chapter concerns the process of data analysis consisting of interview transcripts and learner generated content. A short preamble positions the work in relation to the application of the phenomenographic approach to analysis. This is followed by descriptions of what was ‘done’ to analyse the data.

i. Procedure to analyse the interview transcript data.
ii. Procedure to analyse the learner generated content.
iii. The co-judge second review of the interview analysis process.

5.1 Phenomenographic analysis in this study

The purposeful, convenience (Patton, 2002, Reed, 2006, p. 6; Edwards, 2005, p. 22; Souleles et al., 2014, p.4) sample groups participating in this study are from multiple cultural backgrounds and took part in different yet similar learning activities. Each group was small, between six to nine people, potentially making it difficult to create the ‘full range of experiences’ that phenomenography seeks to establish, if limited to a single cohort. The aim of this study in using several small sample groups rather than one single larger group was to spread the potential for differences that may depend on aspects of “the relevance structure of the learning situation” (Marton & Booth, 1997, p.143) such as subject topic or role in learning. To then analyse at collective level across all groups could provide a potentially full range of differences in experience variation of the phenomenon of this study, and produce ‘the right kind of data’ (Cohen et al., 2007, p. 356) of interest to the research questions. Though Marton initially believed there were limitless experience variations, he later retracts this, as “phenomena were usually experienced or conceptualized in a finite and relatively limited number of qualitatively different ways …” (in Richardson, 1999, p. 62-63, citing various Marton, and Marton & Booth, 1997, p. 117).

This collective set of sample groups provides a ‘snapshot’ of potential experience variations, and is not setting out to offer a definitive set of category descriptions. Åkerlind, Bowden & Green (2005e, p. 81) state “(t)he set of transcripts as a whole represents a snapshot of the ways of experiencing the phenomenon by a particular group of people at a particular time and in response to a particular situation”. Trigwell (2000) refers to “self-reports of a group of people, a bit like a snapshot of that group at a particular time” (2000, p. 80) to describe categories of experience variation. In this study, snapshot data from each sample group combine to form a single larger snapshot that can be analysed collectively. Just as “meaning may vary within individuals as well as between individuals, but the range of variation within individuals is likely to be encompassed by the range across individuals” (Åkerlind et al., 2005e, p. 81). In this study, I adapt Åkerlind’s quote to *meaning may vary within one cohort, as well as between cohorts, but the range of variation within each cohort is likely to be encompassed by the range across all cohorts*.

Reiterating clarification of what is being examined, already previously discussed in chapter three, *(On conceptions and experiences of the phenomenon)*, as to whether I am examining learners conceptions or experiences of a smart learning activity, I am doing mostly the latter with some of the former arising as a consequence of the latter. My aim “is not to investigate the conceptual features of certain limited subject matter, but rather the sense-related features” (Rosiko, 2007, p. 91) of experiencing a smart learning journey. I am “using the terms “experience” or “ways of experiencing … to denote the object of research” (p. 91). In my study, I am examining aspects of experience of a single past event, the smart learning journey activity, albeit with some hypothetical conceptual relevant experiences also being emergent as part of these experience reflections in some interviews.

5.2 Interview analysis procedure

Following sections document the procedures for analysing the interview transcripts. I outline the two interpretive perspectives of analysis of interviews to discover experience variation of the smart learning journey activity, supported by reasoning. I then provide the analysis process stages.

5.2.1 The outcome space categories of description perspectives

Two analysis perspectives were adopted, a primary and a secondary. I attempt to formulate categories of description for experience variation from these two alternate perspectives, though no expectations or outcomes were predicted at the outset (Ashworth & Lucas, 2000, p. 307).

A total of five outcome spaces were developed. The primary analytical perspective outcome space is considered as ‘Experiencing the smart learning journey’, the additional secondary analytical perspective outcome spaces are considered as ‘Experiencing the system elements of a smart learning journey’.

The primary perspective: Experiencing the smart learning journey

- A single outcome space, completely emergent, discovering categories of variation from interpretations of meaning in the structure of awareness of experience.
- Interpretations reference theme, thematic field and margin (Gurwitsch, 1964; Gurwitsch 2010, pp. 355-358); the (referential) meaning, and the (structural) internal and external horizon (Cope, 2004; Marton, 2000; Bruce et al., 2004a; Edwards, 2005; Sjöström & Dahlgren, 2002; Kaapu & Tiainen, 2009; Taylor & Cope, 2007).

I explore experience dimensions of variation (after Cope, 2004) across all transcripts examined collectively in the ‘Swedish’ sense (Reed, 2006) to discover pools of meaning for the smart learning journey activity as a whole. I look for where meaning occurs, and commonality and variation of experience emerges from the collective in an open way, forming categories defined by the commonality of experience and variation of each. This might be characterised by starting with the question “experiencing a smart learning journey as…”.

Four categories of experience variation emerge, with four levels of each category, forming a table of experience complexity for a smart learning journey, and this acts as the foundation for the development of an experience relevance structure for smart learning, the basis for the Pedagogy of Experience Complexity for Smart Learning.

The secondary perspective: Experiencing the system elements of a smart learning journey

Inspired by Meadows (2008), Spector (2014) and my own prior work (Lister, 2017), conceptualisation of broad system element thinking has been discussed in chapter three. Four different outcome spaces are explored for nominated system elements of the smart learning journey for Place, Knowledge, Collaboration and Technology, focusing on elements separately to explore experience variation for each element.

- Utterances are examined for meaning delimited by each system element. This is characterised as starting with the questions of 'experiencing place as….'; experiencing collaboration as….'; experiencing knowledge as….'; experiencing technology as….' … within a smart learning journey activity.
- Meaning, internal and external horizon (the referential and the structural) are defined by the delimited outer edge awareness of the system element, and the variation of it, following the same procedure as for the primary perspective.

Categories of experience variation emerge from system elements, demonstrating an alternate perspective of analysis for a structure of awareness and delimited aspects of experience without directly prompting for them. Further SE experience complexity levels were not explored, considering the overview categories as sufficient for the study.

5.2.2 Reasoning for alternative analysis perspectives

Different analysis perspectives permit examination of the data from different but complementary points of view. This contributes to meaningful solutions for the research questions, and increases 'interjudge communicability' (Cope, 2004) by demonstrating distinct 'interpretive awareness' positions of the researcher (Sandberg, 1997, pp. 208-209).

> *"Interjudge communicability, then, is not a test of whether other researchers can come up with the same outcome space. Rather, interjudge communicability can be used as a test of the reliability of the description of an outcome space and a meaningful contributor to ensuring the rigour of phenomenographic research approaches.", (Cope, 2004, pp. 5-6).*

> *"…the researcher must demonstrate how he/she has controlled and checked his/her interpretations throughout the research process: from formulating the research question, selecting individuals to be investigated, obtaining data from those individuals, analysing the data obtained, and reporting the results" … "establishing reliability of the researcher's interpretation is crucial […] (t)o maintain an interpretative awareness means to acknowledge and explicitly deal with our subjectivity throughout the research process instead of overlooking it.", (Sandberg, 1997, p. 209).*

By contrasting alternate perspectives for the position of interpreting the structure of awareness, understanding might be expanded for experience variation of a smart learning journey, and may contribute further aspects to a pedagogical relevance structure.

5.2.3 Overview of analysis stages

I adopted an analysis approach similar to that indicated by Sandberg (1997, p. 210) and reiterated by Patrick (2000, p. 131). The key principles were

- To ask the same question of each transcript quote - (Sandberg states that the researcher should be oriented to the phenomenon as and how it appears throughout the research process. i.e. clarification of the research question asked to a text.)
- To describe the experience, not seek to explain it
- All quotes are equal, and are analysed with equal relevance
- To search for and establish structural features of meaning (potentially complemented by my adopting a first and second perspective of analysis).
- Acknowledging intentionality of participant as a guiding factor of focus. Duncan puts this as “using intentionality as a correlational rule (looking at what is focused on and how it is represented)” (2000, p. 131).

A note on bracketing of questionnaire responses

I reiterate here again that the introductory questionnaire results were not analysed in any way. The questionnaire served no other purpose than to get the interview going. If the questionnaire had been analysed prior to interview analysis it would have biased potential interpretations of utterances. Additionally, the sample was too small to draw any meaningful conclusions from, so it was therefore decided early on in the analysis process that questionnaires should not be analysed.

5.3 Analysis of interviews

This section outlines the interview transcript analysis process. This process was followed as it is written to discover categories of description for the primary perspective outcome space, “Experiencing the smart learning journey”. The secondary alternate perspective for “Experiencing the system elements of a smart learning journey” also made use of the same iterative grouping and regrouping of quotes to discover experience commonality and variation for each system element.

Roisko (2007, p. 131 onwards), Kaapu & Tiainen (2009, 2010, 2012) and Jarrett & Light (2018) provide useful guides and insight towards forming a robust strategy for each stage of the analysis, and I have attempted to articulate my strategy as accurately as possible. This aids the interjudge communicability and interpretive awareness of the analysis process (Cope, 2004; Sandberg 1997; Kvale, 1996, Chapter 13; Sjöström and Dahlgren, 2002, p. 342). Documenting clarity of process enhances validity and reliability, along with the use of 'co-judge' (Booth, 1992, p. 68) second researchers to review analysis interpretive positions. Cope (2002 p. 71) describes interjudge communicability percentage ratings using two other researchers. In this study, one other researcher was used, together with presentation of findings to other researchers at conferences, via guest lectures and through academic papers and chapters published.

Qualitative analysis software 'NVivo'[29] version 12 has been utilised for the interview transcript analysis process. Nvivo enables grouping of textual quotes across multiple source documents, retaining source transcript for context. Annotation and classification can be recorded, changed and modified. This assists in iterative analysis because the analyst can go backwards as well as forwards if they wish, reflecting on interpretation and understanding. Potential for review by additional researchers is also enhanced. Therefore use of NVivo increases the validity of the analysis process (Roisko, 2007, p. 131; Sin, 2010, p. 315).

Sjöström & Dahlgren's (2002) frequency, position and pregnancy methods were used to reflect on all utterances, for an individual utterance itself, then in context of the whole individual transcript, then across the collective of transcripts. This repeated 'expanding out then focusing in' process helped to reflect on the transcripts in a systematic way, developing clarity of purpose. As I developed this technique I developed a guide of 'descriptive guidelines for experience complexity'. This supported allocation of quotes by thinking of their meaning, immediate context, then their outer edge of awareness (after Bruce et al., 2004a, 2004b) to indicate the delimited external horizon of each level of complexity. Strength of meaning decided the category, similar to a level of presence such as that used by Edwards (2005, p. 134). By making decisions on the most relevant utterances that demonstrated the variation of meaning in experience, one could begin to outline an architecture of variation (Marton & Booth, 1997, p. 202) for an outcome space. This process was iterative, requiring

[29] NVivio https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/about/nvivo

many repeated readings, sorting and interpretation of meaning in the contexts of the outcome spaces.

5.3.1 Preliminary Stages

Transcribing Interviews

I transcribed all interviews in this study, initially using the VLC Player[30] for audio playback and the voice to text function in Microsoft Word[31], repeating verbatim what the interviewee and interviewer (myself) said. Later, I decided to use the Evernote[32] note making app, with the interview audio file embedded in a note. Reverting back to conventional typing produced fewer errors than the voice to text method. All transcripts were then imported into NVivo, identified only by their Pn. Undertaking the transcriptions myself gave a deep sense of what was in each individual transcript, inspiring much self reflection in terms of interview technique, how different participants sometimes reacted in widely differing ways to very similar questions, and characteristics of interview being as much in the control of the interviewee as the interviewer. I became more aware of how to ‘hear the data’, in the way that Rubin & Rubin describe (2012, pp. 29, 30).

Transcribing is a process whereby the interview exchanges change in nature and become removed from their original context. This is remarked upon by Dortins (2002, p. 208), who states “(a)s I transcribed the interviews, I came to understand transcription as a process through which I was transforming myself - distancing myself from the interview situations and participants”. Textual interview utterances become data, and some of “their conversational context is de-emphasized” (2002, p.209). Dortins cites Kvale (1996) who supports this: “(t)ranscripts are not copies or representations of some original reality, they are interpretative constructions that are useful tools for given purposes. Transcripts are decontextualizcd conversations, they are abstractions, as topographical maps are abstractions from the original landscape from which they are derived” (Kvale, 1996, p. 165).

Familiarity and topic grouping

The first step in the process was to become fully familiar with the data. This consisted of building on the first familiarity gained from doing all interview transcripts myself, and then uploading all interviews to NVivo and doing further corrections in text. NVivo can assist in data management, and in the ability to support developing familiarity of interview data across

[30] VLC Player https://www.videolan.org/vlc/index.en-GB.html
[31] Voice to text in Word https://support.microsoft.com/en-gb/help/14198/windows-7-dictate-text-using-speech-recognition
[32] Evernote https://evernote.com/

the collective, rather than relying on repeat reading of each transcript individually, though individual context is retained and easily accessed. As I was limited in being a single researcher, I sought to support the examination of data at collective level by grouping transcript utterances in multiple different groups, to encourage fresh eyes and avoid mental staleness. To achieve this I used a descriptive 'topic grouping' process, to group the same or similar words appearing in quotes. This aimed at beginning the process of "maximising the similarities and differences between the transcripts" referred to by Dunkin (2000). No assumptions for meaning were made other than noting similarity of words, and looking for commonality and difference in quotes and within the context of transcripts. Sin (2010) refers to what sounds like a very similar process: "(a)fter the initial readings, she looked for qualitatively different global meanings that were evident in the data through a process of coding, revision, and recoding…" then referring to use of NVivo: " (t)he NVivo program was used in the example study to manage the data and systematically track the stages of the analysis to enhance the rigour of the process" (Sin, 2010, p. 315).

Initially I called this 'open coding', but changed this to 'topic grouping' to avoid possible misinterpretation as to use of Grounded Theory coding analysis, which was not being utilised. I read and re-read transcripts and quotes in multiple different contexts, to encourage an emergence of an awareness of understanding for what may constitute meaning and structural awareness, through commonality and variation of what was in the quotes. I was continually referring back to the context of individual transcripts and to other topic groupings by making use of the NVivo 'code stripe' function, to move between groupings as well as individual transcripts. I would ask myself the question "experiencing the smart learning journey as …" to focus the perspective of analysis lens. This began the process of understanding what may form the 'referential' and what may form the 'structural' aspects of focal awareness for experiencing a smart learning journey.

I began when I had fifteen transcripts (P1-P15). This was sufficient to begin the analysis procedure, adding further transcripts as I progressed, permitting reflection of possible categories and dimensions of variation as I continued to interview. This is somewhat similar to Taylor & Cope (2007, p. 102). Edwards (2005) notes mentally confirming or rejecting potential categories as she continues to collect data, and ensuring that she directed "questions to illicit further information on critical aspects and their meanings throughout each interview" (Edwards, 2005 p. 121). In this way I was able to iteratively improve the relevance and technique of the interviewing approach and structure encouraged by Ashworth & Lucas

(2000, p. 299). Edwards also uses later sets of data to confirm findings, to "to verify the category framework" (2005, p. 102). Cope supports this as "analysis in terms of the analytical framework of a structure of awareness was occurring as part of data collection" (Cope 2002, p. 71). By subsequently adding the remaining interview transcripts (P16-P24) I was able to clarify or adapt categories as they emerged and were confirmed or challenged.

Early attempts to understand 'dimensions of variation' (abandoned)

I had noted that phenomenographers took an approach of two stages of analysis by proceeding first in asking themselves 'what' (referential) questions and then 'how' (structural) questions about meaning in the transcripts. For example, Sandberg (2000) describes this as "(t)he analysis was carried out in an ongoing iterative process in which I alternated between what the optimizers conceived of as work and how they conceived of that work" (p. 13). He then proceeds to describe the process of repeat reading of transcripts to establish what his participant group thought of as conceptions, first looking at whole transcripts and then comparing between transcripts to compare conceptions. He then moves on to how they thought of their conceptions, where "(t)he primary focus in this phase of the analysis was on how the optimizers delimited and organized what they conceived as engine optimization" (p. 13). Others additionally refer to this process, Marton & Pong (2005, p. 337) describing a two-stage analysis of the first stage focused on identifying and describing the conceptions in terms of their overall meanings and a second stage of analysis focused on identifying the structural aspect of each conception expressed. Roisko (2007), citing Åkerlind (2005b, p. 321), notes "the process of analysis is strongly iterative and comparative in nature. It includes repetitive organisation and reorganisation of the data and comparison between the data and the emerging categories, as well as between categories themselves". I felt it most appropriate to utilise the phenomenographic analysis approach through Cope's Structure of Awareness analytical framework (2004). This appeared to hold the most relevance for how I could articulate commonality and variation to describe *what* participants 'thought of' as significant or meaningful experience, and *how* they 'delimited or organized' (Sandberg, 2000) that experience. Therefore I tried to look at topics from this perspective, as I needed to discover how to understand a 'dimension of variation' in terms of Cope's Structure of Awareness framework. I did not yet know how to interpret the referential and the structural aspects, so experimented with thinking about primary and secondary dimensions of variation, looking for commonality of meaning in these variations. However, this was too early in the repeated reading process, so I abandoned this stage. Marton & Booth maintain that there are "… phases in the constitution of the object of the research… […] the processes of collecting and analysing data cast light on the boundaries, shift them, fill them in, and turn the whole thing around" (1997, p. 132). I felt justified to abandon this method and seek another to retain full potential of emergence, and to understand more about what constituted meaning.

More grouping and regrouping

To encourage further reflection and repeat reading of transcript quotes from differing contexts while maintaining the lens perspective of "experiencing the smart learning journey as…", I grouped quotes into various 'groups of groups', tracing similarity and noting potential variation. I continued to reflect on all quotes, focusing on context within individual transcript, then comparing across the collective for similar quotes in other transcripts. The phenomenon of investigation was a broad and fluid concept, and as such I felt I needed to maintain the largest possible amount of data to discover what may be of relevance to the study in pedagogical terms (as participants had self-reported it to me). Bowden indicates the early selection of relevant data "based on criteria of relevance", that "(u)tterances found to be of interest for the question being investigated . . . are selected and marked" (2000, p. 11, further cited in Åkerlind, 2005b, p. 325). The systematic groupings served to allow me to make notes on different interpretations of possible relevance. This began the process of forming possible 'pools of meaning' (Bowden, 2000, p. 11; Åkerlind, 2005b, p. 325), by familiarising myself with common themes, and what may indicate meaning and variation of it.

The context of reflecting on where meaning resided in quotes in the context of each individual transcript and then across the collective steadily developed my understanding. This slowly enabled identifying "broad lines in experiencing" a smart learning journey, in what were relevant aspects of interest to the study. As analysis progressed I moved towards "trying to identify some sort of differences among the ways of experiencing" (Roisko, 2007, p. 133).

5.3.2 Finding meaning in experience

In order to establish more clearly what was relevant to the study as critical aspects of investigation, I took a break from analysis to reflect more deeply on the notion of meaning in experience, in relation to the structure of awareness and how this applied to experiencing a smart learning journey.

Order of analysis

Order of analysis can be an important consideration, as may impact interpretation, noting (in preceding discussion) that order of analysis is most commonly first the 'what' then the 'how'. Roisko presents this order of analysis stages (2007, p. 131), with first the referential meaning (the 'what'), then the structural 'how'. However, in my study I have sought to find structure and meaning in a co-constituted process, supported by Åkerlind, as "analysis usually starts with a search for meaning, or variation in meaning, across interview transcripts, and is then supplemented by a search for structural relationships between meanings…", acknowledging that "some emphasize the importance of not prioritizing the search for structure too early in the process, […] (c)onversely, others highlight the danger of not considering structure until too late in the process, given that structure and meaning are supposed to be co-constituted in phenomenographic analysis…" (2005b, p. 324). In this study, the 'co-constituted' process seemed to occur naturally as meaning emerged from the data.

After repeated rounds of reflection I was able to discover meaning through an approach of data 'sieving'. This developed a system of grading dimensions of variation (DoV), so that I could see them as more or less significant, in a context of commonality shown by most populous in relation to significance in transcripts. I then further considered these 'referential' aspects within a structural context to articulate a structure of awareness for focus and perceptual boundary. The 'primary' DoV's were steadily noted for possible category relational inclusivity, though this was not perceived at first as hierarchical in the sense of levels of complexity.

Determining the structural and the referential aspect of a smart learning journey

I had realised from early in the analysis that Cope's (2004) dimensions of variation (DoV) table was significant. I needed to establish how to apply these principles to my phenomenon and interview transcript data. Cope's table of "An abstract outcome space…" (2004) divides the referential from the internal and external horizon of the structural, placing increasing complexity of dimensions of variation into the structural side of the table, indicating awareness structure for referential meaning. This introduced an early understanding of what a delimited external horizon might be. Cope (2002) matches Gurwitsch's theme, thematic field and margin to the internal and external horizon of a phenomenographic structure of awareness, with theme as the internal horizon, and everything else as the external horizon. Cope, citing Marton & Booth (1997), states:

> *"(T)he meaning given by an individual to a phenomenon, that is their level of understanding of the phenomenon, lies in the individual's structure of awareness when they contemplate the phenomenon. A level of understanding, then, can be analysed and described in terms of a structural aspect (the internal and external horizons of awareness) and a referential aspect (the meaning inherent in the structure)", (Cope, 2002, p. 68).*

Cope provides further useful tables that helped to form my own interpretation of a structure of awareness and my approach to analysis. The table “Comparison of the various levels of understanding of the concept of an IS” (2002, Table 3) showed surface to deep levels of understanding for technical and social aspects of his phenomenon of interest (the information system). This demonstrated to me how phenomenon experience variation could be multi-layered for complexity and depth, which reflected the multi-strand ‘experiences’ that I was seeing. In his table “Levels of understanding of the concept of an IS from the student data (described in terms of a structure of awareness)” (2002, Table 2), I could see how complexity was interpreted as a structure of awareness.

Taylor & Cope (2007) include a table “Levels of student understanding of the concept of evolution as characterised by dimensions of variation” which shows a hierarchy of meaning with different dimensions of variation for each, again reiterating that complexity and multi-strand experience might combine into variation of experience levels of complexity. This table, combined with Cope’s 2002 levels of understanding table, provided inspiration for the foundation of my smart learning journey experience complexity grid.

Another significant influence was Kaapu & Tiainen (2009, 2010, 2012), who have useful things to say regarding how to interpret referential and structural aspects in contexts outside of ‘learning’ studies. There was much in their work of note, particularly a table titled “Summary of the categorisation of consumers’ information privacy conceptions in e-commerce” (2009) showing separate referential categories that may be inclusive or not, with different structural elements of each. This could be read vertically or horizontally and also seemed closer to what I potentially expected to find in my own phenomenon, though I did not have any preconceived notion of what that was in real terms.

After much reflection I began to see how to apply this to my phenomenon, the smart learning journey, as it offered ideas for how to record the units of meaning experience (Marton & Pong, 2005, 337, Reed, 2006, p. 9) that appeared in the transcript quotes. This led to consolidation to reduce the data and make choices for categories of variation description (Åkerlind, 2005b, p. 325; Roisko, 2007, p. 134).

Making valid decisions about what constitutes internal and external horizon

The Cope (2002, 2004) and Taylor & Cope (2007) tables showed the external horizon representing the furthest extent of understanding, described by Bruce as “(t)he External

Horizon represents that which recedes to the ground, essentially the perceptual boundary associated with participants' ways of seeing", (Bruce, Pham & Stoodley, 2004). In my study this could be interpreted as the limit of utterance scope in relation to how the journey is thought of or experienced. This could be analysed collectively and individually, moving from one to the other, as Roisko discusses (e.g 2007, pp. 79, 128, 135). Edwards states:

> *"(a)ccording to Marton and Booth (Marton & Booth, 1997, p.86) 'structure presupposes meaning and vice versa; the two aspects are dialectically intertwined and occur simultaneously when we experience something.' That is 'the structure springs from the meaning [that has been] found' (Marton & Booth, 1997, p.88)", (Edwards, 2005, p. 88).*

Delimiting a structure of awareness was challenging. Marton, Dall'Alba & Beatty (1993) describe "…a way of delimiting a phenomenon from its context (and relating the phenomenon to its context as well) and discerning component parts of the phenomenon and the relationships between them […] the delimitation from the context defines its external horizon, and the discernment of its parts defines the internal horizon", (Marton, Dall'Alba & Beatty, 1993, p. 297). Edwards, citing Marton, Dall'Alba & Beatty (1993) describes using ideas of the thematic field for the boundaries or limits of a phenomenon experience (Edwards, 2005, p. 91). Further, Bruce et al. (2004a) state: "(i)n the structural component of each category, the awareness structure (Marton, 2000) is delimited in terms of an internal horizon, with stable and variable components, and an external horizon. The External Horizon represents the outer limits, or perceptual boundary, of the participants' ways of seeing and identifies that part of the world beyond which participants, who are looking at the world in a particular way, do not see. The Internal Horizon represents the focus of the participants' attention, that which is figural in awareness" (Bruce et al., 2004a, p. 5-6).

With this further understanding, I adopted the following approach:

- The referential (the what) is the meaning, and is constituted (distilled) from the internal horizon.
- The internal horizon is formed by the factual descriptors of the meaning (the how) and describes it with close focus further details.
- The external horizon then forms from the outer most aspects of these details, which describe the limits of the details, the most outer edge parts. This is the perceptual boundary.

Understanding levels of presence and significance

Edwards' table 'Critical Aspects of the Dimensions of Variation Summary' (2005, p. 134) uses a weighting system showing four levels of presence for each category: element not perceived, element vaguely perceived but not understood, element perceived but not in focus, element perceived and in focus. This system offered inspiration to assist in discovery and evaluation of meaning through notions of 'weighting' for factors of significance in transcript utterances, as part of Sjöström & Dahlgren's (2002) frequency, position and pregnancy approach (discussed in subsequent sections in more depth).

Finding units of meaning

Marton and Pong (2005, p. 337) suggest a unit of experience can be formed whenever there is sufficient evidence that a particular overall meaning has been expressed. I realised I would have to find and select units of meaning experience in stages, to find deeper meaning. There were no predetermined categories of variation or expectations of how dimensions of meaning variation might emerge, only that they would, if simple principles of node grouping reflections were repeatedly applied.

To reiterate, experiences of an activity were being investigated, not conceptions of it, (Roisko, 2007, p. 91). This is significant in what may constitute meaning and how meaning is found, what denotes it and what is considered relevant or not to include in the analysis. Deciding relevance of text in interviews was an aspect of deciding what might constitute meaning related to experiences of an activity. Roisko remarks (2007, p. 130): "(f)rom the perspective of the current research […] the ideas falling outside that situation were taken as irrelevant in the sense that they represented another situation within participants' experience". This was relevant to occasions when discussion in my interviews veered into hypothetical areas involving future practice, ideas or purpose, or other potentially less relevant discussion such as family relationships. An example was P7 talking about how her dad used technology and didn't know anything about computers (outside the remit of the study), why she and her peers use Facebook for their assignments (mostly outside the remit of the study), or how she might have reacted when she was a child to the smart learning journey (relevant to her experience of the journey in this study).

Another area of concern was that multiple experience variation might be present in a single quote, and again, Roisko refers to this (2007, p. 133-134): "one must bear in mind that experiences may also exist within each other or overlap one another […] the same text segment can include more than one kind of analytic units (expression of experiences).” After initially being worried about quotes appearing to be multilayered or ‘multi-strand’ experiences, it was somewhat of a relief to read this, and I began to appreciate multi-relational experience variation. Franke & Dahlgren (1996) discuss the challenge of what may constitute similarity or difference in quotes, as “(s)imilarities and differences relate to the fact that as a researcher, one must decide whether the statements are different expressions of the same conception or whether different expressions refer to different conceptions…” (p. 630), but “…(i)n order to see whether the statements represent different fragments of the same whole, one must have an idea of what the whole is…” (p. 630). Roisko states she progressively reduced her data by “distinguishing and making choices between what was relevant from the point of view of experiencing learning and what was not.” (Roisko, 2007, p. 134). This appears to emphasise it is the role of the researcher to make decisions and choices on these issues, and led me to formulating benchmark statements in my mind about what might be relevant to forming ‘meaning’. This might occupy a similar role to Roisko’s ‘core questions’ at each stage of her analysis (for example, 2007, p. 136).

How meaning is established

Meaning of experience variation is informed by the phenomenon under investigation, and by the research questions. Bruce et al., (2004b), appear to confirm this:

> *“While we have applied emerging phenomenographic understandings of the character of conceptions and phenomenon (Marton, 2000) to our analysis, we are aware that the phenomenon we have investigated has also contributed to the final character of the framework through which it is described. This is evident through the articulation of the external horizon as a perceptual boundary, and through the discovery of both stable and variable elements in the internal horizon.” (Bruce et al., 2004b, p. 5).*

Edwards emphasises the role of the researcher’s interpretation as part of the research, here also citing Cope: “… the researcher develops the categories of description of the phenomenon. In other words, these categories are the researcher’s interpretation, based on data analysis, of the variation in the group’s account of the way they experience the phenomenon (Cope, 2000, p.78)” (Edwards, 2005, p. 97).

Sjöström and Dahlgren (2002) offer pragmatic approaches for finding meaning in interview utterances: “(i)n practice, some indicators may be used for assessing the significance of elements in an answer. Some of these are frequency, for example, how often a meaningful statement is articulated; position – very often the most significant elements are to be found in the introductory parts of an answer, and finally pregnancy, for example, when the subject explicitly emphasizes that certain aspects are more important than others.” (Sjöström & Dahlgren, 2002, p. 341). These three aspects were key to finding units of meaning (Marton and Pong, 2005, p. 337; Reed, 2006, p. 9) in my analysis, providing me with a way to measure what was in a quote, and how to think about the focus and the outer edge awareness of it. I reflected on utterances, for an individual utterance itself, then in context of the whole individual transcript, then across the collective of transcripts. This repeated process helped to reflect on the transcripts in a systematic way, developing clarity of purpose.

As I developed this technique I developed a guide from my early benchmark statements, which came to be known as ‘Descriptive Guidelines for Experience Complexity of a Smart Learning Journey’ (see Appendix 03) for allocating quotes by thinking of their meaning, their immediate context, then their outer edge of awareness (Bruce et al., 2004a, 2004b) to indicate the delimited external horizon of each level. Strength of meaning decided the category, partly determined by Sjöström & Dahlgren (2002) and similar to levels of presence such as that used by Edwards (2005, p. 134). As I familiarised myself with transcripts and quotes I must acknowledge a certain level of intuitiveness to this process, however I think, as Edwards does, that the researchers understanding of the phenomenon and of the transcripts are part of this process of analysis to develop the framework of a structure of awareness. Edwards reiterates “(t)he conceptions of each category are revealed through the data. In that way it is discovered, but at the same time the researcher constructs the categories and defines them all in terms of their meaning (the referential aspects), their focus and eventually their structure (Bruce, 1997b, p.103), so they are constructed”, (Edwards, 2005, p. 97).

Conclusion for my interpretation of meaning and the structure of awareness

Meaning is where focus is most acute and is defined by the internal horizon (and vice versa, as meaning is inherent in the structure, Cope, 2002, p. 68), together these form the theme and close thematic field of Gurwitsch (1964, 2010), the further thematic field and margin then form the external horizon. As Bruce et al. (2004a, 2004b) think of it, the outer edge of awareness defines where the limit of the extent of the external horizon is. This is similar to Cope (2002, 2004), who also sees the external horizon as the limit (of furthest understanding, for example) of a level of experience.

This is how I have interpreted the structure of awareness in this study, each category forms its own structure of awareness and each of the levels of complexity in the experience of that variation define the inner focus and the outer edge of awareness, its perceptual boundary. The meaning defines the category and the name of each category is derived from this meaning.

Statements of analysis interpretation

To assist in determining meaning for the primary perspective of analysis of the phenomenon under investigation and enable discovery of categories of description for “Experiencing the smart learning journey”, I formed two statements of analysis interpretation. These acted as core benchmarks for interrogation of quotes for meaning. Meaning might be recognised in the following ways:

- *By the nature of the phenomenon and the areas of interest to the study: the experience of the activity, and possible learning going on*. The research questions determine what is of interest to the study. They seek to establish if any learning is present, and how to measure it if it is, how that may impact learning ‘design’, and whether or not connectivist principles play a role in forming pedagogy. However, meaning is not ‘fitted’ to predetermined categories or expectations, these must emerge from the commonality and variation of experience. This co-constitutes what is seen as relevant for meaning in experience utterances.

- *By seeing the commonality, variation and potential meaning of the experience in each quote*. Units of meaning are measured by guide concepts of frequency, position and pregnancy (Sjöström & Dahlgren, 2002) of the content of a quote. Edwards’ levels of presence (2005, p. 134) play a part. Then further examined with repeated reflections to delimit meaning and outer edge awareness (Bruce et al.’s ‘perceptual boundary’, 2004a, 2004b), defining the structure of awareness.

5.3.3 Discovering Categories of Variation

Early categories form

Forming categories of description is about making decisions as to what constitutes meaning, and meaning is derived through examination and interpretation of utterances for what is of interest to the study. This being derived through context of quotes in each transcript and similar or related quotes across the collective. Prior knowledge of the phenomenon may also impact how meaning is interpreted and discovered (Åkerlind, 2005b, p. 329), yet overall this is an emergent process, encapsulating the researcher, the researched and the co-constituted referential and structural aspects of the structure of awareness in the self-reported experiences of the participants. “Each category thus consists of a referential component, in which the meaning of the category is captured, and a structural component, in which the awareness structure associated with the referential component is made explicit…” (Bruce et al., 2004b, p. 6).

I began to note what appeared to determine significant meaning of the smart learning journey by recognising and mapping the most prominent emphasised ways that participants articulated their reflections of the journey. ‘Tasks’, and obligations such as ‘what we had to do’, or ‘do we have to do it’ were some of the earliest of these, along with noting that other participants talked about doing prior research into the tasks, or making sure they knew about the topics or the perceived purpose of the activity. I first noted emphasis of ‘tasks’ in P8, then noting that P9 had emphasised social aspects much more, and that P11 had emphasised researching and knowing, P15 had emphasised her reflections on being at a specific place, P1 had valued what being there meant to her creative process, and so forth. This began the understanding for how participants were experiencing the journey, and what they had articulated as ‘meaning’ for them.

I proceeded in this manner, to discover ways of experiencing the smart learning journey that I had begun to recognise across the collective, yet emphasised in individual transcripts. I was aware that emphasis was not an equal measure across each transcript for the meaning being expressed, yet was sufficient to indicate commonality and variation in closely related ways. Though I could not yet recognise any clear relationships between categories, I tentatively correlated categories in a first draft:

- *Having to do it, doing the tasks, the activity as an obligation. Possible name: “Having to do it, to do the tasks”*
- *The activity as a set of locations. Possible name: “Locations in the local area"*
- *Something to do with friends, classmates or other friends. Possible name: “Doing it with friends”*
- *Doing something new, novel, different. Possible name: “Doing something new, different”*
- *Being there, living the experience, being ‘in it’. Possible name: “Being there, in the place”*
- *As personal research, motivation to experience the journey, wanting to gain benefit. Possible name: “As personal experience, to experience the journey"*

Category names simplified and refined to attempt to indicate the scope and related concepts. ‘Doing something new, different’ was removed as it became clear that novelty could be a structural part of a variety of referential aspects, for example, a new way of learning, a new way of using technology, a new way of doing a journey, a new way of discovering surroundings, etc. This also applied to ‘experiencing’, as this came to be seen as structural, not referential. Value of information began to show itself, and is made into a category and absorbs some of the ‘personal experience’ quotes, as they indicate value. ‘Locations in the local area’ and ‘Being there’ combine. Tasks and obligation is formed from ‘having to do it’.

- *Obligation*
    - *Requirements*
    - *Tasks*
- *Discussing*
    - *Helping*
    - *Working together*
    - *Being social*
- *Being there*
    - *Being in the place*
    - *Being there at that time*
- *Knowledge and place for own sake*
    - *Experience as gaining benefit?*
    - *Knowledge and Place as Value*

Creating Case Classifications for categories of description

The first drafts of the Categories of Description (CoD) were created in NVivo (still only analysing P1-P15). This enabled me to assign attributes using NVivo Case Classifications so that quotes were clearly organised. These could be exported as individual files for each case, with attributes and annotations intact. I also began to experiment with using child case nodes to record levels of experience complexity I was seeing. By organising the data in this way NVivo assisted in helping me to deal with the data in detailed systematic ways.

First iteration:

- Obligations, requirements
    - Level 1
    - Level 2
- Discussing, tasks or related
- Being there

- Knowledge and Place as value

Second iteration:

- Tasks, obligations, requirements
- Discussing, with friends, collaborating
- Being there
- Knowledge and Place as value

Selecting quotes to categories and levels

I now assigned quotes to the tentative categories of description (CoD), achieved in two stages, first for P1-P15, then for P16-P24 to confirm or disconfirm category appropriateness, meaning and perceptual boundary. It was during this process that relationships began to potentially emerge between categories.

The process of allocating quotes into categories of variation

1. For P1-P15 the process was as follows: Using the principle of Sjöström & Dahlgren's (2002) frequency, position and pregnancy method, acknowledging level of presence according to Edwards' (2005) concepts. Structural aspects were defined by considering Bruce et al.'s (2004a, 2004b) concept of the perceptual boundary that delimited how a meaning was being made and articulated, the context that appeared to define it.

I selected an utterance on the basis of the following criteria:

- Frequency of topic of focus being mentioned in a single transcript and collectively
- Position of topic of focus within the single transcript - is it introductory or in the summary, showing importance, or if referred to again or continuously.
- Position of the topic of focus within the quote, how much emphasis is placed on it.
- Pregnancy - explicit significance for the interviewee - by repeating, by continuous referral throughout, by stressing verbally, by emphasising.
- The structural internal and external horizon, as immediate context of the meaning, extending to outer edge of awareness. The perceptual boundary as it recedes to ground, perhaps articulated as an indication of limit of context or significance, or a physically defined limit.

2. Using a systematic data management approach enabled by NVivo, I could check to make sure all relevant quotes had been analysed, and review quotes that had not been included in a CoD.

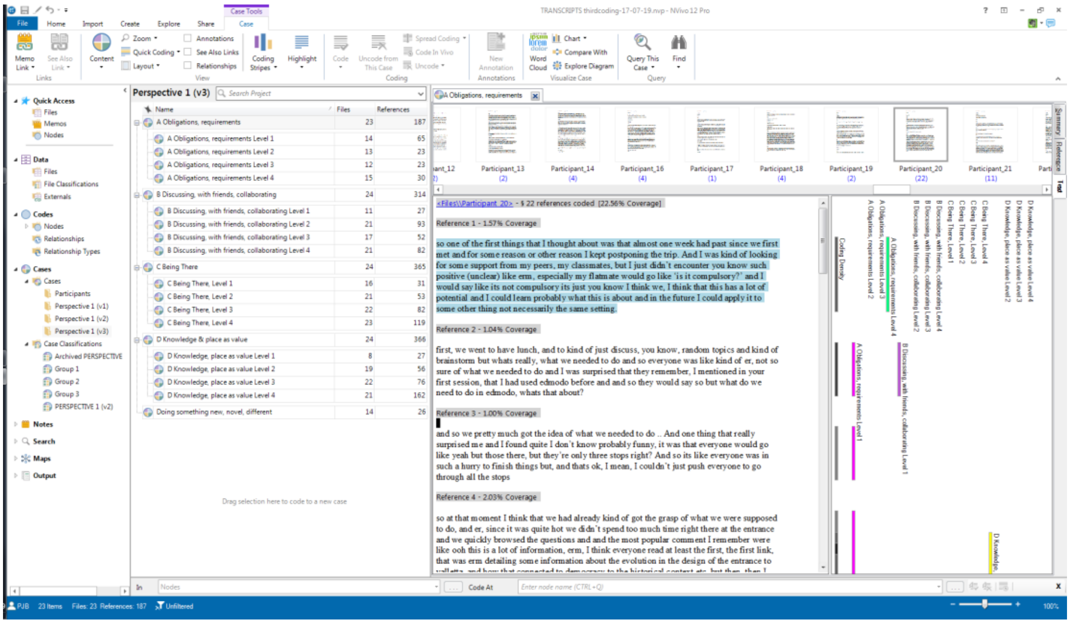

Figure 10 NVivo workspace and selection of quotes to case node categories and levels, with code stripes

3. Review quote allocations. Again making use of the NVivo data management functionality, I was able to repeatedly review how quotes were being allocated and in what context they were appearing in. I now had a much more developed understanding of how to interpret the structure of awareness for each category. Being aware to try not to ‘fit the data to the category’ (Åkerlind, 2005c), but to take into account the widest scope for each level of the category to define its outer external horizon, the perceptual boundary. It was at this stage I began to note down more of the descriptive guidelines to assist in guiding my interpretation of each quote and how categories were forming. Here, the potential relationships between categories became clearer.

This process was carried out after having reflected in some considerable depth both on the single transcripts and the utterances at collective level. I did not make the ‘case node’ categories until I had sufficient confidence that I was making the right decisions about the nature of meaning, the way that I should interpret the structure of awareness and then the distinction of difference to define category variation and levels of differentiation within each category.

5.3.4 Confirming Outcome Space Categories

Additional nine transcripts analysed

The final nine transcripts (P16-P24) acted as a confirmation of the categories of description already tentatively outlined. This was in the manner previously discussed, using Sjöström & Dahlgren's (2002) frequency, position and pregnancy method, and levels of presence (Edwards', 2005). Structural aspects were defined by considering Bruce et al.'s (2004a, 2004b) concept of the perceptual boundary, as context of meaning recedes to ground.

This was useful in that the final nine participant transcripts were highly emergent, potentially the most emergent of all the groups. Yet, they appeared to confirm the categories so far seen, adding to the complexity of experience depth of categories. NVivo assisted in reviewing quotes in an organised systematic way, to repeat read and familiarise with both single transcripts and collective quotes that bore similarity.

The additional transcripts expanded my understanding of interpreting quotes and my descriptive guidelines developed further. An emergence of relational aspects became evident as I contemplated how meaning might relate for participants. Group 3 (the last nine transcripts) were a confident group who had prior knowledge of learning cities and citizen roles in urban contexts, so were another 'purposeful' group to take part in interviews. Their reactions were diverse, ranging from very engaged and motivated, to sceptical, negative and uninterested. But it seemed evident from how they emphasised their reactions that they were confirming the categories as I had outlined them: obligations, talking and discussing, reflections on being at a place at that time, and the value (or not) of knowledge and content relating to place and being there. Ways of articulating are always different in each participant, yet these commonalities seemed evident, in differing levels of complexity, both of experiencing and of how to articulate that experience. It was always challenging to know whether I as the researcher was merely fitting data to existing categories (no doubt this may have happened in some instances), however, the overall commonalities and variations were present. I felt reasonably confident I was seeing confirmation of my earlier deductions.

Developing Descriptive Guidelines

I formed further understanding of the guidelines for each category level that helped to define the referential meaning and internal horizon focus towards its outer edge awareness external horizon. This became the more comprehensive iteration of the 'Descriptive Guidelines for

Experience Complexity of a Smart Learning Journey' (see Appendix 03, Table G), and in due course I realised that they were part of the structures of relevance that could potentially form part of the pedagogy of experience complexity for smart learning. Figure 11 below shows the completed case nodes for each category and level and the number of files and references for each category (aggregate) and level.

A Obligations, requirements	23	186
A Obligations, requirements Level 1	14	64
A Obligations, requirements Level 2	13	23
A Obligations, requirements Level 3	12	23
A Obligations, requirements Level 4	15	30
B Discussing, with friends, collaborating	24	315
B Discussing, with friends, collaborating Level 1	11	28
B Discussing, with friends, collaborating Level 2	21	93
B Discussing, with friends, collaborating Level 3	17	52
B Discussing, with friends, collaborating Level 4	21	82
C Being There	24	366
C Being There, Level 1	16	32
C Being There, Level 2	21	53
C Being There, Level 3	22	82
C Being There, Level 4	23	119
D Knowledge & place as value	24	366
D Knowledge, place as value Level 1	8	27
D Knowledge, place as value Level 2	19	56
D Knowledge, place as value Level 3	22	76
D Knowledge, place as value Level 4	21	162

Figure 11 NVivo completed case nodes with levels, aggregate parent case nodes shown without level in name. Number of files and references is shown on the right

Developing and refining the table of experience complexity

The table of experience complexity emerged steadily. At first I had no expectation that I would have any hierarchical relationship or inclusivity between categories, I was merely discovering similarities and differences. Indeed, Walsh states "(a) process of discovery means emphasising the similarities and differences in the data, rather than the hierarchy of categories. Focusing on the similarities in the data classified against a particular category develops the detail in that category. Focusing on the differences between sets of data where each set is classified against a different category elaborates the differences between those categories" (Walsh, 2000, p. 25).

As similarities and variation of them took shape, I slowly realised that a hierarchy was emerging (Lister 2021a, pp. 9-10). It began with seeing the apparent importance of tasks or similar obligations in many of the transcripts, then seeing how this related to discussing, and onwards. I sketched out a flow diagram, shown in Figure 12.

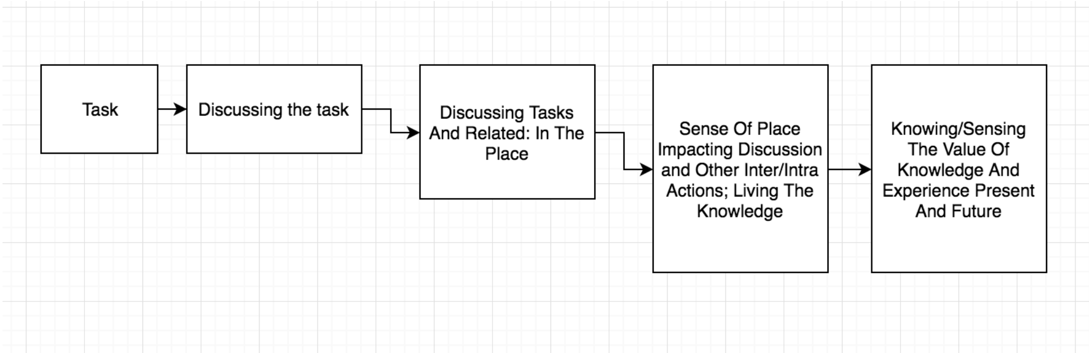

Figure 12 The first understanding of the potential hierarchical inclusivity of categories

Over some time, a working version of the table of experience complexity appeared (Table 9). This worked in conjunction with developing a table for the structure of awareness, (see Table D 'Working table, structure of awareness for a smart learning journey, four category descriptions', included in Appendix 03, for sake of space here).

	Category A **Doing the tasks**	**Category B** **Discussing**	**Category C** **Being there**	**Category D** **Knowledge and place as value**
Level 4	Research tasks and topic beforehand, take time doing and reflecting on tasks	Share tasks and content, do additional learning, discuss related experience and knowledge	Live it, being in the picture, live the atmosphere, take more time, seeing the whole and related parts	Knowing and seeing knowledge and place as valuable, personal experience, deeper engagement and 'possibilities'
Level 3	Tasks indirectly related to coursework or assessment	Discuss tasks and topic in relation to time and place	Experience in the place relating to other people, aspects and memories. Make connections between places and knowledge	Engage further with knowledge in topics, create upload content for tasks and at locations
Level 2	Do the tasks of interest, directly related to coursework or assessment	Discuss the tasks, help each other with tasks and tech	Locations are of some interest, potential for learning, creativity or inspiration	Click a few content links, save links 'for later', make screenshots of augmentations or tasks
Level 1	Do the tasks, go home	Discuss who does the tasks, how technology works	Go to locations, do tasks, go home	No engagement with content or knowledge, don't create or upload content

Table 9 Understanding the experience complexity of a smart learning journey

As my understanding of categories developed, so did my ability to describe the meaning for the less apparent but still present levels. This was not regarded as fitting the data to the category (Åkerlind, 2005c) rather, it was being able to recognise more clearly the differing shades of complexity for a category, and the meaning that was being shown.

5.3.5 The system element analysis

The system element analysis of a smart learning journey aimed to provide a 'secondary' alternative perspective view on the transcript data. System element outcome spaces would form categories of referential and structural aspects defined by each broad element, with delimited perceptual boundaries, different to those of the primary perspective outcome space.

Discovering the outcome spaces of the system elements

The system element analysis process achieved another round of reflection on the whole data, both from the perspectives of each system element, as well as confirming or disconfirming the validity of the first outcome space, experiencing the journey as a whole. The secondary perspective demonstrated alternate interpretations of the structure of awareness according to what was being examined. The aim of showing different interpretations is that an interpretive perspective is therefore demonstrated and can be understood more distinctly. This supports communicability of the analysis process and outcomes. Harris (2011) challenges the validity of phenomenography because there is evident difference in interpretation of the structure of awareness during analysis of data. The paper does not advocate a standardised 'prescriptive' definition of "context or perceptual boundary … as this will vary based on the phenomenon under study" (Harris, 2011, p. 116). Rather, Harris "makes it clear that authors should define and explain their use of this framework" (p. 116). I do not consider this as 'fitting the data to the categories' (for example Åkerlind, 2005b, p. 329, citing Bowden, 1996, Ashworth & Lucas, 2000) though there is always a risk this may be happening. By describing the SoA for each category as clearly as possible and outlining why it has been nominated then a level of objectivity might be maintained.

Some level of duplication with the primary perspective occurred, which was to be expected, however effort was made to focus on aspects of the structure of awareness experience defined by each nominated system element. For example, participant implicit engagement in the topic of a journey without explicitly saying it was of interest might result in it being included in the primary perspective 'Knowledge and Place of Value' category (level of complexity dependent on amount of engagement being expressed), but perhaps not in the system element 'Knowledge/Of Interest' category. Depending on context, explicit interest in the topic (or similar) is what would define the perceptual boundary of the 'Knowledge/Of Interest' category of description.

Analysing the system elements of a smart learning journey

By re-imagining the process that had iteratively developed from close examination and reflection for the primary interpretive perspective, I was more prepared to develop the secondary perspective. I proceeded to form system element structure of awareness descriptions of variations to help establish the interpretive perspective. These were formed through reflecting on the quotes and thinking about the system as a functioning whole with separate yet connected parts.

I maintained the same process as in the first outcome space for how to define the close focus of referential meaning and structural internal horizon, and then the delimited perceptual boundary to define the outer edge awareness of the external horizon. At first I thought the system element exercise may be a pointless one, and that the meaning was 'the same', as aspects of meaning were already included in the primary perspective. But I persisted in reflecting, trying to maintain the key analytical questions posed: 'experiencing place as….'; experiencing collaboration as….'; experiencing knowledge as….'; experiencing technology as….' … within a smart learning journey.

While 'duplication' of meaning is certainly there, other meanings show themselves by asking these more specific 'system element meaning' questions. Perspective one was concerned with finding meaning in the journey as a whole, the outcome space and levels of experience complexity are all variations of experiencing 'the journey'. By only looking for the experience of the system element, other meaning appeared, or was magnified. The limit of the perceptual boundary is in the aspect of the element present in the quote.

Practical process of system element analysis

All existing quote topic groups were examined for possible referential meaning in a structure of awareness (SoA) manifestation for each system element. Working through the topic grouping sets and individual transcripts resulted in viewing collective commonalities and forming proposed categories of commonality and variation. I further examined and reflected, "focusing on similarities and differences within and between categories and transcripts associated with particular categories" (Åkerlind, 2005b, p. 328).

I examined transcripts and topic groupings to find experience meaning (the what) for each system element (the how) within itself. I was aware that the broad system elements were essentially being imposed by the researcher (me), however, looking for in essence the referential meaning derived from the co-consituted structural aspects permitted some emergence to occur naturally, without being imposed by my assumptions (Åkerlind, 2005b, p. 324, 2005c, p. 97). To assist in this process I iteratively developed sets of statements, as I had done for the analysis of experiencing the journey as a whole, but for system element SoA delimited. This became known as the 'Descriptive Guidelines for Experiencing the System Elements of a Smart Learning Journey' (see Appendix 03, Table H).

Only partial 'true' emergence was possible, as I had already discovered categories of description for the primary outcome space. I accepted that my role as the researcher was already somewhat compromised in terms of bracketing prior findings or conclusions about meaning. However, by continuously reminding myself of the delimited system element analytical questions, I could attempt an overview, a possible snapshot for each system element outcome space of focal awareness. After spending time reflecting on quotes, I managed to form summary interpretations of the structure of awareness for system element delimited concepts.

It became increasingly clear that a significant amount of repetition was occurring between some of the system element quotes and those that had already been included (for somewhat similar meaning) into the primary perspective outcome space. I therefore sought to discover an overview of category variations with no further levels of these. I believe sufficient reflection took place to at least partially achieve this (it being difficult to state for certain) for the main purpose of the exercise, which was to demonstrate alternative interpretive awareness perspectives. After some time the final categories for each of the four nominated system elements were:

- Place
    - Being there, at the place
    - Being outside
    - Tour, trip, game

- Knowledge
    - Not of interest, not engaged
    - Of interest
    - Too much

- Collaboration
    - Distracting
    - Sharing
    - Social, engaged

- Technology
    - Easy
    - Helper
    - Novel, future
    - Problematic

These system elements categories differed most when considering collaboration and technology, as place and knowledge appeared to overlap more with the first perspective of analysis. For example, the experiential variation aspect of collaboration being distracting only really showed up when I reflected on meaning relating to collaboration in more delimited ways. Aspects of experiencing technology differed the most when technology was considered as a system element. These issues are discussed further in subsequent chapters. Refer to Appendices 03 Table F, and 04 for Key Quotes of the system element outcome spaces.

5.4 Analysing Learner Generated Content

Learner generated content (LGC) (Pérez-Mateo et al., 2011) from participants who agreed to take part in the research was analysed for reflections of experiences of learning. LGC included multimedia, hyperlinks or digital files, and was uploaded by participants into the Edmodo app, a collaborative participatory learning platform. Participant content often formed part of a greater whole, being part of content created by several learners in a class or group, and sometimes part of 'group work' to complete a task or set of tasks as part of the smart learning activity.

5.4.1 Analysing LGC using experience complexity

A very real challenge of analysing the LGC with a phenomenographic approach was in attempting to analyse in an emergent way. It was clearly no longer possible at this stage of analysis to retain impartiality towards natural emergence of categories of description for experience variation in the learner generated content as I had already discovered and then devised an analysis system for the interview transcript data. This posed a problem: how to analyse the LGC meaningfully, to still attempt some emergence yet to contribute to the focus of the research. I looked back towards the primary outcome space and reflected on how this may or may not impact the LGC. This content had been generated by the same participants who had taken part in interviews, and I began to think of the primary perspective 'experience complexity table' in relation to how it might be relevant to the LGC. The LGC I examined seemed to reflect similar variations to those seen in the table of 'experience complexity for smart learning' formed from the primary perspective outcome space. At this point I was not sure of whether this was fitting the data to pre-existing categories, as "the structure of the outcome space may potentially be imposed upon the data by the researcher" (Åkerlind, 2005b, p. 329), or recognising clear similarities, but I also knew that impartial fresh analysis eyes were not possible.

On further reflection I had the idea of re-imagining the experience complexity table by aligning it to equivalent Bloom's Revised (Anderson & Krathwohl, 2001) and SOLO (Biggs & Collis, 1982) taxonomies. O'Riordan et al. (2016) provided guidance for taxonomy selections, Taylor & Cope (2007) and Newton & Martin (2013) provide precedent for these taxonomies co-existing in a phenomenographic context (previously discussed in chapter three), in the way that I have done. This approach would provide a more conventional cognitive domain equivalency with experience variation complexity, and perhaps create opportunity for how to demonstrate this as an evaluation of LGC. Of note, the SE outcome spaces were not used to evaluate LGC.

Making use of Hounsell's (2005) three concepts for the quality of essay writing: arrangement, viewpoint and argument, I described a deep to surface learning hierarchical structure, visualising the categories and levels of experience complexity as aspects of learning (as reflected from the table of experience complexity). This is summarised in Table 10. These equivalence factors and reasoning are described in detail in Appendix 03, Table J.

	Cat A Tasks & Obligations	**Cat B Discussing**	**Cat C Being There**	**Cat D Knowledge & Place as Value**	**Surface to deep learning relationships**	**Bloom's Revised**	**SOLO**
Level 4	4A	4B	4C	4D	DEEP APPROACH shows intentionality for tasks, topic, knowledge and locations to contribute to argument; to understand further potential interpretation (inter/intra); ideas,	5/6	4/5

					application		
Level 3	3A	3B	3C	3D	SURFACE TO DEEP #2 moving towards ‘argument’ concepts; tasks and journey begin to be seen as indirectly relevant to wider settings; more reliant on imagination, creativity, inventiveness, inspiration	4	3/4
Level 2	2A	2B	2C	2D	SURFACE TO DEEP #1 some engagement with ‘viewpoint’, building elements of meaning and connection resulting from the journey participation	3	3
Level 1	1A	1B	1C	1D	SURFACE APPROACH shows intentionality of doing tasks as fact, ‘arrangement’ only. The bare minimum required.	1/2	1/2

Table 10 Description of surface to deep learning with Bloom's & SOLO taxonomies in relation to CoD levels of complexity using code representations

The learner experience complexity rubric

I realised that this idea could form a grading rubric, and may contribute to planning for possible pedagogical relevance structures of understanding, and measurement of learning. The rubric became a set of letters and numbers that could be assigned as an aggregate score to a piece of LGC. This could be used to acknowledge aspects of experience reflected in the content that correspond to the levels of complexity in the table.

	Cat A	**Cat B**	**Cat C**	**Cat D**	**Bloom’s Revised**	**SOLO**
Level 4	4A	4B	4C	4D	5/6	4/5
Level 3	3A	3B	3C	3D	4	3/4
Level 2	2A	2B	2C	2D	3	3
Level 1	1A	1B	1C	1D	1/2	1/2

Table 11 Experience complexity categories with Bloom's and SOLO taxonomies, forming the 'learner experience variables rubric'

Process of grading using the experience complexity rubric

Some LGC was from individual participants and analysed as such. Other LGC was developed as a part of a group, similar to many other class assignments in traditional learning and teaching. A decision was made to analyse content if a member of a group had agreed to participate in the research. Other's content who had not agreed were only referred to as 'another learner' if necessary, and not singled out in any way. I therefore analysed the LGC for each participant as part of the 'group work' wherever this was relevant, acknowledging context to other content that belonged to learners who had not agreed to participate in the research. As is typical of how group work might be assessed in many summative scenarios, it is never possible to tell 'who does what', unless the assignment requires this to be stated explicitly. This solved issues around potential infringement of ethics permissions for those who had not agreed to participate in the research.

What was being examined was not about individual assessment, but about ways of thinking of different kinds of learning that may be present in LGC, and how to potentially assess that. Whether the LGC was part of a group or individual effort was not relevant, as I was not making any connection with individual participants or what they may or may not have said in their interviews or created in their LGC.

The LGC analysis was a separate process of analysis, though based on the experience complexity table derived from the primary outcome space of experiencing the smart learning journey. It may be said that I was examining the LGC at collective level, derived from both individual and group LGC, as a phenomenographic exercise to apply prior findings.

LGC analysis step by step process

1. Work through any LGC made available via ethics consent for each participant group. Compile what is eligible into table.
2. Note down the content format: multimedia, text, hyperlinks to sources, Word document, PDF, Google Doc, comments in Edmodo, other.
3. Note relevant known factors for role of task in activity (for reference but do not impact assessment)
4. Learner experience rubric variables are assigned to whole pieces of content, these being written content or sets of images uploaded, for example.
5. Rubric variables take the form of:
    - Experience complexity categories and levels, (e.g. A2, C3…).
    - Number to indicate Bloom's Revised grade.
    - Number to indicate SOLO grade.

Using this rubric resulted in an aggregate score such as A3 C3 D3 D4 (5/4, 4) as an experience variable assessment of the content. Eleven sets of LGC were assessed in this way.

This exercise formed a way of looking at experience complexity variation as it contributes to LGC and how these variations of types of experience might perhaps even inform more implicit values of learner analytics that could help in ways of ‘machine seeing’ (Azar, Cox & Impett, 2017) learner generated content and interactions. If this rubric was a practicable way of assigning learner experience variation to LGC, then a form of deep/surface learner reactions data could potentially be gathered from these kinds of technically mediated interactive activities. This rubric of learner experience complexity might contribute to a grading of interactions as a potential form of learner analytics for smart learning, using learner experience variables data. These concepts are discussed further in chapter 8, in ‘Experience complexity as data variables’, followed by a brief critical examination in ‘Implications of machine learning’.

5.5 The second review of analysis

This section describes what was done to achieve a co-judge (Booth, 1992, p. 68) second review of the analysis process. I provide a description of practical procedures, the content of analysis reflections and the recording of outcomes. Cope (2002 p. 71) describes interjudge communicability percentage ratings using two other researchers, in this study I have used a single other researcher.

As I noted down the step-by-step process of my analysis, and particularly how I had come to understand and interpret the structure of awareness as it relates to a smart learning journey, I shared this with the second reviewer. Using both theoretical written discussion, related literature and my own summary statements of the SoA interpretive stance I had adopted, I communicated the interpretive position. Over several sessions he and I discussed and reflected on how this worked in theory and then applied in practice. We discussed how to interpret the ‘Descriptive Guidelines for Experience Complexity of a Smart Learning Journey’ and further developed the ‘Descriptive Guidelines for Experiencing the System Elements of a Smart Learning Journey’ (see Appendix 03, Table G and H), and the applying of these guideline statements to quotes. The second reviewer would review each of the exported documents I had made from NVivo classification collections independently from me, for each of the interpretive perspectives. This was a lengthy process, taking several weeks to complete.

Over this period I was able to consider some of the most challenging quotes highlighted by the second reviewer for inclusion in often multiple categories, though it was also very heartening to see that the second reviewer agreed with a large majority of my interpretations for both the interpretive perspectives. Overall I felt this indicated not only that my system could be communicated, but that it was a reasonably logical method by which to have come to understand the SoA of a smart learning journey. Though some quotes proved impossible to fully ‘decide’, I felt this wasn’t a problem, as it had been known for some time that quotes might exhibit multiple experience variations (Roisko, 2007, p. 133-134), as discussed previously in this chapter.

The system element (secondary) interpretive perspective proved more difficult to achieve full understanding and agreement on. My view is that this secondary perspective asked the analyst to suspend their first interpretive stance and attempt to look with different eyes on the data. This was difficult in itself, made more challenging by the issue of duplication - obvious similarity - with much of the first perspective. The system element perspective for Technology showed the most significant differences (compared to the primary perspective of the journey as a whole) and because this was more self-evident it made understanding and interpreting the other three system elements of Place, Knowledge and Collaboration more clear and easier to define the meaning and perceptual boundaries of those system elements, in contrast to the primary perspective counterparts.

This process was more art than science and may have limitations of validity, however I felt it achieved its aim as showed analysis can be achieved using different interpretative positions to define referential meaning and structure of awareness, and could be communicated and understood by another researcher. Many of the nominated ten key quotes selected to demonstrate each of the categories for both perspective positions indicate a review status. It is clear from these tables how much agreement is present from the second reviewer, as well as occasional queries being indicated. It was not felt necessary to ‘agree’ on the data in its entirety, rather, to make sure a strong level of agreement was being established.

5.6 Summary, chapter five

The analysis process proved challenging. I reflected continuously both on the data itself to understand a SLJ structure of awareness, and for my approach to analysis in terms of the phenomenographic method. This led to initial ideas being abandoned, before resuming analysis after further reflection and reading. I have sought to provide rich descriptions of my analysis process to communicate method and reasoning as clearly as possible. I have attempted to maintain an interpretative awareness "to acknowledge and explicitly deal with … subjectivity throughout the research process instead of overlooking it." (Sandberg, 1997, p. 209). I continuously questioned interpretive decisions, developing confidence that interpretations were a fair and reasonable way of understanding the data. Though potentially rather simplistic, my application of the primary outcome space categories of description to the analysis of the LGC was useful and innovative. Applied in conjunction with learning taxonomies it was a way of measuring learning in the LGC.

Chapter six describes the data interpretation findings. Primary outcome space categories of description are provided in detail, secondary outcome spaces provided as summaries. Again I attempt to offer rich descriptions of why data was interpreted the way it was.

6 DATA FINDINGS

This chapter describes the outcomes of interview and learner generated content (LGC) analysis in this study, in three parts.

- The primary outcome space and categories of description for experiencing a smart learning journey;
- The secondary outcome spaces and categories of description for experiencing the system elements of a smart learning journey;
- LGC findings, with conclusions and potential of the exercise in applying experience complexity to understand and measure LGC

6.1 Summary of Outcome Spaces

Five outcome spaces were established as a result of the phenomenographic investigation into how participants experience a smart learning journey. The primary outcome space comprises the categories of description derived from “experiencing the smart learning journey”. The secondary outcome spaces are the categories of description derived from “experiencing the system elements of a smart learning journey”.

6.1.1 Experiencing the Smart Learning Journey

The primary outcome space, ‘Experiencing the Smart Learning Journey’, contains four categories of description, each with four levels, forming an emergent table of experience complexity, describing levels of experience variation for each category. Categories were named using brief descriptive terms derived from words appearing in transcripts, and were ‘Tasks and Obligations’, ‘Discussing’, ‘Being There’ and ‘Knowledge & Place as Value’. Outcome space categories exhibit aspects of hierarchy, both within and between relational inclusivity. Category descriptions shown in the table of experience complexity (that indicates each category and the levels of complexity variation within it) demonstrate that potential hierarchical relationships are present. These might be better described as inter-related levels of experience complexity of a smart learning journey structure of awareness rather than specific directional hierarchy.

6.1.2 Experiencing the system elements of a Smart Learning Journey

A secondary perspective of analysis for the nominated system elements of a smart learning journey resulted in four further outcome spaces being developed. These were Place, Knowledge, Collaboration and Technology. These secondary outcome spaces were formed of three or four categories of description for each. The secondary perspective of analysis assisted in communicability of all the different perspective positions taken in the study, by being able to demonstrate the differences between them, and how interpretation of a structure of awareness can vary dependent on the object of interest to the research (after Bruce et al., 2004b). Additionally the secondary perspective of analysis offered useful contributions for further discussion and pedagogical consideration, and might be deserving of further research.

6.2 Experiencing the smart learning journey

The primary outcome space of 'Experiencing the Smart Learning Journey' is described in following sections. A brief summary of key aspects of the process of discovery for this outcome space are given, relevant to interpretations of the structure of awareness and discovery of any useful pedagogical approaches. This is followed by defining each of the four categories of description, and the four levels of experience complexity within each category. Key quotes demonstrate levels of presence and complexity of experience in each of these categories of description.

The four categories of description for the primary perspective outcome space of 'experiencing the smart learning journey' are:

- Tasks and Obligations
- Discussing
- Being There
- Knowledge and Place as Value

6.2.1 Descriptive guidelines for experience complexity of a smart learning journey

Interpreting the quotes to understand their position in the table of experience complexity (if any) was a continuous process of reflection, as previously described in chapter five. As this process iterated, I began to develop what became the "Descriptive Guidelines for Experience Complexity of a Smart Learning Journey", though at first it was not clear that this was a significant aspect of the analysis process. What began as an informal method of keeping track of understanding and of interpretive awareness for the different strata of structure of awareness variations became a method of clarifying this understanding, and of confirming or challenging inclusion of quotes within one or more categories and levels. Though it must be acknowledged here that data should not be fitted to pre-existing categories of description (Ashworth & Lucas, 1998, Åkerlind, 2005c), this emergent set of descriptors themselves developed and modified as understanding clarified, or was challenged in relation to quotes and interpretation. The set of descriptors came about iteratively, using the mechanisms outlined in chapter five, in the section '*Statements of analysis interpretation*':

> *Units of meaning are measured by guide concepts of frequency, position and pregnancy (Söyström & Dahlgren, 2002) of the content of a quote. Edwards' level of presence (2005, p. 134) plays a part. Then further examined with repeated reflections to delimit meaning and outer edge awareness (Bruce's 'perceptual boundary', 2004), (defines) the structure of awareness. (Chapter five, 'Finding Units of Meaning')*

The set of descriptions is included in this chapter because I consider it as a significant tool of the process for analysis. This set of descriptors forms the first basis of relevance structures produced from the table of complexity. Appendix 03, Table G contains the full 'Descriptive Guidelines for Experience Complexity of a Smart Learning Journey', also referred to later in this chapter at various points. The table of descriptions in the appendix is shown as it was used in the study, with the additional notation and comments regarding potential equivalency or similarity with Hounsell's descriptions of levels of complexity for essay writing, that is, arrangement, viewpoint, argument (Hounsell, 2005).

6.2.2 Category A, Experiencing the smart learning journey as 'Tasks and Obligations'

Category A was the first category to emerge from the data, as it became clear early in analysis that talking about 'the tasks' or 'what we were supposed to do' were frequently mentioned by participants. Though effort was made to not prejudge this emerging category, the persistent mentioning of these kinds of statements provided the first building block of the outcome space with its first category of description. P2 mentioned whether or not they ‘had to do it’, P6 reiterated this, and neither of these participants took part in the (Literary London) activity. They knew they would not be assessed on it, and taking part was optional, (though interestingly, still wanted to take part in the research). When P8 stated so clearly and succinctly “we went for the first four tasks, we looked them up and completed the tasks and then we left.” and other similar quotes, stressing with foremost emphasis placed on tasks, and doing them, I began to note ‘tasks’ as being potentially significant. Other participants (e.g. P1, P5, P10, P18, P19, P20, P23) mention obligations, relevance to assessment, ‘tasks’ or ‘questions’ they ‘had to do’. Initially I simply noted this, then as more data was gathered, I began to realise there were levels of this kind of activity experience interpretation. This led me to understand more about how to interpret a structure of awareness (SoA) for ‘Tasks, requirements, obligations’ as a set of independent though related SoA referential and structural elements. Initially I did not recognise the potential hierarchical relationships, these only forming more clearly as other categories took shape.

Next I describe each level of this category, using the most illustrative quotes to demonstrate the presence of each category level and how it is possible to interpret the SoA in this way, using literature where relevant to justify reasoning.

Also refer to Appendix 04, “10 key quotes for each category of Experiencing the Smart Learning Journey”.

Category A: Tasks and Obligations, Level 1

Category A: Level 1 Structure of Awareness Attributes

- Category A, Level: 1
    - Referential (Meaning): A1 having to do it, doing the tasks (or not doing the tasks)
    - Internal Horizon: A1 the tasks, the basic obligations
    - External Horizon: A1 limited to how many tasks, the time it takes to do them

Quotes

- Cat A Level 1 Q1: “we were focused on the task, not people and where we need to go next or whatever. We were focused on the task”; (P8)

- Cat A Level 1 Q10: “We went for the first four tasks, we looked them up and completed the tasks and then we left. So just went up, completed the tasks and that’s it, really, as a group experience.” (P8)
- Cat A Level 1 Q5: “it was annoying because em, the first thing that annoys me is that it seems to be like a general feeling that er, if… if something is not mandatory then there’s not interest in doing it so… erm, I felt that when my flatmate kept on saying 'but is it compulsory? (puts on whiny voice) is it mandatory?” (P20)
- Cat A Level 1 Q7: “I think a couple of the people especially in the beginning were not happy about being there or feeling like they needed to do this.” (P23)

Both Q1 and Q10 exhibit a strong emphasis on tasks and doing the tasks, P8 was explicit in strongly emphasising focus on tasks, questions and doing things (quickly) before leaving. These quotes leave little to doubt as to what is at the forefront of attention and even expresses that other aspects (people, ‘where we need to go next’) were of less importance. Tasks are central, and occupy the referential meaning, the focus of reason for taking part in the activity, and explicitly place other aspects into the background. This seemed to define the Level 1 SoA for ‘tasks’. This participant was part of Group 2a, Maltese BA Undergraduates. Other aspects of obligations were present at this most basic level of SoA and as tasks were an aspect of Obligations (albeit a very specific one), these seemed to naturally go together. Q5 is a remark being made by P20 about a peer participant and the issue of the activity being mandatory or not, whether it was compulsory to take part. This core issue of obligation, the simple requirement of having to do it appeared to be another version of expressing the requirement of something needing to be done. Q7 is P23 talking about other participants being unhappy about ‘needing to do this’. There is some room here to interpret this as aspects of ‘happiness’ regarding taking part, but the clarity by which the participant refers to ‘needing to do it’ again emphasises indication of obligation at core level. These quotes are grouped in this way because there are no qualifying factors of obligation or task, just the requirement to do them, having to do them. This is the aspect that is binding this level of structure of awareness interpretation, the simple requirement to do things, no matter what they are. External horizon extends to how many must be done, or time it might take to do them.

Category A: Tasks and Obligations, Level 2

Category A: Level 2 Structure of Awareness Attributes

- Category Level: 2

- Referential (Meaning): A2 doing tasks of interest, related to coursework or assessment
- Internal Horizon: A2 choosing tasks of interest, relating directly to coursework
- External Horizon: A2 limits to relating to direct assessment, direct to coursework

Quotes

- Cat A Level 2 Q2 “we were told it was a group activity but then we weren’t clear on where the group part of it lay because we were all doing individual assignments. So I think there was a bit of confusion about that” (P3)
- Cat A Level 2 Q4 “because for example Lambeth North was not included in the tour well I was like it’s not going to be very useful for my project anyway, for my essay” (P5)
- Cat A Level 2 Q5 “but at the moment you are, you’re like doing this you’re being engaged into seeing what you have to do and take pictures and do the task at that time” (P7)

Level 2 begins to raise the awareness into relevance to coursework and assessment, or tasks. Q2 shows P3 describing how the activity was being thought about in terms of the assignments and classwork. P3 explicitly describes the confusion between group work and individual assignments, and the way the sentence is structured implies that the assignment is placing the group work into a ‘confused’ requirement. “We were told it was a group activity” is a strong indicator of something being instructed as a potential obligation, and then confusion arising out of that requirement as the assignment is individual. The structure of awareness is therefore interpreted as being related to coursework and assessment but in this particular issue they are not directly related to assessment. Q4 demonstrates a clear quote about something again not being directly relevant to assessment, P5 stating “it’s not going to be very useful for my project” as the locations of the activity were not the ones she would need for her assignment. Q5 is expressing an engagement with “what you have to do”, so in this case there is a positive feeling of relevance of activity to tasks and in relation to engagement, yet what you have to do remains emphasised.

Category A: Tasks and Obligations, Level 3

Category A: Level 3 Structure of Awareness Attributes

- Category Level: 3
  - Referential (Meaning): A3 tasks can be indirectly related to coursework or of personal interest
  - Internal Horizon: A3 tasks become indirectly relating, relevance, interest to coursework
  - External Horizon: A3 limits defined by personal interest of task directly and extends to indirectly related

Quotes

- Cat A Level 3 Q1 "I think, especially as you're in third year as well and you want your results, you want to do as well as you can and you think how can I do that, and for me it's basically going somewhere and observing and kind of feeling, you know feeling what that place feels like, I'm looking at the people there." (P1)
- Cat A Level 3 Q2 "Yes I found it really interesting in that way the places themselves [weren't] necessarily the focus of what I was doing (..) just that kind of old London getting a feel for that" (P3)
- Cat A Level 3 Q6 "at first, we all thought that we haha we all thought like it was really an activity that we needed to complete, with all of the answers, the questions, being answered, and with everything such as the pictures and the videos but then we kind of shifted a little bit the, our own outcome and what we should be posting and sharing" (P20)
- Cat A Level 3 Q9 "I think with us being a group of people doing the same task, erm, I don't know, I wanted to try and contribute something personal… something bit more individual, erm, for the sake of sharing and learning" (P21)

Level 3 begins to indicate a broadening of how to define relationships between tasks and assignments, and the nature of the activity. These quotes all have in common the experience of thinking about tasks and assignments in ways that appeal to them, personally, as well as having an indirect connection to their assignments or tasks. P1 is very clear in Q1, expressing this in terms of grades and the way they personally choose to do well in their assessment, relating indirect 'feelings' of visiting somewhere and looking at people. P3 again expresses in Q2 the indirect relationship to their coursework, in positive terms of getting a feel for that old London as of beneficial effect to their work. P20 in Q6 notes the change in interpretation, describing the difference clearly between just thinking about tasks, questions and answers to becoming more of 'our own outcome' of what they should be posting. Q9 states a very definite wish to do something personal, more individual 'for the sake of sharing and learning', rather than everyone in the group doing the same task. This broadens the idea of what a task is or how it can be interpreted as indirectly relevant to learning.

Category A: Tasks and Obligations, Level 4

Category A: Level 4 Structure of Awareness Attributes

- Category Level: 4
  - Referential (Meaning): A4 research tasks beforehand, take time doing tasks, consider reflectively
  - Internal Horizon: A4 researching topic and tasks, reflections on assessment, obligations
  - External Horizon: A4 limit expands from personal reflection, further research before/after and value in relation to time

Quotes

- Cat A Level 4 Q1 "I think that when people found out that ultimately they were going to be marked on their assignment for the submission, the kind of essay type thing that they wrote, they devalued this kind of side to the assignment." (P4)
- Cat A Level 4 Q4 "Because I think, we are living in a world that the most important things are, I mean they give more importance to the exams and these things rather than things which we are doing just to, well not just, to be informed about. So if we are not assessed I don't think we … prioritise it…" (P10)
- Cat A Level 4 Q5 "Yes because I read them before, I read them whilst I was preparing for the journey. I made sure I knew each and every task you know so I was quite confident about it – Usually I'm not always so confident" (P11)
- Cat A Level 4 Q8 "... my flatmate would go like 'is it compulsory?' and I would say like its not compulsory its just you know I think we, I think that this has a lot of potential and I could learn probably what this is about and in the future I could apply it to some other thing not necessarily the same setting." (P20)

Level 4 extends the SoA to still having task or obligations as central to the theme yet now has a perceptual boundary consisting of deeper reflections about the role of assessment or obligation in this kind of activity, or pursuing research and interest in the tasks well beyond the activity itself. This level has a flexible outer boundary depending on the nature of the quote, and the selection shown here for this level demonstrate this, from Q1 (P4) reflecting on how value changed for the activity and how people thought about it, to Q4 which sums up the value of the activity with “we are living in a world that the most important things are, I mean they give more importance to the exams…”. Then P11 relates in Q5 how she prepared beforehand and made sure she knew “each and every task” to be “quite confident about it”, showing another aspect of further reflection and engagement. P20 again reflects on “is it compulsory?”, then going on to describe the value of the activity for potential and in the future, showing a deeper understanding of the nature of the activity. These are different kinds of quotes but all have task, assessment, obligation as central meaning, with a much further extension of the perceptual boundary emanating out from this.

6.2.3 Category B, Experiencing the smart learning journey as ‘Discussing’

Category B began to form after early repeated reflection of the transcripts and node collections in NVivo, ‘discussing’ things emerging as a common theme. Initially aspects being discussed such as technology, tasks or locations were thought to be possible categories of variation in themselves but as my understanding of interpreting a structure of awareness and of finding meaning increased, I realised that ‘discussing’ was itself the most appropriate description of the category, and that aspects of its variation would form the meaning and steadily expanding limits of perceptual boundaries of the SoA. I realised that the aspects of what was being discussed (technology, tasks, locations etc.) were sometimes structural and sometimes meaning (referential), depending on the quote, and this contributed to how a SoA for a smart learning activity could be understood and interpreted. By realising that ‘discussing’ was a potential category, and ‘tasks and obligations’ was another category, clarity was developed.

Also refer to Appendix 04, “10 key quotes for each category of Experiencing the Smart Learning Journey”.

Category B: Discussing, Level 1

Category B: Level 1 Structure of Awareness Attributes

- Category B Level: 1
    - Referential (Meaning): B1 discuss who does tasks, how tech works

- Internal Horizon: B1 focus on tasks, who does them, what should be done, how technology works
- External Horizon: B1 limit is who does what is required, discussing what needs to be done, and how the apps work

Quotes

- Cat B Level 1 Q1 “We just decided who is going to do and that’s it. Everyone was working on their task.” (P7)
- Cat B Level 1 Q3 “Yes we were helping each other out how to download the apps and how to use the apps, and when we are going to meet what we are going to do” (P8)
- Cat B Level 1 Q5 “we try to do it the three of us, [...] and then we saw how it works, together and saw the information, took some you know screenshots, on the questions, erm, and then we had worked them, we tried to work them together so that we get enough the information, “ (P14)
- Cat B Level 1 Q6 “we just decided we will not do all the assignments together, we’ll just divide it, like, er, two people will do this one and two people will do that one” (P16)

The first quote, Q1, describes discussion of deciding “who is going to do (something) and that’s it”. This was in referral to using an online messaging app to support learning, reflected on as part of their experience of the journey. In Q3, we can see that the idea of helping each other in relation to how to download and use the apps (this latter extends the SoA a little) and other factual aspects such as meeting time, and again “what we are going to do”. In Q5 the quote is a little fractured but included here as reiterates again trying to “do it”, “how it works” and “the questions” being “worked together”. In Q6 decision-making is again being mentioned in relation to assignments, allocating these to different members of a group. These quotes are all interpreting the situation in terms of the implied discussing to allocate and ‘do’ tasks or work out technology together, but no other context is expressed. The sum total of the SoA can therefore be interpreted in summary as having a meaning of ‘discuss who does tasks, how tech works’, the internal horizon reflecting the focus on this meaning, and the external boundary being defined by ‘who does what is required, discussing what needs to be done, and how the apps work’.

Category B: Discussing, Level 2

Category B: Level 2 Structure of Awareness Attributes

- Category B Level: 2
  - Referential (Meaning): B2 discuss some tasks and locations, help with tech
  - Internal Horizon: B2 focus on aspects of locations relating to tasks or helping each other technically
  - External Horizon: B2 limit is discussion extends to task/location relationship, not beyond

Quotes

- Cat B Level 2 Q1 "… you reassure each other that it's fine and you're still doing the journey and you're still experiencing this kind of walk through the streets so I think we knew after a bit that it was fine to kind of do what we were doing" (P1)
- Cat B Level 2 Q6 "We discussed also the websites... and tasks. For example, sure the biggest topic was the tasks. What should we engage on and what should we do to perform the task, such things" (P13)
- Cat B Level 2 Q8 "we were helping each other out with you know, using the apps, finding the locations, erm, and the conversations that we have along the way, you know, discussed this or that, you know, we liked the building, we liked what about it, don't like what about it, erm, that keeps us engaged with the activity. " (P17)

I include quotes here to illustrate how level 2 of the Discussion category develops from level 1, so some inclusively is present, especially for how to use the apps. But this extends out towards discussion of locations, *what* to do to "perform the tasks" (Q6). Locations become more evident for finding them, and discussing them, but tasks or obligations are still strongly in focus. Q 1 stating "it was fine to kind of do what we were doing" indicates awareness of obligation, Q6 expressing "what should we engage on and what should we do…" affirms this, Q8 mentions "helping each other using the apps and finding locations", then offers a glimpse of the next level with discussing the locations of "the activity", so still has awareness of what might be expected. While it can be said that level 1 and level 2 have much in common, level 2 is delimited to see this small but arguably significant change, that tasks or locations begin to be discussed more, in ways other than what needs to be done. We also see an emerging inclusively with aspects of level 3 in Q8, as this expresses aspects of the locations specifically, albeit in limited terms.

Category B: Discussing, Level 3

Category B: Level 3 Structure of Awareness Attributes

- Category B Level: 3
  - Referential (Meaning): B3 discuss tasks, content, relating to place and time
  - Internal Horizon: B3 focus broader than L2, expanding to time and place towards related aspects
  - External Horizon: B3 limit to discussion of tasks and locations in the journey and to history or close related

Quotes

- Cat B Level 3 Q1 "we eventually just kind of stopped looking at the information. Maybe just a little bit of it, and then kind of just discussing the places ourselves or even googling things ourselves because we found that was a little bit easier for us to do." (P1)
- Cat B Level 3 Q4 "if for example if I had someone else there with me I would be able to tell them like can you imagine for example, imagine this, like in one of them there was a photo of the past, more than one of them, and I would've liked to tell for example to someone like oh look how it was, look how this building was in the past." (P11)
- Cat B Level 3 Q6 "we went to the city gate. We went to the Parliament, the Palazzo Ferreria, and it was good to know about this Palazzo Ferreria, through its website, because then I later accessed the websites at home. Erm it was interesting" (P15)
- Q9 "but I remembered those two specifically because I remember the photo of Edith Warton … and I remember the photos of the gate […] we talked a lot about er like what that represented for Malta and like the progression from the original stage to now and so you know them wanting to open up more, them wanting to welcome tourists…" (P23)

Level 3 clearly expands the external horizon and creates central focus and meaning towards what the tasks and locations are *about* that are being discussed. Participants are discussing the places, searching or reading for themselves during or afterwards, mentioning facts or pertinent points relating to journey content, or in the case of Q4, remarking on what it would have been like to be able to discuss these things had they gone on the journey with other people. Interest in what things are about is much more evident, but still mostly delimited to referring to locations, buildings or facts relating to the points of interest. Q9 does begin to move towards level 4 as the participants reflections extend both meaning and out to the perpetual boundary with "what that presented for Malta, and like the progression from the original stage to now… them wanting to open up more, … to welcome tourists". This on its own would be level 4 as is a wider reflection of the implications of the knowledge, but is placed in level 3 because the quote starts with focus on a specific location and the comments are in relation to that place.

Category B: Discussing, Level 4

Category B: Level 4 Structure of Awareness Attributes

- Category B Level: 4
  - Referential (Meaning): B4 share tasks, content, additional learning, related experience, knowledge
  - Internal Horizon: B4 sharing aspects of tasks, content and beyond, the value of shared experience and collaboration
  - External Horizon: B4 talking about and sharing content, knowledge, for tasks and wider relevance, related experience, also value of collaboration

Quotes

- Cat B Level 4 Q2 "and for example I went with N on the walk, and I think if we spend a lot of time discussing our ideas and things that we're doing and I think it's really, really useful because then it is no longer just your idea you're bouncing it off of somebody and getting feedback on it I think its really helpful" (P3)
- Cat B Level 4 Q6 "we didn't only talk about the content or the places that we went to, we also talked about each other, our lives, erm, about the places we went to like travelling and stuff, yeah its quite an informal experience like a learning experience" (P16)
- Cat B Level 4 Q8 "I think the fact of being there as a group actually made it more interesting, than it actually is and I clearly remember having said to one person in my team that erm, this type of learning activities is (sic) really meaningful and motivational" (P20)

In level 4, wider relevance of aspects of discussion become more evident, of the collaborative experience, of discussing the locations and content, of what the locations prompt as further discussion, and how discussion might impact coursework as well as wider relevance. Sharing each others knowledge and experience of other relevant locations is present in Q6, the usefulness of "bouncing (your idea) off of somebody and getting feedback on it" (Q2), and “being there as a group actually made it more interesting” (Q8) all position focus in the value of shared experience and collaboration, with meaning as additional learning, related experience, and sharing as learning experience, as meaningful and motivational, as really helpful.

6.2.4 Category C, Experiencing the smart learning journey as ‘Being There’

Category C, Being There, came about through realisation that though locations or places were often the subject of quotes, they were not of themselves a category of description as were (or could be) structural aspects of a variety of other experience meanings. This was another factor in understanding how to trace units of meaning in quotes rather than simply counting recurrences of ‘location’ or ‘place’ in quotes. This difference of referential (meaning) and structural was central to developing the overall structural awareness of the smart learning journey. The experience of ‘being there’ and expressions with similar meaning such as ‘at the place at that time’, ‘being in a picture’, ‘living it’, ‘being part of history’ were reflecting a sense of what was experienced when a participant was standing in the location itself. Variations of this were then recognised and formed the category.

Appendix 04, “10 key quotes for each category of Experiencing the Smart Learning Journey”.

Category C: Being There, Level 1

Category C: Level 1 Structure of Awareness Attributes

- Category C Level: 1
  - Referential (Meaning): C1 Go to locations, do tasks, (then go home)
  - Internal Horizon: C1 focus on go and do it, facts, minimum locations
  - External Horizon: C1 Limit to direct relevance and none or low focus or attention to place

Quotes

- Cat C Level 1 Q6 “We went from one place to another because they were near each other. That’s about it” (P10)
- Cat C Level 1 Q8 “Like you have to do certain things at the certain location, and to find this and that, do this and that, yeah?” (P17)
- Cat C Level 1 Q9 “‘Erm. What happened after third stop because erm, we were just like ok only three stops right?’ ‘Yeah… three stops’” (P20)

Level 1 of Category C is the basic sense of going to a location, and doing a task. There is often an overt sense of the simplistic factual nature of this experience within the quotes, as indicated here in Q6. In Q8 there is a slight shift to describing this in the third person, and in Q9 we see the repetitive emphasis of "only three stops right?" as being the acknowledgement of a minimal sense of attention and effort to go somewhere. This is the least possible experience of being there, "to do certain things at the certain location" (Q8).

Category C: Being There, Level 2

Category C: Level 2 Structure of Awareness Attributes

- Category C Level: 2
  - Referential (Meaning): C2 Locations of some interest, potential for learning, creativity, inspiration
  - Internal Horizon: C2 one or few locations are noted as of some interest
  - External Horizon: C2 limits to mention one or two locations, only connected to journey itself (and task)

Quotes

- Cat C Level 2 Q2 "for instance if I'm going to go to a building and I've been told about the building and yes it's got this fancy window oh yeah this is where they used to do things on this and I learned about it by you know books or Internet but I wouldn't appreciate it as much as I would if I saw it." (P2)
- Cat C Level 2 Q3 "I think for me the most important aspect was being taken to the places we were reading about in our course and to get that sense of place kind of being taken by the hand and lead through these places." (P3)
- Cat C Level 2 Q6 "First of all I never been to Palazzo Ferreria, so to do the journey and be at the Palazzo Ferrerria, it was much helpful to be there instead of seeing it online for example so I appreciated, I appreciate it more." (P10)
- Cat C Level 2 Q8 "So I said oh look the city gate is gone now and then they were oh yeah, oh my god! So it really helped." (P16)

Level 2 of Being There was present in many quotes and demonstrates that at this level of locations being of some interest and engagement many participants appeared to share this meaning of experience variation. Quotes talk of appreciating things more "if I saw it" (Q2, P2), “get that sense of place … being taken by the hand and lead through these places” (Q3, P3), appreciating it more (Q6, P10). Q3 is interesting here as begins to expand towards level 3, thereby indicating inclusivity upwards and demonstrates elements of hierarchical relationship in terms of expanding referential meaning, internal and external horizon by use of the expression “that sense of place”. It is included in this level as does not expressly mention anything further, only hinting at further reflection, which the participant does do in other quotes.

Category C: Being There, Level 3

Category C: Level 3 Structure of Awareness Attributes

- Category C Level: 3
    - Referential (Meaning): C3 Place relating to other people, aspects, memories; connections between place and knowledge
    - Internal Horizon: C3 begin connecting some locations with overall journey /knowledge
    - External Horizon: C3 limits to seeing more of journey as whole, for content and own LGC, for ideas or related memories

Quotes

- Cat C Level 3 Q1 “I think the most important thing was getting students out onto the streets, and actually walking these journeys on what we speak about in class all the time. And all the literature we read about London it’s important to experience that at first hand to try to get a sense of that history from the streets” (P1)
- Cat C Level 3 Q4 “the place definitely does make a difference because it’s kind of a layering of knowledge feeling you get a feel for it especially I think when we were in that spot actually there was a church bell ringing somewhere so that, added an extra well just an extra layer” (P3)
- Cat C Level 3 Q10 “I did try to take some videos of like the first one at the gate and there was like a musician playing it was kind of cool like Bob Dylan-esque music, and there was like a group of Chinese tourists and like the big screen like the big gate so it was kind of like lovely mix.” (P22)

Level 3 establishes connections between place and knowledge, associating memories, or other related knowledge or ideas, seeing the journey as more of a whole. Participants sometimes refer to their own content relating to place, to points they make relating to locations and their own reflections. P1 reflects in Q1 about "getting students out into the streets" and makes the connection of that and what they cover in class. P3 talks about a "kind of a layering of knowledge feeling you get", describing an illustrative experience of church bells ringing to add layers (Q4). In Q10, P22 describes making their own video to demonstrate what the experience is like at that moment "of like the first one at the gate and there was like a musician playing it was kind of cool like Bob Dylan-esque music… and like the big screen like the big gate so it was kind of like lovely mix." She recognises the comparison of the (City Gate) location and the current social life going on. Location and being there at that time are emphasised in all the quotes, with connections to further related experience or reflections being made.

Category C: Being There, Level 4

Category C: Level 4 Structure of Awareness Attributes

- Category C Level: 4
    - Referential (Meaning): C4 Live it, be in the picture, live the atmosphere, take more time, seeing the whole and related parts
    - Internal Horizon: C4 sensing the being part of history, walking in footsteps, being in the picture, living it
    - External Horizon: C4 limits to seeing the whole, the being in the place, sensing place in history and time, for wider relevance and purpose, inspiration, creativity of place

Quotes

- Cat C Level 4 Q1 "So, I think when you go to the place it, it just improves your creativity massively, because you're stood, say like in one of the Dickens streets, you're still there and you're thinking he was here, you can't compare that to reading a book. At all. Ha ha ha!" (P1)
- Cat C Level 4 Q2 "even walking past you know these places and you see them around maybe even new buildings have come across, but having that journey, you know just that walk and looking, put yourself in the other shoes feeling like you're part of the history" (P2)
- Cat C Level 4 Q3 "what it does is in putting you in the place it almost gives you another level of access to something that really we don't have anymore, get a deeper

understanding of what that part would’ve been like at a certain time and what was going on around that time” (P3)

- Cat C Level 4 Q6 “I think what I found useful is the ambience of the place gets you in the spirit of the journey like even hear the sound of people talking, are they locals, people going to work, there are tourists. For me I felt it wasn’t really a distraction completely, it got me in the mood, I’m there, it’s not like I’m at home behind my laptop reading, you know, being a passive receptor. I was immersed in the environment.” (P12)

There are numerous quotes in this level of this category as participants describe their own reflections of what they felt they gained from the experience of ‘being there’. Descriptions in this level provide a range of experience that may indeed benefit from further granular analysis (hinting at level 5 or more of complexity). P1 describes the experience of standing where Dickens once stood that “can’t compare that to reading a book. At all. Ha ha ha!” (Q1). P2 in Q2 uses the expression to “put yourself in the other shoes feeling like you’re part of the history”. P3 describes “another level of access to something that really we don’t have anymore, get a deeper understanding of what that part would’ve been like at a certain time” (Q3). P12 tells us “I’m there, it’s not like I’m at home behind my laptop reading, you know, being a passive receptor. I was immersed in the environment” (Q6). These quotes describe the sense of being in the place, sensing place in history and time, and the relevance and effect of that. They are living the atmosphere, and seeing the wider relevance and purpose, inspiration and creativity of place.

6.2.5 Category D, Experiencing the smart learning journey as ‘Knowledge and Place as Value’

This category was last to emerge in its current named form, taking shape over repeated reflection of transcripts and NVivo node collections. The category is named using a general term overview to indicate the sense of value of knowledge and place and the relationships that might be experienced between those by participants. To have only considered knowledge as content would not have encapsulated the range of variation being expressed and then discovered, though experiences of knowledge content are a part of this category. The significance of value needed to be reflected in the title as quotes would refer to a variety of terms that indicate value such as interest, boredom, appreciation, engagement. The category additionally attempts to capture how LGC is experienced in contexts of knowledge and place relationships and may shed light on the process of LGC as value in these contexts.

Appendix 04, “10 key quotes for each category of Experiencing the Smart Learning Journey”.

Category D: Knowledge and Place as Value, Level 1

Category D: Level 1 Structure of Awareness Attributes

- Category D Level: 1
  - Referential (Meaning): D1 don’t engage with content, knowledge, don’t create or upload content
  - Internal Horizon: D1 No real focus on any content or learning, no engagement in topic
  - External Horizon: D1 limits to no engagement, interest, do not read any content or create any LGC, valueless, pointless

Quotes

- Cat D Level 1 Q2 “Oh okay, no we just accessed the tasks. I didn’t know about the websites” (P8)
- Cat D Level 1 Q3 “Like I said I’m not good with history, I’m not really interested in the subject so I didn’t even make the effort you know what I mean “ (P9)
- Cat D Level 1 Q4 “… we got bored midway. Cos we didn’t want to read all the text. You know, I thought, it would have been better if it’d been, if there’d been like videos, so I wouldn’t have to engage cognitively, as much (laughing!)” (P17)
- Cat D Level 1 Q8 “I didn’t want to be that formal. You know what I mean like we just kind of wanted to be like oh look around erm, yeah I don’t even remember what the questions were something about... Significance of the open gate versus something” (P22)

Level 1 of Category D reflects the lowest levels of engagement and interest in the topics and content of the smart learning journey activity. Quotes reflect aspects of not engaging at all, not creating any LGC, not reading any content, not being interested in the topic, “I’m not good with history” (Q3), “we just accessed the tasks. I didn’t know about the websites” (Q1), “we got bored midway. Cos we didn’t want to read all the text.” (Q4), “I don’t even remember what the questions were” (Q8) all encapsulate focus on not wanting to engage with the knowledge content or topic in general. Meaning here is no engagement in topic, and the perceptual boundary might be regarded as valueless, pointless.

Category D: Knowledge and Place as Value, Level 2

Category D: Level 2 Structure of Awareness Attributes

- Category D Level: 2
  - Referential (Meaning): D2 click a few links, save links for later, make screenshots
  - Internal Horizon: D2 some task focus as basic interactions, screenshots of AR or minimal photos (as proof of participation)
  - External Horizon: D2 limits to low interest, some tasks or information read, screenshots or photos but little sense of value

Quotes

- Cat D Level 2 Q3 "… because when we went on the tour I could see some of the information that was displayed at every location and I could see it was a lot of information and a lot to read" (P5)
- Cat D Level 2 Q7 "Cos I guess my, my mood, on that day was feeling a bit lazy, was very tired, so I didn't want to engage cognitively cos reading requires a lot more you know, cognitive effort whereas if you're watching a video you're, you're receiving it more passively information-wise…" (P17)
- Cat D Level 2 Q9 "… the content of the course for me was, perhaps its just not, not something I personally felt an affinity with so much and so I found some of the questions and some of the tasks a bit … much … or a bit heavy?" (P21)

These quotes show variation within a commonality of disinterest and lack of engagement, though a presence of a bare minimum of attention. Reasons such as laziness and tiredness (P17), lack of affinity with (P21), a lot of information and a lot to read (P5) show either a focus on lack of value and therefore engagement, or vice versa. There is an expressed awareness of locations, topic and types and amount of information, having seen or interacted to a limited level, and an explicit explanation of not being engaged. Reading forms part of the external horizon as it appears to be the limit of perceptual boundary at this level. Basic interactions, focus on minimal content engaged with or created form the meaning and internal horizon.

Category D: Knowledge and Place as Value, Level 3

Category D: Level 3 Structure of Awareness Attributes

- Category D Level: 3
  - Referential (Meaning): D3 create, upload content, engage more with knowledge in some way
  - Internal Horizon: D3 knowledge interest limited to location content, creating some LGC
  - External Horizon: D3 more engagement with topics & tasks but limited to locations, more photos, of topic or people, or both, more sense of value

Quotes

- Cat D Level 3 Q3 "… the impression I have now is, is kind of remembering, like I said, the authors or the time periods that are kind of attributed to the different places. So for example at first the great fire of London where we started off from St Paul's." (P4)
- Cat D Level 3 Q4 "… yeah, you're seeing those characteristics. If I have to take it *(a photo)* from in front I just see the city gate, I wouldn't see that perspective. Because when I was little I never saw it as a fortification, I didn't care much I just seen the gate, it was different at that time and I didn't see it from that perspective, that it's a fortification, it's a bridge. Nowadays you can see it especially from that angle you can see those characteristics." (P7)
- Cat D Level 3 Q5 "My context was I was interested I wanted to learn about the actual places or whatever but I knew that other students just me maybe they weren't. They saw it as just they had to do it and that's because they don't really know the value of this. I don't think they even get the value and I don't think they let themselves experience it." (P8)

These three quotes again show some variation within a similar perspective grouping, of interest in the topic or awareness of locations and information and the relationship between them. Q3 (P4) indicates clearly the connection between time period, author and location; Q4 describes how they can see and know more about the topic and information because of where they are standing at the location and what they are seeing (P7); Q5 (P8) is intent in their expression of wanting "to learn about the actual places or whatever" but then reflecting on their peers who were not interested and did not "get the value", implicitly implying that she did.

P8 is of particular interest in this study as he exhibits a lot of variation within himself, across multiple categories, about his own reflections, awareness of experience and potential of the activity, and frustration at his peer group. He might be referred to as a classic case of Åkerland's "variation within the individual" (Åkerlind et al., 2005e, p. 81), as his awareness structure appears to extend from Cat A1 through to Cat D3 or even 4. Again this shows the nature of relational inclusivity within and between categories and levels.

Category D: Knowledge and Place as Value, Level 4

Category D: Level 4 Structure of Awareness Attributes

- Category D Level: 4
  - Referential (Meaning): D4 knowing and seeing knowledge & place as value and experience, more engagement and possibility
  - Internal Horizon: D4 research, as value for learning, as motivation and interest, wider reflections on value and purpose
  - External Horizon: D4 limits to wide sense of the point of the whole, for personal gain, value, deeper reflection potential. Create more content, tasks examined at deeper level, researched, prior or post activity, or both.

Quotes

- Cat D Level 4 Q1 "I did another creative piece after all of this and it was set in Stamford hill in London did the same thing. I went off about three times walked up and down the streets, and into shops just to kind of get a feel the place." (P1)
- Cat D Level 4 Q2 "I think that's the thing about smart phones on the Internet, being always connected you know. It's the like overload of information you can get some time and I'd like to avoid that also it's really interesting to, I mean it could be really helpful to have a map as a guide, like an interactive map but also not something that is too much, too time-consuming or not very comfortable to use." (P5)
- Cat D Level 4 Q3 "… It's more interesting being there and learning at the same time, like for example the things I've seen in pictures now I am seeing them in real life like for example there is a famous fountain in Italy it will be much more interesting to see and read about it at that time, like you're a tourist again. Like you're seeing the Lonely Planet at that time…" (P7)

- Cat D Level 4 Q10 "… it's like people walking around and looking just like zombies and not paying attention to anything or anyone you know like they're in this beautiful park and all they're doing is like looking at their phones. It just drives me crazy. And I realised that we were doing it, we'd be walking into this crowded area you know looking for the hidden one and I realised like we hadn't acknowledged a single person within that space." (P22)

The final level of category D is where the value and deeper reflections about the activity are expressed. This level can be very positive, participants describing connections with the topic, and personal interest and gain. But it can also capture expressions of doubt and criticality in terms of use of technology or engagement with the real world. These quotes are chosen to show this variation, as all quotes are reflecting deeply, sensing the relationships between their own reactions and the further implications of having experienced the activity. This level hints at additional further potential levels of sophistication, for example seeing experience as positive or negative awareness reactions, however it is sufficient here to note that deeper criticality is evident, and this in itself is perhaps a significant outcome for the participants' own awareness of what they have experienced.

6.3 Experiencing the System Elements of a smart learning journey

The system element analysis aimed to provide an alternate view on the data. Rather than focusing on quotes that might reflect meaning about the experience of the smart learning journey as a whole, the system element (SE) outcome spaces formed categories that had broadly delimited structure of awareness (SoA) perceptual boundaries (Bruce et al., 2004a, 2004b). System element boundaries are delimited by the element itself, defined by asking the question, "experiencing place as…", "experiencing knowledge as…, and so forth. The system elements perspective is discussed further in chapter five.

The categories derived from the most obvious and clear commonalities of experience variation, so aspects that show across multiple transcripts and also demonstrate the variety of experiences within those commonalities defined the categories. It was not sought to define these beyond a first level view of a possible SE structure of awareness, as these glimpses of other SE SoA's serve to show other perspectives are possible and potentially useful. The intention was not to drill down deeply into system element experience for two reasons: first, in a study this size you risk high levels of duplication, and second, that the main focus of the questions in the study are on relationships for learning and development for pedagogical understanding in the experience of a smart learning journey, not to analyse deeply the experience of place, knowledge, collaboration or technology within it. In view of this, the main body of findings for the System Element outcome spaces are included as an appendix (Appendix 04, "Experiencing System Elements of a Smart Learning Journey"), with summaries included here. Readers may also refer to Appendix 04, "10 key quotes for each SE category for how categories are demonstrated with further quotes.

6.3.1 Descriptive guidelines for system elements of a smart learning journey

'Descriptive Guidelines for System Elements of a Smart Learning Journey' were developed to support analysis as part of the analysis process, making notes to assist and delimit understanding of meaning according to the broad system elements (SE). These contributed some pragmatic aspects for consideration within relevance structures of a smart learning activity. Adopting an approach of interpreting the structure of awareness bound by its internal horizon focus and referential meaning and the outer edge awareness to define the perceptual boundary of the external horizon, I developed SE descriptive guidelines to define the emerging categories of variation of the separate system elements. This 'broad stroke' approach attempted a brief overview of what the system elements might uncover that might add to the primary outcome space. Descriptor guidelines were a way of summing up the general interpretation I had for where I placed an utterance, to define where it belonged, and what it was telling me. I did not attempt to look for deep complexity in the system elements, only to sketch what might emerge if analysis perspective were adjusted to be orientated towards the element specifically.

6.3.2 The Place system element

The 'Place' element enables thinking about aspects of being at locations, points of interest or the journey itself in ways slightly different to the 'Being There' experience variation as interpreted for the journey as a whole. Here the analysis statement is "experiencing place (in a smart learning journey) as….". It is therefore more possible to delimit the variations of the position place occupies in the awareness of the learner. There is clearly some duplication with the 'Being There' categories for the primary outcome space, yet still some additional light is shed on this element. Three categories in 'Place' were discovered.

Category: Being at the place

- Referential (Meaning): Being at the place, there in front of it, at that time, in the moment of being there
- Internal Horizon: Being in front of it, really there (physically)
- External Horizon: Living it, being part of it, it being real, realistic, bringing information to life

Category: Being outside

- Referential (Meaning): Outside, not in the classroom, out and about
- Internal Horizon: Seeing, hearing, being outside, walking
- External Horizon: The outside atmosphere, the mood and ambience, the difference of being outside, the weather

Category: A tour, a trip, a game

- Referential (Meaning): A tour, game, discovering, hunting
- Internal Horizon: Finding, guide or tour, scavenger hunt, treasure, game
- External Horizon: Sense of reward for going to stops, the progression, connection between stops, challenge, discovering, finding

6.3.3 The Knowledge system element

Looking at the 'Knowledge' element for how information is experienced, variation is reasonably clear to see: it is interesting, or it isn't, or there is just too much (even though this can be interesting or not interesting). Analysis of how information is viewed by the participant as a part of the whole SLJ means it is possible to separate that part from the other parts. This is especially useful when considering learning activities. Three categories in 'Knowledge':

Category: Of Interest

- Referential (Meaning): Relevant, useful, of interest
- Internal Horizon: Useful for coursework, of general interest, love the topic
- External Horizon: Sparks interest, researched before or after, triggers memories

Category: Not of Interest

- Referential (Meaning): pointless, not useful, dull, boring
- Internal Horizon: could Google it, could be a book, not my taste, didn't look

- External Horizon: not relevant, didn't know it was there, meant for someone else, not video

Category: Too Much

- Referential (Meaning): Too much reading, too much information
- Internal Horizon: Overwhelming, too much choice
- External Horizon: Too serious, too political, too much content, too complicated

6.3.4 The Collaboration system element

Though the categories of 'Collaboration' have significant overlap with the 'Discussing' category in the primary outcome space of experiencing the journey as a whole, 'Collaboration' enables a further drilling down of focus. Collaboration was how I chose to acknowledge the direct or indirect impact between people on the smart learning journey system element experiences. It could be argued that people form part of all aspects of the smart learning journey system, perhaps especially as interconnections. Rather than having 'people' per se, which would have been too broad an element, 'Collaboration' created a broad category, but with some focus on narrowing down the experiences between people. Emphasising that the system elements were an overview of what might be discovered about more delimited aspects of smart learning journeys, three categories were found. The three categories in 'Collaboration' were:

Category: Distracting

- Referential (Meaning): Too many people, annoying, bad moods, (demotivating)
- Internal Horizon: People compete for space, bad mood in friends, people not wanting to do it, others being in a rush
- External Horizon: Demotivation from others lack of interest, not being able to do what you'd like to, having to fit in with others

Category: Sharing

- Referential (Meaning): Helping each other, discussing, sharing tasks and opinions
- Internal Horizon: Sharing phones, tasks, working out the technology
- External Horizon: Group work, teamwork, negotiating, diverse opinions

Category: Social, engaged (sociable)

- Referential (Meaning): Friends, classmates, together, engagement, fun
- Internal Horizon: More fun and engaging, someone to chat to, enjoyable, feeling of doing it together
- External Horizon: Made it less serious, more motivating, keep each other going

6.3.5 The Technology system element

The Technology system element permitted a drilling down of the structure of awareness for 'Technology' in a smart learning journey. Technology topics nearly always emerged completely naturally in conversations but were not at the forefront of most participants minds. This was noted early in the study and helped me to understand how to discover 'meaning' in utterances for the journey as a whole, as oppose to seeing meaning in ways I (initially) expected to find it. This might be considered as an overt process of bracketing. Many comments about the experience of technology were about how augmented reality (AR) worked, and this caused both a sense of 'wow factor' as well as frustration when things didn't work. Other comments were about the potential of AR for interacting with the environment for civic as well as learning experiences for the young professionals in Education. The English Literature students did not talk so much about potential, so range of experience is likely impacted by subject area. This is reflected on later in 'Further scope for research' (chapter nine). Four categories in the 'Technology' system element emerged.

Category: Easy

- Referential (Meaning): Simple, easy to use, works
- Internal Horizon: Fast, normal, straightforward, works
- External Horizon: The normality of it

Category: Helper

- Referential (Meaning): Guide, helping, convenient
- Internal Horizon: Convenient, right there, personal assistant
- External Horizon: Providing content you would not know about, sparking ideas and interest

Category: Novel

- Referential (Meaning): Novel, new, futuristic
- Internal Horizon: Sci-fi, modern, new, different

- External Horizon: Expectations of new technologies, potentials

Category: Problematic

- Referential (Meaning): Not working, not good
- Internal Horizon: Not working, no wifi, no data, no battery
- External Horizon: Overwhelming, too complicated, difficult, tiring, obstructive, self conscious, tech zombies

Comments regarding technology in context of this study

The consideration of this study in the practical human computer interaction (HCI) aspects of technology are not what is being studied, though clearly may be an issue. I created a 'future-present' (Ireland & Johnson, 1995; Kitchin, 2019) version of real world AR interactivity that will likely become a much more streamlined set of technical interactions in the not too distant future with apps such as Google Lens[33], What3Words[34] and others perhaps integrated with a Virtual Learning Environment (VLE) and Application Programming Interface (API) connectivity. I discuss this further in chapter nine.

I draw attention here to a forthcoming paper in preparation (as of late 2021), 'Ways of Experiencing Technology in a Smart Learning Environment', an invited submission for the Human-Computer Interactions International 2022[35], following previous papers presented at 2020 and 2021. This paper reflects in greater depth on some of the possible implications from the technology system element findings. The findings themselves did not inform the development of the PECSL in direct ways as did not form significant meaning for commonality and variation of the journey as a whole.

6.4 Experience in Learner Generated Content

I chose to analyse the LGC of the smart learning journey activities in this study by re-imagining the primary outcome space experience complexity table and aligning it to equivalent Bloom's Revised (Anderson & Krathwohl, 2001) and SOLO (Biggs & Collis, 1982) taxonomies. By placing an equivalency of cognitive domain from Bloom's Revised with the levels of experience complexity, I was developing potential aspects of learning

[33] Google Lens https://lens.google.com
[34] What3Words https://what3words.com
[35] Human-Computer Interaction International Conference https://2022.hci.international/

‘measurement’, and this contributed to pedagogical understanding for smart learning. I noted that the Europeans Commission’s Digital Competence Framework for Citizens, known as ‘DigComp 2.1’ (Carretero, Vuorikari & Punie, 2017) positions Bloom’s Revised grading in relation to levels of digital literacies and ‘soft’ transversal skills (UNESCO, 2018). This appeared to have some relevance to experience complexity, and demonstrated how to utilise the Bloom’s Revised taxonomy in relation to other aspects of competence complexity.

Eleven sets of content were analysed, using the process and rubric system outlined in chapter five. I assigned each set of LGC (this being either individual or group) a ‘grade’ that included the rubric of experience complexity, and separately noting Bloom’s Revised and SOLO relevant levels (see also Tables 10 and 11 in chapter 5). Summarised results are:

Participant	Experience rubric + (Bloom’s, SOLO)
P1	A4 C4 D4 (6/4,5)
P3	A3 C3 D3 D4 (4/5, 4)
P4	A4 B3 C4 D4 (5/5)
P5	A4C4D4 (6/4,5)
P7	A3 C3 C4 D4 (4,5/4)
P9	A2 B3 C2 D3 (3,4/4)
P11	A4 C4 D4 (5/5)
P12	A2 C2 D2 (2/3)
P16, 19, 20	A1 B3 B4 D4 (5/4)
P17	A1 C3 D2 (2/2)
P21, 22, 23	B4 C4 D4 (6/5)

Table 12 LGC assigned experience complexity levels, with Bloom's and SOLO grading equivalence

Noting that codes used to indicate participant LGC assessment in the above rubric (Table 12) used abbreviations of the primary outcome space experience complexity CoD’s and levels (previously described in more detail in chapter five), in conjunction with Bloom’s Revised and SOLO taxonomies. These indicate how learner experience can be recognised in variation and complexity for LGC images and text, in relation to cognitive domain indicators. While no conclusions are drawn from this exercise, a variety of aspects are of note:

- Reflecting on possible experience variation within individuals is of interest when considering learning effectiveness;
- That undergraduate participants can exhibit deeper complexity than postgraduates (the two participants who are assigned level 2 of Bloom's are both postgraduates);
- This system is an early version of what might be possible using this type of approach to estimate levels of experience variation and learning equivalency present in LGC, both qualitatively and quantitatively.

Quantification of experience variation complexity as a measurement of learning may offer mechanisms to apply experience variation via machine learning techniques. If an approach to analysis perspective is adopted that reflects relevant experience variation of an activity, it may offer potential for how to analyse learning effectiveness in LGC using data variables derived from collective experience variation rather than personal learning ontology data. This is discussed further in chapter eight.

Examples of LGC are provided below, with potential assigned CoD, as general indicators of how this analysis exercise was approached.

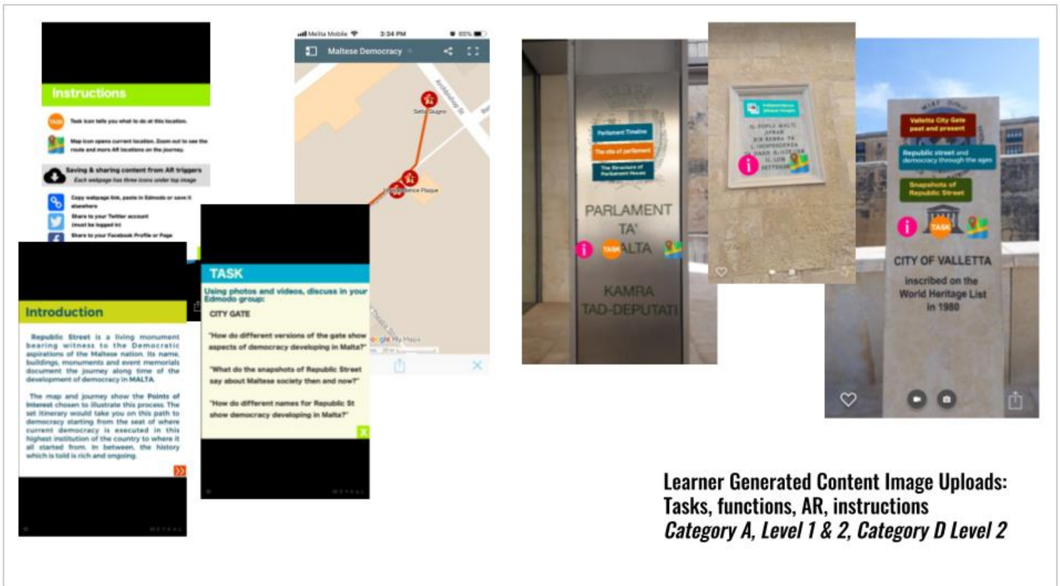

Figure 13 LGC Images reflecting Category A, Level 1 & 2, Category D, Level 2

Figure 13 shows Category A, Tasks and Obligations, Levels 1 and 2 is strongly evident, as questions, instructions and maps are shown. Category D is also present at Level 2, as photos of the AR triggers on the PoI are created.

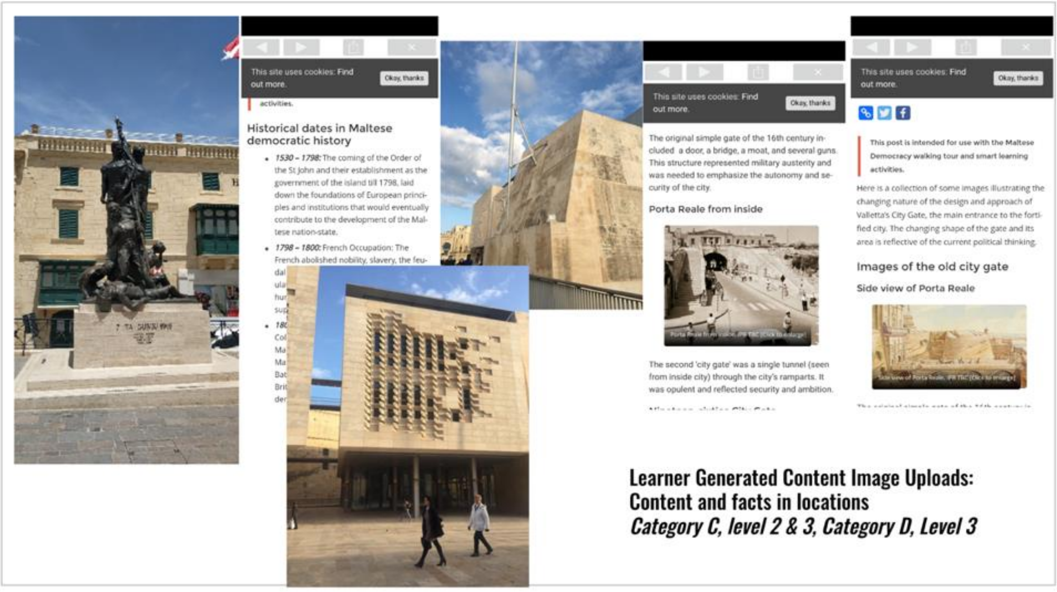

Figure 14 LGC Images reflecting Category C, Level 2 & 3, Category D, Level 3

Figure 14 shows Category C, level 2 and 3, demonstrating the actual points of interest specific locations with some detail, then also Category D, level three because information and knowledge is being shown, specifically relating to location.

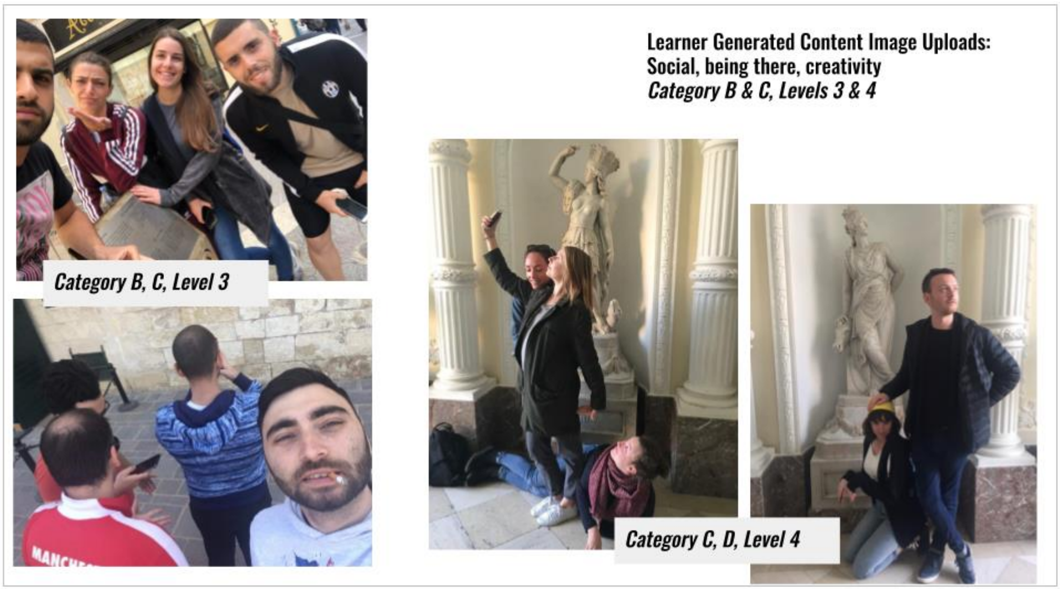

Figure 15 LGC Images reflecting Category B and C, Levels 3 & 4, then Category D, Level 4

Figure 15 shows the most sophisticated experience complexity seen in the LGC. On the left very sociable sharing images that show at least a level three of Category B and Category C because 'being there' and being present is strongly evident in the images. The two images on the right demonstrate moving up into level four quite strongly, with very creative approaches to engaging with knowledge and place as value. Being there in the place and then the knowledge and place in terms of creative reflections and ideas bring about a level four of experience complexity levels for Category C and D. These concepts are discussed further in chapter 8, in 'Experience complexity as data variables', followed by a brief critical examination in 'Implications of machine learning'.

6.5 Summary, chapter six

Writing chapter six provided me with another opportunity to reflect on the outcome spaces and how quotes indicated commonality to form categories and variations of complexity. I felt the system I developed to analyse the LGC, by applying the primary outcome space table of experience complexity was a practical and interesting solution that overcame the challenge of bracketing my assumptions in assessing the content. It experimented with possible ways of measuring learning effectiveness through applying experience complexity variables alongside learning taxonomy equivalences.

Though system element outcome spaces offered further opportunity for consideration in 'drilling down' for aspects of a SLJ, in practical terms they were already present when applying the primary outcome space findings to pedagogical practice conceptualisations. I considered them as supporting evidence rather than direct input. As previously noted, an invited submission for the Human Computer Interactions International 2022 conference[36] discusses the system element of technology findings as a separate debate outside of this thesis.

In chapter seven I outline the Pedagogy of Experience Complexity, a four-tier model of pedagogical considerations that emerged through the application of these findings.

[36] Please refer to footnote 35

7 PEDAGOGY IN EXPERIENCE COMPLEXITY

This chapter describes a four-tier model, the Pedagogy of Experience Complexity for Smart Learning (PECSL), arising from the data findings of this study. These are the four layers of pedagogical considerations for smart learning journey activities. I outline each layer, and the relationships between them. The four tiers are:

- Tier 1: The experience complexity relevance structure: derived from the experience CoD of the study
- Tier 2: Related pedagogies: arising from the experience complexity relevance structure
- Tier 3: Pedagogical relevance structure: arising from the related pedagogies and their contexts
- Tier 4: Epistemological context: the context of the previous tiers of consideration

7.1 Pedagogy and structures of relevance

I begin with initial reflections on the significance of 'relevance structures' for smart learning activities (Marton & Booth, 1997, Chapter 7; Schutz & Luckmann, 1974), proceeding with planning for experience complexity. Following this I then describe Tier 1, experience complexity as relevance structures derived from the CoD of the primary outcome space. I then discuss Tier 2, related pedagogies followed by Tier 3, pedagogical relevance structures arising from related pedagogies and experience complexity. Finally, Tier 4 is the epistemological context of these three layers that forms the fourth theoretical foundations layer. Concluding sections of the chapter are a summarised view of the PECSL overall, followed by a brief outline for design and measurement of smart learning using the PECSL.

7.1.1 The nature of a structure of relevance

A structure of relevance, or relevance structure, is how a person may interpret the meaningfulness of something, in relation to surrounding context. Usher (1989), citing Schutz & Luckmann (1974) explains "… the definition of meaningful is sometimes the semantic sense of meaning. At other times it means 'being significant,' related to one's 'structure of relevance'…" (Usher, 1989, p. 26). According to Marton & Booth (1997, pp. 141, 142) a relevance structure is how a learner may interpret relevance of a single activity within more 'global aspects of learning' and hidden curriculum contexts. They use the term 'hidden curriculum' as being a reflection of the layered structure of society, and finding out one's position in it (p. 140). They describe 'global aspects of learning' as "different constituent thematic fields that surround the theme of awareness, the very situation the learner is a part of provides the immediate context for learning. The sorts of task being presented; the nature of the stuff being learned; the expectations of students, peers, and teachers; forms of assessment and future pathways - all of these are aspects of this layer of global concern…" (pp. 141, 142).

Schutz & Luckmann (1974, Chapter 3) discuss 'knowledge and the life-world', describing thematic, interpretational and motivational relevance. Their opening passage of this chapter provides more understanding:

> *"A distinction can be made in the life-world between what were characterized by Husserl in another connection as the attitudes of 'living-in-the-relevances' (whereby the relevances them selves do not come into grasp of the consciousness) and the reflecting (although not necessarily 'theoretical') 'looking-to-the-relevances'".*
>
> The authors add a footnote:
>
> *"This distinction is between the lived experience of the relevances and reflection on the relevances. Husserl's contention was that such reflection did not distort that which was reflected on." (Shutz & Luckmann, 1974, p. 182)*

A relevance structure of and for learning can be thought of as "the persons experience of what the situation calls for, what it demands. It is a sense of aim of direction in relation to which different aspects of the situation appear more or less relevant", (Marton & Booth, 1997, p. 143). Motivational relevance factors like personal interest, 'added value' such as fun and sociableness, the extrinsic value of assessment and possible gain in qualification metrics, and the 'background' context of how things fit into the wider context of study, if this is applicable. Dron (2018) notes that instrinsic and extrinsic motivation become highly significant in considering autonomous learning activities - after all, why should someone participate in an activity if it doesn't have any relevance to them?

7.1.2 The significance of relevance structures for smart learning activities

I had noted that pedagogical approaches, learning and instructional design may be impacted by how the activity is *situated*. By this I mean how it might be introduced to participants, how it is placed within their wider study, or if the activity is not part of more formal learning, how it is 'pitched' to them, in terms of value and worth. Considerations of the immediate focus of the activity, the surroundings, motivational factors and relevance to future learning, work, practice or life experience might all play a part in approach and design of activity.

I first came to recognise the importance of relevance structures through classroom sessions I had taken with University of Malta education students who had participated in the smart learning journey in Valletta as part of their studies, but had not taken part in the research. Further discussion of these students' anecdotal classroom reflections is included in chapter eight (and in more depth in Lister, 2022).

7.1.3 Planning for experience complexity

I reflected on the challenge of how to apply experience complexity categories of description findings to support pedagogical understanding for smart learning journey activities. These were the real world scenarios of pedagogical practice that could potentially benefit from further understanding from the variation and complexity of experience in participation of a smart learning journey. The question was in how to apply the findings to real-world scenarios in meaningful ways taking into account these kinds of experience variations.

Much phenomenographic literature poses these kinds of questions, with various topics and purposes in mind. Bowden's (2000) developmental phenomenography orientates explicitly towards applying "the findings to affect the world I live and work in" and that "(t)he research findings are not the objective per se", (Bowden, 2000, p. 3). In this study the purpose of gathering interview data from participants and then analysing with a focal awareness approach was to build potential pedagogical understanding, aiming to support guidelines and design approaches for similar smart learning activities.

Sandberg's 2000 phenomenographic study into human competences at work notes that "seeing changing conceptions of work as the most fundamental form of developing competence has major implications for designing and conducting training and development activities" (2000, pp. 22-23). This clearly acknowledged that insight of variation of experience gained from phenomenographic investigation into experiencing a phenomenon can (and potentially should) be applied to a real world scenario, in Sandberg's case 'training and development activities'. Jones &Asensio (2001) likewise made similar assertions, remarking on "phenomenographic emphasis on variation could […] provide useful information that could inform the design of networked learning environments […] by revealing variations in students' approaches and understandings can help evaluate the suitability of a relational approach to design" (p. 320). More recently, the study by Rocha-Pinto, Jardim, Broman, Guimarães & Trevia (2019) considered how the "phenomenographic outcome space may become a catalyst of a theorization about practices, which is capable to modify them or modify the way they are understood", within a context of organisational studies. Sandberg and D'Alba (2009) assert that an increasing number of social science researchers are turning towards practice, including in education (p. 1349). Space here does not permit more thorough examination of ideas about learning and practice theory, however, it can be said that learning and pedagogical 'systems' can be argued as practice theory related (e.g in Schatzki, 2017; Grootenboer, Edwards-Groves & Choy, 2017). In light of this, consideration of ways to apply the findings of this study to practice might contribute valuable input towards developing a flexible pedagogical guide or framework for smart learning.

It was clearly not viable to apply findings in directly statistical ways, as I had for example not 'tested' participants and compared outcomes. Findings were interpretive, and had depended to a significant extent on the specific activities being investigated. However, I became aware that the primary outcome space experience category descriptions and levels of complexity could be interpreted in pedagogical ways as 'experience relevance structures', by thinking about *planning* for these kinds of experience variations. Placing myself in the role of the tutor/facilitator, I considered how experience variation - the categories of description, and the potential levels of complexity in each - could inform design of activities from pedagogical perspectives. It is important to state that I could not (and did not intend) to attempt to make a definitive theory or pedagogical framework of step-by-step guidelines. But the possibility of developing a broad scope and approach might be determined in a similar way to that of how user experience evaluation findings contribute to user-centred design (UCD), for thinking and planning in a digital media design and development cycle. This is reflected in UCD texts such as Garrett (2010), Saffer (2010) and others. In this way, those wishing to apply my pedagogical conceptions to their own activities, relevant to how applicable they felt my findings, might draw some inferences and subsequent interpretations for their own activities.

I considered the primary outcome space in contexts of pedagogical interpretation, as it was a broad set of categories, and potentially therefore flexible and versatile. This led to developing ideas around each category of description: Tasks and Obligations, Discussing, Being There and Knowledge & Place as Value, in terms of the most practical pedagogical approaches that might support planning for these kinds of experiences in smart learning journeys. Early in the process of understanding how to match a 'good fit' pedagogy to a category of variation, I referred to the primary outcome space descriptive guidelines and developed the idea of 'activity plans' to scope how one might think of planning for each category of experience. I anticipated that categories did not work independently but were rather overlapping and somewhat inclusive of each other, nevertheless it was useful to deal with each as separate. This permitted multiple combinations in varying ways, wholly dependent on the type of activity being designed by any future tutor/facilitator. I expand in a further publication on this kind of application using several pragmatic real-world examples (Lister, 2021d). Again this adopted the approach of UCD, that the 'thinking and planning' model was iterative and stages were interchangeable in order and significance, not a step-by-step instructional guide that was followed in a 'waterfall' project management manner (e.g. Sharp, Preece & Rogers, 2019, pp. 474, 479).

The alignment of smart learning experience complexity with interpretations of surface to deep learning and cognitive domain taxonomies (Bloom's Revised and SOLO) offered potential for scoping and planning activities according to what might be emphasised in the specific activity. In terms of implications for measurement of learning (or learning effectiveness), the pedagogical model derived from the insight gained from the study sought to offer a conceptual foundation for designing assessment rubrics with learning aims or goals, somewhat in the same way utilised in the DigComp 2.1. Again this rubric design would be wholly dependent on the type of activity being designed by the tutor/facilitator. By planning for (anticipated) experience complexity an activity is contextualised by the related pedagogies employed in the pedagogical design. Therefore, levels and types of learning could be supported from the perspective of related learning goals, and potentially assessed accordingly. These concepts are expanded further in Lister, 2021c, 2021d, and a forthcoming publication in preparation, 'Measuring learning that is hard to measure: using the PECSL model to assess implicit learning'.

The system element (SE) outcome spaces did not inform the development of the pedagogical ideas in direct ways. Many of the aspects that were present in the SE outcome spaces duplicated in similar ways what could already be seen as evident in the primary outcome space. It is arguable that the key role of system element perspective analysis was only to demonstrate an alternate perspective, and in this it was useful. In hindsight the SE outcome spaces acted to support confidence in the primary outcome space as a broad and flexible way to interpret meaning in a structure of awareness that could then be applied to inform a pedagogical interpretation. However, some insights from the SE analysis are of additional interest, for example my previously mentioned forthcoming paper reflecting on 'Ways of Experiencing Technology in a Smart Learning Environment'. Whilst this was not within the remit of this study, nevertheless it provides findings worthy of further discussion outside of this thesis.

Tier one of the PECSL pedagogical model brings pedagogical thinking into experience variation and complexity by interpreting the core attributes of the primary outcome space descriptive guidelines analysis notes as aspects of an 'experience relevance structure'. This led to scoping factors of activity plans for each category of description, thereby planning for types of experience. In turn, this permitted related pedagogical approaches to form a potentially 'good fit' pragmatic pedagogical foundation on which to design activities.

7.2 Tier 1 – The experience complexity relevance structure

The first tier of the PECSL is the experience complexity relevance structure.

The descriptive guidelines that emerged for understanding the structure of awareness in participant experience variation shed light on how to interpret and plan for smart learning activities, connecting in practical ways to pedagogical considerations. The 'Descriptive Guidelines for Experience Complexity of a Smart Learning Journey' form the experience relevance structure for a smart learning journey, with the 'Descriptive Guidelines for Experiencing the System Elements of a Smart Learning Journey' referred to in discussion where relevant. For full detail of the guidelines refer to Appendix 03, Table G and H. I summarise the experience relevance structures using the following diagrams (see Figure 16, 17, 18, 19, 20), these being most effective in communicating these concepts.

7.2.1 Diagrams of experience relevance structures showing related pedagogy

Diagrams presented here show each category of description for experiencing the journey as a whole, with experience complexity descriptive guidelines forming a summary of relevance structure with related pedagogy that may usefully be associated with the category. Circles shown are used as visual representations of the SoA, for the smallest (centre) inner focus of awareness, the meaning and its internal horizon, expanding to the largest (outer) external horizon forming perceptual boundary. These assist in conceptualising the journey as four inter-related segments of a whole for levels of experience variation and related pedagogy.

The first diagram is an overview for all CoD (Figure 16), using a visualisation of a 'full' structure of awareness, and the interrelated categories of description, with a summary of their descriptions. The diagram implies that the close focus of awareness may have aspects of all categories at play, extending out, depending on relevance to the learner.

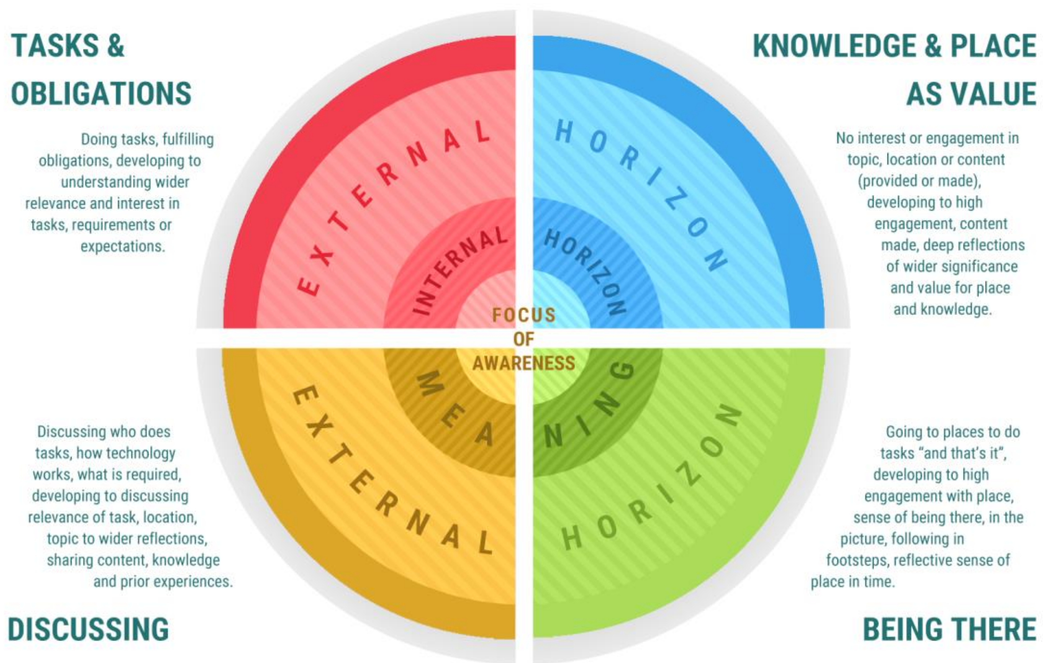

Figure 16 Visualisation of the primary outcome space structure of awareness for a SLJ describing summarised categories of description and experience complexity

The following four diagrams are for each CoD shown separately (Figure 17, 18, 19, 20). Each of these shows the relevance structure summary from the analysis descriptive guidelines, the related pedagogical approaches deriving from the category of experience, and the addition of a brief ‘activity plan’ to support applied pragmatic thinking for the CoD in relation to any learning design. Each category is further indicated by its designated colour in the wheel of the structure of awareness experience complexity for smart learning.

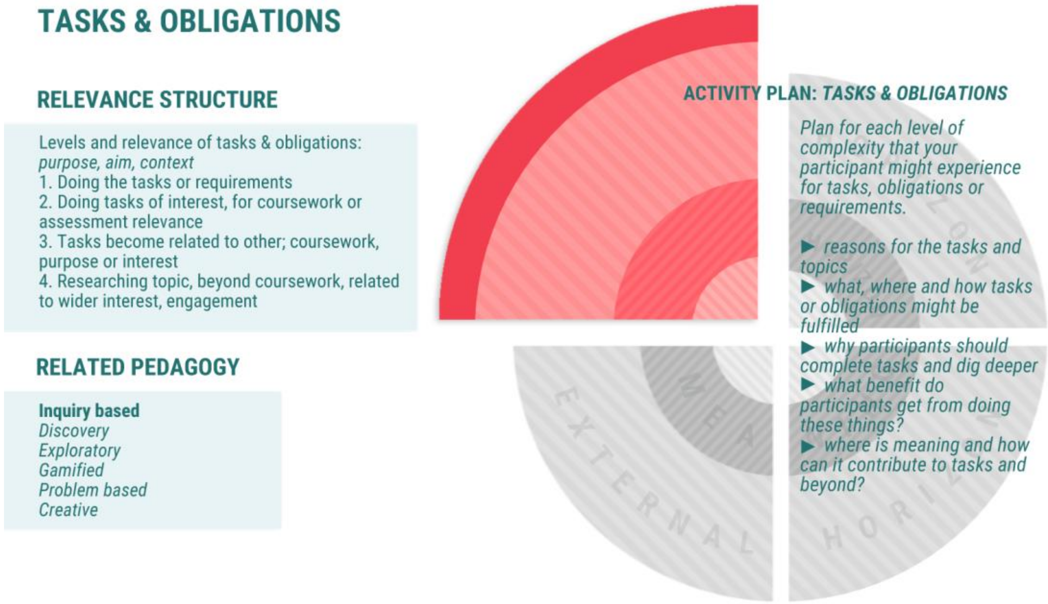

Figure 17 The category of description 'Tasks & Obligations', with experience relevance structure and related pedagogy

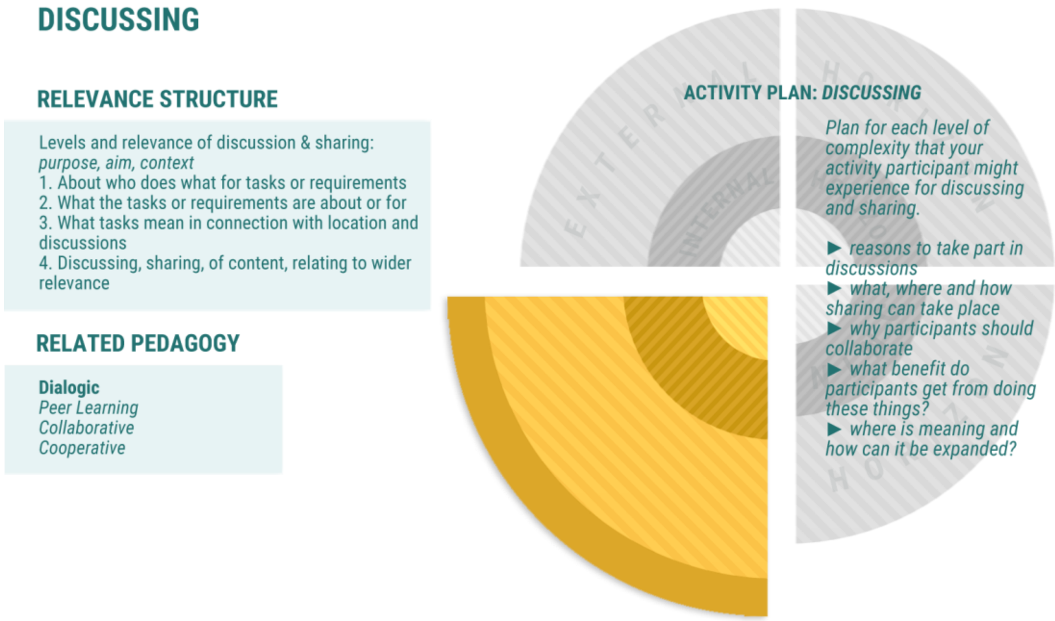

Figure 18 The category of description 'Discussing', with experience relevance structure and related pedagogy

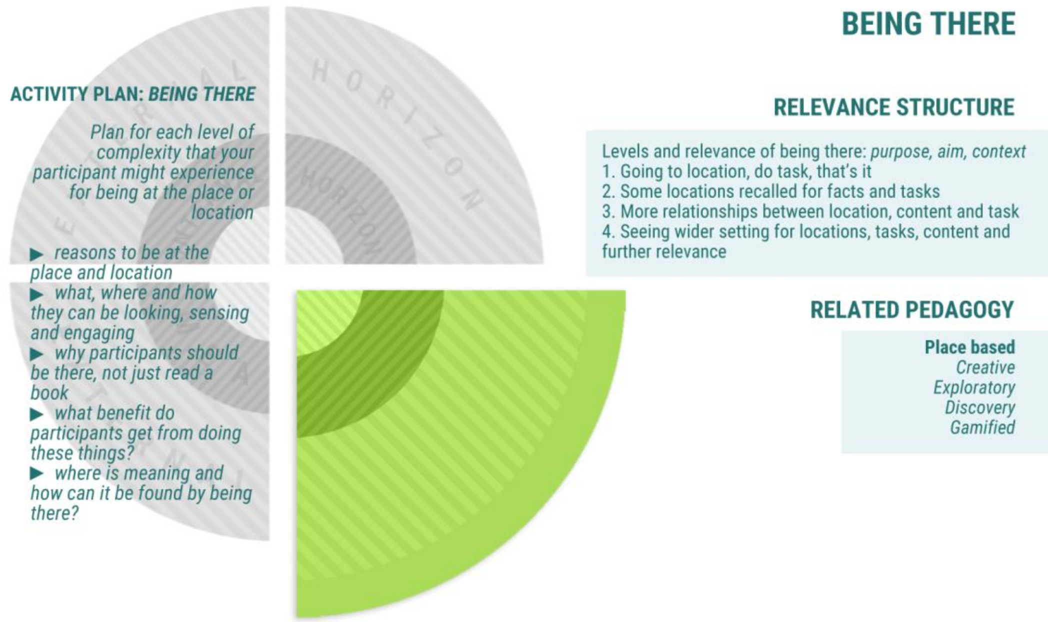

Figure 19 The category of description 'Being There', with experience relevance structure and related pedagogy

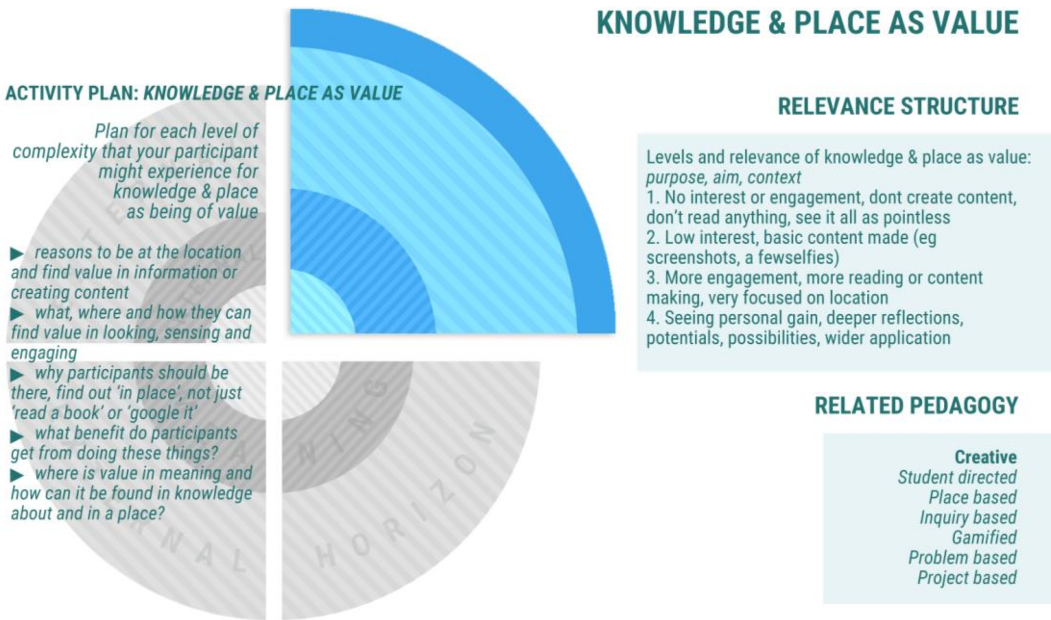

Figure 20 The category of description 'Knowledge & Place as Value', with experience relevance structure and related pedagogy

These diagrams indicate how experience complexity becomes relevance structure, and context of pedagogical approaches and considerations that become apparent. Each participant learner may perceive some or all of these complexities in varying amounts, depending on their own perceptions of what is significant for them. Accommodating this kind of experience variation in learning design can support levels and types of engagement and therefore potentially encourage deeper learning.

7.3 Tier 2 – The related pedagogies

The second tier of the PECSL is the related pedagogies arising from the experience complexity relevance structure.

The related pedagogies outlined here might be described as key pedagogical orientations arising from the experience relevance structure. After reflecting on pedagogically orientated behaviours or interactions (for example in Bonanno, 2005, 2010, 2011) that had arisen from the early outcome space findings (Lister, 2021a), aspects such as participation, creativity, collaboration, autonomy, motivation and engagement were all noted as having potential pedagogical value. I now discuss four main related pedagogies considered most relevant, and how they might be applied to support and enhance the experience complexity relevance structures. I cover each in separate sections for each related CoD, though pedagogies are interrelated, as parts of the whole.

7.3.1 Inquiry-based learning

Inquiry-based learning is used here as an umbrella term for focusing on inquiry and research based learning, encompassing student-directed inquiry, guided inquiry, discovery or exploratory learning (Suárez, Specht, Prinsen, Kalz & Ternier, 2018; Spronken-Smith, 2012). Current literature supports concepts of utilising inquiry-based learning in conjunction with mobile, location-based and augmented reality learning activities (Suárez et al., 2018; Chiang, Yang & Hwang, 2014). Inquiry learning encourages engagement and higher motivation (Suárez et al., 2018; Chiang et al., 2014), suggesting strong relevance for this category of experience complexity in the context of connectivist autonomous learning.

Inquiry-based learning is therefore considered a key pedagogical approach for ‘Tasks and Obligations’ and the relevance structure that arises from this category of description. The deepest learning and engagement is apparent in the experience complexity shown by those who researched or wanted to research beforehand, or after they had participated in an activity, or used search engines to find things out while they were at locations. This leads to the emergence of inquiry-based learning as a basis to support participation and deeper engagement. Tasks in a context of the SLJ as a whole are seen as things to be done, achieved, fulfilled or completed. Tasks can be associated with reward, therefore aim and purpose of the SLJ need to be fully clarified, acknowledging different levels of understanding and experience present in each participant. Obligations (what is required, needs to be achieved, perceived expectations) occupy a similar role to 'tasks' but may not be so explicitly stated. Tasks are mentioned in transcripts from the most basic 'we did the tasks', to tasks being viewed as part of a wider relevance to knowledge and personal reflection significance of the topic or similar related topics.

Inquiry-based learning can be defined as "carefully designed research activities for learners. The core idea here is that the activities involved in such research processes must be based on formulating and asking questions that will require critical thinking" (Seel, 2012, p. 1571). These strategies can suit SLJ activity approaches by setting challenges, puzzles, quests, discovery trails, potentially also using gamified learning to increase levels of engagement and motivation (Özhan & Kocadere, 2020). In more complex learning, setting problems that are multilayered and perhaps involving different kinds of skill and expertise, for example different subject area groups of learners or participants from interdisciplinary backgrounds, can foster other aspects of participant experience complexity by enhancing the need to collaborate, or visit specific places at specific times. This supports expanding the experience complexity and increases the possibility of deeper learning (Marton & Booth, 1997, pp. 168-170) to occur, rather than 'doing the tasks' which is surface learning in nature, similar to the 'arrangement' of Hounsell (2005), the 'act of learning' rather than object of learning (Marton & Booth, 1997, pp. 169, 171), discussed further in chapter eight.

Inquiry based learning is interrelated with creative learning and dialogic or peer learning.

7.3.2 Dialogic learning

'Dialogic learning' is used here as an umbrella term for various methods and approaches that place dialogue at the forefront of the learning process. Dialogic learning enhances critical thinking "to promote the students' active learning and higher-order thinking skills (Hajhosseiny, 2012). Wegerif defines thinking as "not referring to the whole area of cognition as defined by psychology but the more limited area (of) 'higher order thinking' … characterised by creativity and complexity…", (Wegerif, 2016).

Wegerif (2013, pp. 59-60) argues that dialogic learning supports creativity, using an example of differing perceptions of the hexagon/cube diagram (similar to the Necker cube in Richardson, 1999, p. 60, citing Prosser, 1993), additionally referred to by Sandberg (2005, p. 41) when describing the role of subject in constituting meaning. Wegerif demonstrates that a dialogue where both parties are invested in resolving perceptual differences results in both parties learning, a co-constituted meaning and expanded understanding. He argues that this differs from Vygotsky's Zone of Proximal Development (Wegerif, 2013, p. 59), where emphasis is on monologue, not dialogue. The essence of dialogic learning as Wegerif sees it is in teaching and modelling creative thinking, to listen with respect, remain patiently with pauses and breakdowns in the conversation, and genuinely respond with interest to emerging ideas. This imparts value to a learner's vision, and at the same time understanding different ways of seeing things that others may have (Wegerif, 2013, p. 61). Dialogic learning seeks to use dialogue to discover and develop knowledge, encouraging learners to learn from each other as much as from experts, and beyond set texts or other prescribed content (Wegerif, 2013, p. 121, Wegerif & Yang, 2011, Ravenscroft, 2011). This would appear to support connectivist principles of learning.

Dialogic learning approaches are therefore useful to consider for 'Discussing' and the relevance structure that arises from this category of description. In more complex 'discussing' experience variation it was evident that learners talked more, discussed prior knowledge and past experiences, relevant comparisons, or other aspects they thought pertinent to their co-learners. Those that participated alone remarked that this would have benefited their learning. Though it is important to also acknowledge that some participants viewed people (either passers-by or co-learners) as potentially distracting or demotivating, the predominant perception was that 'some' people or friends participating together enhanced the learning experience. Therefore this implies that guided dialogic pedagogy may be beneficial to providing and supporting deeper levels of learning and engagement.

Using concepts of expanding the dialogic space to encourage learners in how they think and express ideas, who they are addressing and how to expand ideas to encompass wider reflection and relevance (Wegerif, & Yang, 2011) are techniques relevant to dialogic interactions in a SLJ (e.g. in Lister, 2017) for the experience variation indicated in the Discussing category of description. These can either be face-to-face or mediated by various suitable technologies - perhaps sometimes technologies being selected by learners themselves outside of any that might be an official part of the activity (for example WhatsApp or Facebook groups). Cutajar studied higher education academics use of technology in their practice, of them “fostering a community of learners participating and convening dialogic learning” (Cutajar, 2019, p. 5), where “the focus is on dialogic learning “pushing” the students “to go beyond the basic”, encouraging debate among students, cheering them to “argue” and “fight” with each other for learning” (Cutajar, 2019, p. 7). Learners learn from each other, as well as any expert guidance, similar to peer learning or cooperative learning.

Collaborative learning

Collaborative learning is closely related to dialogic learning, and to the ‘Collaboration’ system element experiences of participants in this study. Collaborative or cooperative learning may be used interchangeably (Topping, Buchs, Duran, & Van Keer, 2017, p. 5). Ryberg et al. (2012) cite McConnell (2002) distinguishing them as “whether the work on the task or problem and the outcome is shared (collaborative)” or “whether individuals engage in discussions with others about their reflections on individual assignments (cooperation)”, (Ryberg et al., 2012, p. 46). They also observe that “connectivism seems to emphasise and value the autonomy of the learners and cooperative (networked) interdependencies over more strongly tied, collaborative dependencies” (2012, p. 51). This indicates that type of approach taken depends on the type of smart learning activity that is being planned for.

Peer learning

Peer learning is a term for dialogic learning approaches to activities where learning between co-learners is emphasised, and may be particularly relevant in some SLJ activities. Peer learning, “allows a positive use of differences between pupils, turning them into learning opportunities” (Topping et al., 2017, foreword). Distinguishing between cooperative and collaborative approaches as “(c)ooperative learning constitutes a generally more structured setting (…) while more freedom is usually given to students who can use open strategies in collaborative learning”, (Topping et al., 2017, p. 6). They emphasise cooperation as an important learning strategy, as “(c)ooperation develops skills and attitudes needed for a democratic society. Teamwork allows playing with skills and attitudes in real-life situations, and favours interpersonal and cognitive skills useful to the argumentation of ideas, attentive listening to others’ points of views, resolution of conflicts through negotiation and assumption of shared agreements” (Topping et al., 2017, p. 8). Further, they argue that “cooperative learning is essential to meet the four crucial challenges in the twenty-first century” of rapidly increasing global interdependence, increasing number of democracies throughout the world, need for creative entrepreneurs and growing importance of interpersonal relationships (Johnson & Johnson, 2014, in Topping et al., 2017, p. 9). These more ‘covert’ learning agendas are discussed further in chapter eight, both in additional pedagogical context and then in supporting frameworks such as the DigComp 2.1 (Carretero et al., 2017) to develop citizen skills and literacies in an increasingly digitised world.

7.3.3 Place-based learning

Place-based learning (Ferguson et al., 2019, p. 33) is used here as an umbrella term to indicate learning in context-aware scenarios in real world locations. These might also be referred to interchangeably as place-based education (Getting Smart, 2017), geo-learning (Sharples et al., 2013, p. 26; Sharples et al., 2015, pp. 9, 21) or location-based learning (Chiang et al., 2014; Brown, 2010).

Considering the experience complexity variation of ‘Being There’, place orientated learning is suited to supporting activities that emphasise the learner in their environment in geo-spatial contexts. This broad set of pedagogical ideas can encourage interaction and immersion with the physical surroundings to support meaning making (e.g. Sacré, de Droogh, De Wilde, & De Visscher, 2017, p. 39). Place can be experienced in various ways, internally and with the physical surroundings of the learner, and may represent different things concurrently to them as individuals and as a group. Participants talked about personal memories, similar past experiences, bringing history to life, being ‘in the picture’, making it ‘real’, living the history or deep reflections about time as a separator of people at ‘the exact same place’.

Place-based learning (PBL) is defined as recognising that “people exist in a cultural context and that acting on that context can change the person, the situation and the relationship people have with that context”, (MacGregor, 2018, p. 205). PBL encapsulates what smart learning journey activities are really ‘about’, attempting to foster deeper reflection in topics relevant to specific locations in the mind of the learner via different methods of engagement. While technology may be used to mediate some interactions (for example accessing context aware content or community portal content upload areas), it is also important to consider the impact of other people, both as co-learners and as ‘passers by’ that impact the participant experience of place as an ambient learning environment. Smart learning journey activities are best thought about as real world face-to-face experiences with some technologically mediated interactions, borne out by collective experience variation not placing over emphasis on technology.

Interrelated with creative learning such as writing in place or research orientated student as producer (discussed in the next section), and with aforementioned inquiry-based learning (Chiang et al., 2014), emphasis on place asks learners to discover, reverse-engineer, reconstruct, problem solve, imagine, co-create and interact in other creative ways with their immediate surroundings. For example, Taylor (2017) describes students using a location based app for mapping habitats and pathways, where "(a)t each location …students capture digital images and compose ecology-themed considerations or challenges for local policymakers and conservation advocates" (Taylor, 2017, p. 3). Noting "the leading mode of engagement for learners was physical and technological mobility through the city" (p. 3), she remarks "(l)ittle work has yet considered the digital literacies bound up in understanding … place-based inscriptions with location-aware tools … and how young users might use their bodies as a resource… Location-based technologies foreground the relationship bodies-in-place have to reading and writing at the scale of the city", (Taylor, 2017, p. 8).

A useful example of levels of engagement with place is found in Simeone, Sikora, & Halperin (2017), with the 'ARC[37] Place-based Learning Rubric' in 'Table 19.4 Formative Assessment Rubrics' (Simeone et al., 2017, p. 285), showing 'observe', 'judge' and 'act' factors for 'novice', 'associate' and 'master' levels of proficiency. These kinds of ideas could be re-imagined appropriately for different kinds of activities depending on topic, age group or purpose.

Additional considerations of place are being outside and the sensation of games, adventures and tours. These experience variations tell us how learners interpret the impact of being there, and can further help to design activity interactions. Further consideration is given to complex learning environments later in this chapter. Pedagogies of place are further reflected on in chapter eight.

7.3.4 Creative learning

Creative learning encompasses pedagogical approaches that incorporate creativity into learning. Here I especially refer to interacting with surroundings for (finding, making) value in knowledge and place to support deeper engagement and reflection. Participants described doing research beforehand so that they knew what the activity was about (P11, P1), of integrating imagination with content (P5), the potential for engaging citizens in their local

[37] Action Research Center (ARC) at Illinois Wesleyan University (IWU), https://www.iwu.edu/action/

environment (in their own practice) (P20, P21, P23), deeper reflections of process of learning for multiple perspectives or reactions, and of the wow factor of the technology increasing the sense of discovery about place. These self-reported experiences provide glimpses into the minds of the learners for how they interpret the value of the activity for knowledge and place and creative pedagogy may be a useful approach for eliciting these kinds of experiences in other learners.

"Creative pedagogy" is defined as "the science and art of creative teaching" (Aleinikov 1989, 2013), however this may not account for the two way (learner-teacher) process and practice of using creative means to develop understanding of self, others and surroundings for more successful learning. Further definitions found in literature shed more light: Lin (2011) proposes "practice that enhances creative development through three interrelated elements - creative teaching, teaching for creativity, and creative learning", (2011, p. 151). Cremin (2015), citing Davies et al. (2013, p. 88), notes that conditions to enhance creativity include significance of flexibility in the physical and pedagogical environment, diverse resources and working beyond the classroom, such as outdoors and in museums (Cremin, 2015, p. 2). This latter description closely reflects the experience of participating in a smart learning activity.

Two approaches are indicated below to illustrate how creative learning might support SLJ activities for deeper engagement.

Writing in place

The writing in place creative approach supports a place-based integrated pedagogy. Writing in place is a fairly established approach (e.g. Sacré, et al., 2017, Jordon, 2015) to creative writing that has been variously employed in recent years with some technological mediation. Ambient literature[38] is a technique to form narrative across real locations in space and time, for example Twitter stories such as "Some contemporary characters" and "Black box" provide "new ways of understanding craft as a synthesis of readers' affect and participation in an unfolding narrative" (Koehler 2013, p. 387). This is similar to how Wood Street Walls[39] and a Paper Hunt in Tokyo[40] have used the What3Words[41] geo-location tagging app more recently to create discovery narratives with words, images and street art. Coverley's 'Pyschogeography' (2006) traces historic as well as current experience of place as literature. Opening with a quote from MacFarlane's A Road of One's Own, also cited in Jordon (2015),

[38] Bath Spa Ambient Literature project https://www.bathspa.ac.uk/projects/ambient-literature/
[39] Wood Street Walls YouTube video (2018) https://youtu.be/O-lhbhfibDI
[40] Paper Hunt Tokyo, 2017. https://what3words.com/news/general/3-word-address-paper-hunt-around-tokyo/
[41] What3Words see footnote 34

to illustrate the impact of visual urban landscapes: "(c)atch the textual run-off of the streets; the graffiti, the branded litter, the snatches of conversation. Cut for sign. Log the data-stream. Be alert to happenstance of metaphors, watch for visual rhymes, coincidences, analogies, family resemblances, the changing moods of the street" (MacFarlane, 2005, p. 3). Jeremiah (2000) provides ideas about students writing descriptive essays from what they see and hear in a physical environment. "Students could borrow, rent, or use their own video cameras to capture events or people at specific places … the visual stimuli that confronts students by way of posters, ads, and messages seen on billboards, on mass transit systems …", (Jeremiah, 2000, p. 24). This is mirrored in Mora, Pulgarín, Ramírez & Mejía-Vélez (2018), who outline a case study supporting literacy projects by using advertising across urban localities.

'Student directed' learning

Student directed learning can happen in many ways, blending inquiry-based with creative learning, and could include project based and problem-based approaches. Seeking to build total immersion and engagement with knowledge and associated relationships to place, learning strategies are put in the hands of the learners themselves, to find and construct learning either individually or in groups. Breunig (2017) describes this as 'transformational learning', and that "(n)on-formal education embeds learning content in activities across an array of settings providing wide latitude for self-direction and interpretation on the part of learners", (2017, p. 3). Breunig describes "a dialogical method" where learners are co-creating and sharing responsibility for learning. In SLJ activities these concepts seem particularly relevant, perhaps especially for citizen based informal or covert learning (Lister, 2020).

"Student as Producer", conceptualised and implemented at the University of Lincoln in 2007-2014, (Neary, 2016) pioneered a research led approach to learning and teaching that appears relevant to how participants could be engaged in SLJ activities. Basing his ideas on the University of Berlin (founded in 1810), who saw "higher education as the collaboration between academics and students for the production of knowledge and meaning", 'Student As Producer' sought to achieve a "democratic and collective production of knowledge; and not just (…) a teaching and learning technique, but (…) a way of making the future…". I suggest these concepts of co-creation of knowledge in (learning) environments to 'make the future' are highly relevant to learning in urban modern settings that might involve a variety of stakeholders, and may contribute to learning environments being 'smarter' in the sense of how Dron (2018) may envisage. Again referring to Johnson & Johnson's (2014) crucial twenty-first century challenges, two are perhaps especially relevant here: the need for creative entrepreneurs and the growing importance of interpersonal relationships.

Consideration should also acknowledge other forms of self-directed learning, such as proposed by Karoudis & Magoulas (2017), previously discussed in chapter two. Their pedagogy-andragogy-heutagogy model suggests tools are needed to "support meta-learning, reflection, problem-solving and instructional scaffolding", stressing autonomy, intrinsic motivation, enculturation, discourse and collaboration, and reflection (2017, pp. 110-111). This is further supported by Blaschke & Hase (2016) as heutagogical self-determined learning, "an extension to andragogy, or self-directed learning … heutagogy further expands upon the role of human agency in the learning process" (2016, p. 27).

7.4 Tier 3 - The pedagogical relevance structure

The third tier of the PECSL is the pedagogical relevance structure arising from the related pedagogies and their contexts.

Building on the previously outlined experience complexity relevance structure and the subsequently arising related pedagogies, I now examine what might be termed pedagogical relevance structures of motivation, autonomy, demand structures (Marton & Booth, 1997, p. 169) and interwoven collaboration to support the related pedagogies of smart learning and the epistemological context that underpins them. I additionally reflect on the complex learning environment of a smart learning journey and note that the Technology system element outcome space as also impacting relevance structures from pedagogical perspectives. I begin by briefly considering participatory pedagogies.

7.4.1 Participatory pedagogies

Participatory pedagogies can be both face-to-face and online, and focus on fluid relationships between co-learners, tutors or other activity facilitators, to create meaning, content and understanding. Andersen & Ponti (2014) cite Siemens (2008) as positioning participatory pedagogy within a connectivist interpretation, then refer to Kumpulainen et al. (2009), who "took participatory pedagogy one step further by placing it within a sociocultural approach to learning" (2014, p. 237). This highlights participatory interactions in the community are socially constructed, as a way of giving learners the opportunity to position themselves as ‘agents’ (2014, p. 237). Particapatory pedagogy places emphasis on learners taking responsibility for each others learning and though connectivism appears to consider the individual at the centre, Siemens’ description of participatory pedagogy is “(m)ultiple perspectives, opinions, and active creation on the part of learners (to) all contribute to the final content of the learner experience” and “reflective of current ongoing trends with online content creation (…) and with collective approaches to participatory sensemaking” (2008, p. 12). This shares aspects of social-constructivist and constructionist perspectives, with Kumpulainen et al. (2009) adding further cultural historical activity theory (CHAT) related epistemic value.

Participation in the wider sense of the term of taking part, whether or not there is explicit pedagogical emphasis being placed on mutual co-learner responsibilities or direct input into what should be learned, requires more fundamental consideration. Using the umbrella grouping of motivation, I reflect next on what can impact participation in SLJ activities.

7.4.2 Participation and Motivation

Participation impacts all aspects of the learner experience for sense of engagement, relevance, potential outcomes and perceived benefits for any participant in a smart learning activity. Perhaps chief amongst these and affecting many others is ‘motivation’.

Siemens’ relates motivation to relevance: “(a) learner must be able to see relevance. If relevance (determined by the individual) is not ascertained, motivation will not be enacted. Lack of motivation results in lack of action … (r)elevance, however, is not only about the nature of content. The process of ensuring currency of content/information is critical…” (Siemens, 2006c, p. 8). He stresses the currency of content, and the closer its relationship is to “the point of doing/need, the more effective the learning process” (p. 8). However Marton & Booth point out that “learners have a primary focus on more global aspects of learning then on the content intended by the instructional setting” (1997, p. 141). They consider ‘global aspects’ of learning to be the ‘very situation the learner is part of’ (p. 141). Tasks, nature of what is being learned, expectations of students, peers, teachers, methods of assessment and future pathways are all considered as immediate context. Extending this context further, cultures of educational institution, common practices, shared values and ways of thinking that “point the way to the learner’s whole future world of work” (pp. 141, 142). As Siemens acknowledges “learning is much more than exposure to content. Social, community, and collaborative approaches to learning are important” (2006c, p. 8). Participants in the study displayed all these issues in motivational interpretations, reflecting levels of experience complexity for each of the categories of description. Multiple participants talked about whether tasks or content were relevant or would be assessed, for example “I think again it kinda goes back to how relevant, the level of relevancy to my question. It wasn’t that significant for me [...] it’s irrelevant” (P6, Cat A, L1, Q9), or “the places we went to weren’t very much connected with what I was doing” (P5, Cat A, L2, Q3), or “… if we are not assessed I don’t think we, er, prioritise it…” (P10, Cat A, L4, Q4). Expectations of peers or teachers were also evident as motivational factors, for example “to be honest I think we went because we knew we should” (P18, Cat A, L1), or “I think the fact of being there as a group actually made it more interesting, … I clearly remember having said to one person in my team that … this type of learning activities (sic) is really meaningful and motivational” (P20, Cat B, L4, Q8).

Examining intrinsic and extrinsic motivation and the autonomous nature of an SLJ activity, consider P6, who was not motivated to go on the journey as she felt she could get that information anywhere: “(w)e walk around, use the app where you move your phone over it and it gives you information. It’s kinda like I can get that information if I just google it…?”, (P6, SE, knowledge not of interest, Q2). Dron notes that “(e)very Google search is concerned with seeking knowledge” and that “online learning is (natively) the motivational inverse of traditional institutional teaching”, that “billions (of) learning journeys start every day with a Google search” (Dron, 2018, p. 12). He is implying that intrinsic motivation is present ‘per se’ in many learners, however, ‘traditional learning’ diminishes this if activities are not relevant to assessment as a consequence of ‘credentialing’ (Dron, 2018) education. The most common reaction to “loss of intrinsic motivation is to replace it with extrinsic motivation, usually in the form of reward and punishment”, but “extrinsic motivation persistently replaces, rather than enhances, intrinsic motivation”, (Dron, 2018, p. 11). The more you assess, the less you intrinsically motivate learners.

Participants often reflected on whether or not they ‘had to do it’, for example “... my flatmate would go like ‘is it compulsory?’ and I would say ... it’s not compulsory … (but) I think that this has a lot of potential” (P20, Cat A, L4). Some participants realised that participating in the activity would give them insight into possible future uses or technological understanding while others felt they were obliged to do it, but subsequently found more engagement as they took part. For example P14 “… at first, we thought just we go to do the tasks … but after, I mean when you see the information in front of you, you will get automatically like interested”

(Cat A, L4, Q7), P21: “having … that accountability later, … definitely helped me to stay focused and to engage more” (Cat A, L4, Q9), or P8 “I was interested I wanted to learn about the actual places or whatever but I knew that other students just me maybe they weren’t. They saw it as just they had to do it and that’s because they don’t really know the value of this” (Cat D, L3, Q5).

Dron’s solution to this problem is to ‘decouple credentialing from the learning process, and thus limit extrinsic drivers to learning’ (Dron, 2018, p. 15), using alternative assessment that is practical, skills based and student centred, such as “portfolios, challenge processes, and competence-based techniques…” (p. 15). Breunig (2017), writing about student-directed learning, cites Dewey (1938) who asserts that “classroom structures are often decontextualized from students’ lived experiences…” making “knowledge obtained in schools irrelevant to their lives”, and “experiences in the context of traditional schooling are largely uninspiring and fail to actively engage students”, noting “that many students lose the impetus to learn” (Breunig, 2017, p. 2). Yet, in the autonomous participation of a learning activity situated ‘outside’ and removed from classroom settings where the idea of a ‘teacher’ is absent, the issue of motivation remains.

7.4.3 Motivation and Demand Structures

In this study, relevance and motivation are positioned as a dynamic and hybrid set of experience and pedagogical interpretations, at individual and group level dependent on the aims and expectations of the activity, both for participants and for instigators. The aim of developing a competency or skill, as well as the processes by which that aim is achieved (Marton & Booth, 1997, pp. 119,126) are central to learning effectively. However, unplanned (Dron, 2018) or even covert learning (Lister, 2020) may be part of an SLJ activity, especially for citizen informal activity engagement. Citizen smart learning activities differ to those situated within formal learning, as learning itself may be a covert agenda. In these kinds of activities, the act of participation may cause learning to happen that the participant is consciously unaware of. In these contexts, support for this kind of learning must be acknowledged, and relevance to activity may be central to that support. If relevance is experienced, participants are more likely to engage, with “what the situation calls for, what it demands …”, (Marton & Booth,1997, p. 143). In so doing, the face-to-face or digitally mediated interactions of the activity create ‘unplanned’ or ‘covert’ learning experiences. In this sense, citizen smart learning activities are well positioned to support digital literacy and skills development (Lister, 2020). Tomczyk (2019) describes digital literacy (DL) competencies as an increasing challenge for society: "(t)he development of DL is one of the key priorities in informal and incidental learning… The shifting conditions of the modern world force constant updates to previously acquired knowledge…" (Tomczyk, 2019, p. 4). Recognising the issue of knowledge currency as connectivist in nature (Siemens, 2006c, p. 8), overall digital literacy and skill levels are currently reported as worryingly absent in working age populations (Bughin et al., 2018) causing a new digital divide (Goggin, 2018). Of note, work based digital skills can be measured for different purposes, Sultana (2018) highlights a 'developmentalist' approach, focused on 'personal growth and fulfilment […] to facilitate self-exploration and self-construction' (p. 64). This chimes with the effective learning principles described in Liu et al. (2017b, p. 209) for relevance to citizen smart learning activities.

Unplanned learning, the conversational process that leads to "much that is of value" (Dron, 2018) may incorporate a variety of aims and expectations not explicit in a learner's mind, yet implicitly are present. The "sense of aim, of direction, in relation to which different aspects of the situation appear more or less relevant" (Marton & Booth, 1997, p. 143) impact the complexity of experience variation implicit in reasons for motivation to engage, and subsequent 'unplanned' learning effectiveness. How do we know if unplanned learning is effective? Comparing virtual and real world field trip learning, Harrington (2008) remarks on not 'testing' for unplanned learning, noting "there is a student perception that more was learned in the real field trip" and "… the test only measured facts 'in the curriculum,' and as there was more information embedded in the real field trip, the children did indeed learn more 'out of curriculum' information in the real field trip. The test simply did not capture all information learned", (Harrington, 2008, p. 131). Therefore it may be that through awareness of these strata of relevance structures and layers of different kinds of learning, those who facilitate SLJ type activities might be able to adapt design to incorporate this type of less overt learning taking place.

7.4.4 Complex learning environments

In framing their analysis of complex learning environments, Goodyear & Cavalho (2012, pp. 49-60) describe a three architecture interpretation. A physical architecture of tools, artefacts and other material world or digital resources; a social architecture involving interpersonal working relationships, divisions of labour and roles, and an epistemic architecture, the structure of knowledge and ways of knowing, consisting of nested architectures of tasks (Goodyear & Cavalho, 2012, p. 53). This layered understanding is particularly helpful when applied to a smart learning journey environment. They adopt an ‘activity-centred’ position, where what matters is what the learner does (p. 55). The nature of activity determines part of the connection to learning, but it is a mistake to assume that learning will occur (via tools, resources or in places) just because learners may be in a place designated for learning to happen (p. 55). Therefore, there needs to be a connection between artefacts and human activity (p. 54). Noting that “human action can involve deliberation and interpretation but it can also be rapid, fluid and seemingly automatic” (p. 55), they outline this as thinking fast (automatic, with little or no effort) and slow (subjective experience of agency, incorporating choice, concentration and effortful mental activity), (citing in Kahneman, 2011, Goodyear & Cavalho, 2012, p. 55).

This assists in understanding the complex pedagogical environment inherent in a SLJ, acknowledging the activity centred human, embedded in a three layer architecture of interactions with ‘two kinds of thinking’. It articulates the “emergent consequence of dynamic interactions between the environment’s constituent parts, including those of its human inhabitants and the artefacts and structures they wittingly or unwittingly create… smartness emerges as a result of structure and interaction, whether or not either aspect is mediated or enacted through digital technologies”, (Dron, 2018, pp. 2, 3). Developing SLJ activities therefore requires planning for connections that are made between places, humans and knowledge, sometimes via digital artefacts and mitigated by acknowledgement of ways of thinking involved in these interactions. This chimes with the sociomateriality of Gourlay & Oliver (2018).

Traxler’s reflections on context-aware learning are closely relevant to smart learning environments. Noting that context has been defined in a variety of ways, here I highlight his citing of Brown (2010, p. 7): “the formal or informal setting in which a situation occurs; it can include many aspects or dimensions, such as environment, social activity, goals or tasks of groups and individuals; time …”, then in Cook, (2010) “the notion of ‘user-generated contexts’”, (Traxler, 2015, pp. 190, 192). He further reflects on ‘Place, Space and Presence’, as “the one physical space and multiple mobile virtual spaces of multiple conversational interactions” (p. 197). This is echoed in P22’s comments about “it’s like people walking around and looking just like zombies and not paying attention to anything or anyone (…) all they’re doing is (…) looking at their phones. (…) And I realised that we were doing it…”, (Cat D Level 4 Q10).

From a practical pedagogical relevance structure perspective, the complex learning environment revolves around planning for issues of preparedness. Goodyear & Carvalho provide a very useful case study illustration reflecting similar challenges to an SLJ activity (2012, p. 56). A postgraduate student research project involving field training for paramedics on use of iPads 'in the wild' produced field notes on things that seemed to influence activities and outcomes that are echoed in the participant transcripts in this study. In that exercise (conducted in remote countryside), use of GPS, maps, torches, whistles etc., plus things like traversing rough terrain, coping with low visibility or having proper clothing were all noted as potentially challenging for participants. This was likewise evident in SLJ participant transcripts that various aspects of preparedness were significant for them. The use and understanding of maps, finding points of interest (PoI) where AR triggers were located; technological preparedness, for example knowing how to get access to AR trigger content, or technology 'not working', batteries running out, no WiFi access, unsuitable phones; weather conditions being too sunny, windy or rainy, or inadequate allocation of time to actually take part in the activity. Further challenges related to complexity of environment were also evident, such as the unknown-ness of the technology, problems of the activity in terms of cultural associations (of PoI locations), or simply that other people were distracting, either co-learners or others. Practical preparedness is therefore a key consideration.

7.4.5 Technology in pedagogical relevance structures

Experiences of technology in a smart learning journey as seen in its system element analysis perspective showed four categories of variation. The novelty of the technology proved popular, it was also perceived as 'easy' and a 'helper' for access to context relevant information. However the 'problematic' category was significant for some participants. The general context emphasised was that technology was not a chief consideration for most, unless it did not work (for whatever reason).

I took an approach to the AR triggers to offer an 'AR interface' of choices, not the more common approach of triggering one piece of content only, such as opening a video or single webpage. This was to accommodate the content intended by the tutors, and create an impression of being 'smarter'. The technology used in this study is a future-present representation (Lister, 2022; Ireland & Johnson, 1995; Husman & Lens, 1999; Kitchin, 2019) of what may happen more seamlessly in the near future and as such was 'clunky'. However, participants either realised this and accepted it, or did not particularly notice it and accepted it. As such, very few participants actually spoke about for example any frustration with using multiple apps (maps, LGC area, AR triggers), or made any comments at all about the icons and design of the AR interface. This is interesting as though the study is not a user-experience study of digital design for app interfaces or interactions, it perhaps hints at a general understanding of 'what things do'. This is further discussed in context of Tier 4 in this chapter and then in chapter nine, and in my forthcoming paper for HCII22, as previously mentioned.

7.5 Tier 4 - The epistemological context

The fourth tier of the PECSL is the epistemological context arising from the previous tiers of considerations. This does not seek to 'account for learning' in a smart learning activity, but to reflect and contrast relevant epistemological positions relating to activities being investigated.

I have sought to examine 'connectivist-style' activities to respond to the research questions of this study. Arising from these activities are the CoD experience variations, as self-reported by learners and analysed according to phenomenographic approaches. These CoD experience variations provided experience complexity relevance structures and from these the key related pedagogies were identified. This led to further pedagogical relevance structures, those aspects that may impact experiences of learning indirectly as a result of pedagogical approach to an activity. In this context it is now possible to consider underlying theory that may support these related pedagogies and tiers of considerations.

7.5.1 Learning theory, related pedagogy and phenomenography

Participant interview utterances have shown within levels of experience complexity that knowledge construction factors are evident in contexts of levels of interest, engagement, finding, compiling, creating and meaning making. This is evident in individual and social contexts, and can happen with or without discussion and sharing aspects of activity participation. Discussing and sharing are significant aspects of experience variation in themselves, within the scope of knowledge and meaning making, task perceptions, place orientation, interest and engagement with place, co-learners and location. Connections are being made, both with human and non-human agents, making fluid and impermanent networks. Technology mediates some of these interactions and experiences, but not all. Related pedagogies previously discussed have emerged from these experience complexities.

I now explore relevant epistemological positions present in related literature, focussing on constructivism, constructionism and connectivism, acknowledging individual and social factors, with additional reference to activity theory and actor network theory. I further consider notions of ontological 'dualism' that may be present in some form in these theories, contrasting these with the 'constitutionalist perspective' non-dualist position of phenomenography (Wright & Osman, 2018; Prosser & Trigwell, 1999, p. 13; Marton, 1996, pp. 172-177). This builds the foundational tier of the 'pedagogy of experience complexity' for smart learning.

7.5.2 Constructivist contexts

Student-directed, inquiry-based, place-based, collaborative and social learning literature discuss implicit or explicit (often) social constructivist based pedagogical practice (MacGregor, 2018, pp. 205-206; Breunig, 2017, referring to Dewey, 1938; McConnell, Hodgson & Dirckinck-Holmfeld, 2012, p. 12; Topping et al., 2017, p. 162). Constructivism is a prevalent epistemological position of current pedagogical discourse, being the most recent of the Behaviourist, Cognitivist, Constructivist progression (Jones, 2015, p. 49). Legacy epistemological bases for pedagogical approaches related to smart learning are clear in 'Emerging Technologies In Distance Education' (Veletsianos, 2010), where almost every chapter discusses constructivism in one form or another. However De Laat & Ryberg (2018, pp 7-9) discuss theories prevalent in Networked Learning, many of which are relevant to smart learning, and note that constructivism has lost popularity since 2010, being replaced by overarching cognitivist aspects (citing Jones, 2015), also listing constructionism, social constructionism, activity theory and actor network theory.

Consideration of constructivism entails assumptions about the dualistic nature of external reality and how we come to know about the world. Interpretative positions taken are generally considered as 'individual' (Piaget, 1970) or 'social' (Vygotsky, 1978). However, "the polarisation of Piaget and Vygotsky along the individual and social is at least in part due to the dualist thought that lies implicit within so much of constructivist writing", (Liu & Matthews, 2005, pp. 389) and "popular constructivism and its criticisms, despite their seeming disagreement, are similarly grounded in a dualist philosophy and consequent separatism of human mind and external world", (p. 390). Nevertheless, a general consensus is that "(c)onstructivists embrace different worldviews and emphasize social relationships and cognitive interaction in learning environments (Bruner, 1966)", (Perry & Edwards, 2016, p. 190).

Understanding the constructivist link to epistemology “can make constructivism, viewed as a learning theory, difficult to grasp because educational ideas become entwined with philosophical arguments that extend beyond epistemology and touch on the nature of reality itself” (Jones, 2015, p. 53). Jones argues that “(t)he distinction drawn between individual and social constructivism is (…) one of convenience, allowing psychological and social accounts to be brought together under a single constructivist banner without any apparent contradiction”, (p. 53). Within a phenomenographic ontology, this problem is avoided. Roisko (2007), citing Prosser & Trigwell (1999, p. 13), and Marton & Booth (1997, p. 13) describes phenomenography in contrast to individual and social constructivism as “fundamentally different” (Roisko, 2007, p. 74), going on to state that “(b)y defining humans and the world as inextricably intertwined phenomenography transcends the person-world dichotomy”, (p. 74). In this study therefore, learner self-reported experience is accepted as their reality, in an ongoing state of reconstitution (Prosser & Trigwell. 1999, p. 13). This position is what leads to interpretations of ‘educational ideas’ and underlying epistemologies in this study to be proposed within a context of phenomenographic non-dualism.

7.5.3 Constructionist contexts

Constructionism as a general term is taken in these discussions to mean learning by ‘constructing’. Constructionism “shares constructivism's connotation of learning as ‘building knowledge structures’” (Papert, 1991, p. 1), avoiding the term ‘learning by making’ as being considered too simplistic an interpretation (pp. 1, 8). Constructionism is interpreted here as including making things and meaning, by discussing with others (Shotter, 1993, p. 61-62, Papert, 1993, p. 74), also interpreted as social constructivist (Vygotsky, 1978), finding and constructing knowledge through searching, compiling, adapting, modifying and generating of content by learners (Papert, 1991). Patten et al., citing Papert, define constructionist concepts as advocating “that learning occurs ‘especially well when the learner is engaged in constructing something for others to see’”, (Papert, 1993, in Patten et al., 2006, p. 9). Generating solutions to problems, or working on similar yet individual projects together might all be interpreted as constructionist.

Ally (2008) could be describing multiple aspects of a smart learning journey, to facilitate “exploratory learning and to allow students to explore during the learning process, a constructionist approach to learning must be used. Learning must be project-based to allow learners to build things, to experience the world by doing things rather than passively listening to teachers, to think critically, and to develop problem-solving skills" (2008, p. 886). This acts as a useful description of the practical aspects of learning involved in a smart learning journey. It brings to mind P12's comments: "… instead of having a lecture here, in the same place, we got to do and apply what we had learned in the hands on manner" and "…it's not like I'm at home behind my laptop reading, you know, being a passive receptor. I was immersed in the environment" (SE Place: Being Outside, and SLJ Cat 3, L4).

Social constructionism may share some of the ontological dualism of constructivism, but with an "emphasis on reality as constituted in language … (r)eality, in social constructionism, is usually viewed as dependent on how groups of people collectively elaborate their ideas", (Raskin, 2002, pp. 18-19). This aligns with the connectivist principle of diversity of opinions (Siemens, 2006a), with the accompanying "possibilities and complications of the current age, with its abundance of ultra-sophisticated communication technologies" (Gergen, 1991, 1994 in Raskin, 2002, p. 19).

7.5.4 Connectivist contexts

Connectivist principles have been employed for activity approaches in the SLJ of this study, as I sought to examine 'connectivist-style' activities (to permit useful responses to research questions), these being discussed in some depth in chapter two. These activities involved aspects emphasised by connectivism as autonomy, participation, collaboration, diversity of opinions and connected technologies to access and create knowledge content. Examining the underlying theoretical foundation of connectivism, Ryberg et al. (2012) assert that the individual is central, citing Siemens (2005): "(t)he starting point of connectivism is the individual…", (Ryberg et al., 2012, p. 49). Siemens' argues that "(l)earning is the process of creating networks (…) nodes may be (…) any… source of information" (Siemens, 2006c, p. 5), and that "(t)he act of learning … is one of creating an external network of nodes where we connect and form information and knowledge sources. The learning that happens in our heads is an internal network (neural)…" (Siemens, 2006c, p. 5). Ryberg et al. question whether this represents a "'cognitivist information processing' metaphor dispersed into a socio-technical network, or a basic 'constructivist perspective' where the notion of, e.g. schema is replaced with the metaphor of a network", (Ryberg et al., 2012, p. 50). Simplifying, individual (cognitive) constructivism may be at the centre of connectivist epistemological assumptions, as the individual is the key focus, and how the individual processes and connects sources of content. Therefore, some potentially unaccounted concepts of dualism seem present. To quote Ryberg et al., "we wonder what the relations are between the two "realms" or if they are the same (without wanting to re-iterate complex discussions around dualism)…" (Ryberg et al., 2012, p. 50). Ryberg et al. additionally "find it problematic that knowledge is equated with content" (2012, p. 49), but Siemens states elsewhere that "… learning is much more than exposure to content. Social, community, and collaborative approaches to learning are important" (Siemens, 2006c, p. 8), though he does not say in what way.

7.5.5 Activity Theory and Actor Network Theory contexts

I acknowledge the additional relevance of Activity Theory (AT) and Actor Network Theory (ANT). 'Cultural-Historical' Activity Theory (CHAT), the third generation of AT (Engestrom, 1987, p. 6), has grown in popularity (Roth & Lee, 2007). Anderson & Dron (2014) note that Engeström added "community" to Leont'ev's individual and object as a fundamental unit of interaction (2014, p. 50), and as such may provide additional theoretical accounting for learning in smart learning journeys. Additionally, CHAT emphasises culture to "show the rules, roles and expectations that can shape activities" (Edwards, 2011).

According to Roth, Radford & LaCroix (2012), CHAT investigations are interested in "… something that is an event—activity. Something has to happen… We're interested in understanding something that's going on…" (2012, p. 6), and that "… any kind of human-human interactions that we look at is contextualized by activity […] a double temporal component, the local temporality as well as the historical and the cultural embeddedness…" (2012, p. 6-7). In addition to the cultural 'embeddedness' of smart learning activity experience, technological artefacts mediate human-non-human interactions. In Activity Theory "artefacts are understood as transitional objects between activity systems", but "(a)rtefacts are never … conceived as actors themselves but as mediators of human actors' intentions through complex and interrelated activity systems" (Beetham, 2012, p. 39). This is important in smart learning, as learners make use of a variety of technologies to mediate interactions with knowledge and content, content creation, or communication amongst co-learners or others. This asks the question: how do we account for non-human agents of an activity impacting on the nature and possibility of meaning making? Fenwick et al. (2011) are cited by Goodyear & Carvalho (2012) to capture 'some of this complexity' (Goodyear & Carvalho, 2012, p. 51) though they remain sceptical as to "whether it is reasonable to attribute agency to artefacts" (p. 51). Fenwick & Edwards (2010) raise multiple relevant issues of epistemological context with which ANT may assist, for example citing Nespor (2002), "how and in what forms people, representations and artefacts move, how they are combined, where they get accumulated, and what happens when they are hooked up with other networks already in motion", (2010, p. 23). Gourlay & Oliver describe "knowledge and meaning-making practices not only residing in […] cognition, but also relying on interaction and entanglement with the internet […] in which the human 'contracts out' the responsibility to store and organise information" (2018, p. 85), describing a connectivist style relationship. Siemens asserts that learning "may reside in non-human appliances" (2005), and that learning is "a process of connecting specialized nodes or information sources" (2005). He further describes this as off-loading "many cognitive capabilities onto the network … our focus as learners shifts from processing to pattern recognition. When we off-load the processing elements of cognition, we are able to think, reason, and function at a higher level (or navigate more complex knowledge spaces)", (Siemens, 2006c, p.11). I follow up the concept of learning as 'pattern recognition' in a subsequent section (8.2.1) , in a context of categorisation and learning.

Returning to the challenge of accounting for 'external reality' and 'internal construction of knowledge', Roth & Lee (2007) argue that activity theory is an "intelligible and fruitful alternative to existing psychologies of learning that overcomes some problematic dualisms in education". CHAT assists in bridging this divide, as "along with Dewey's idea-based social constructivism … breaks down the Cartesian wall and lays the foundation for an interaction between us and the environment we live in" (Postholm, 2008, p. 38), Dewey being further cited by others in this context (e.g. Lotz-Sisitka, Wals, Kronlid, & McGarry, 2015, p. 76; Dahlin, 1994, p. 90; Hildebrand, 2003; Johnson, 2017, p. 40). Dahlin, writing for an early prominent phenomenography conference, notes that Dewey claimed to resolve the dualism between subject and object, "characteristic of almost all traditional philosophy since Descartes" because experience "recognizes … no division between act and material, subject and object" (Dahlin, 1994, p. 90, citing Dewey, 1981:257). In this sense, from a pragmatic epistemological interpretation it is possible to form pedagogical guidelines based in the non-dualist experience of the learner, even in acknowledging that pedagogical framing may often be implicitly based within a dualistic ontology. In Nature and Experience (1929), Dewey argues he is 'not concerned about dualism', "beyond pointing out that it is the inevitable result, logically, of the abandoning of acknowledgment of the primacy and ultimacy of gross experience - primary as it is given in an uncontrolled form, ultimate as it is given in a more regulated and significant form - a form made possible by the methods and results of reflective experience" (1929, p. 15). This may be in the empirical (scientific) method or in the "continued and regulated reflective inquiry…of the intervention of systematic thinking" (1929, p. 5). The pedagogical considerations discussed here arise from these reflective experiences, and as such, a ‘pedagogy of experience complexity’ for smart learning is developed.

7.6 A pedagogy of experience complexity for smart learning

To conclude, I now summarise the four-tier model of the ‘Pedagogy of Experience Complexity for Smart Learning’, consisting of the experience relevance structure, the related pedagogy, the pedagogical relevance structure and the epistemological context. To illustrate relationships between each layer I make use of several tables and diagrams.

The four tiers of considerations form the conceptualisation of the ‘pedagogy of experience complexity for smart learning’. Utilising the visualised approach of a structure of awareness (Figure 21), we can think of these considerations as beginning with a close focus of awareness, evolving outwards to wider and wider layers of interrelated pedagogical connected-ness.

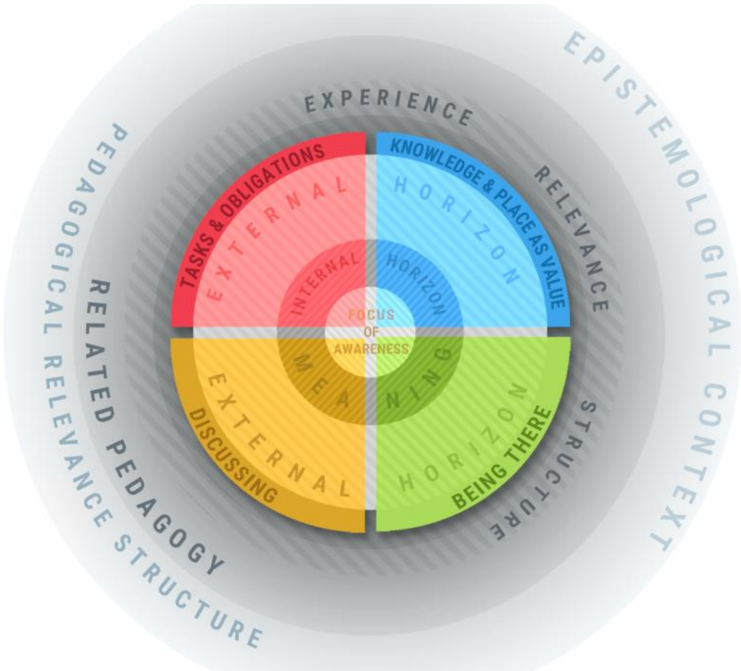

Figure 21 Diagram conceptualisation of the pedagogy of experience complexity for smart learning

The overall conceptualisation diagram shows the four categories of description (CoD) variations for the primary outcome space, and how each may begin by having shared aspects with each other in the central focus, then extending outwards with all the subsequent considerations that may be involved.

1. Experience complexity relevance structures - experience variation descriptive guidelines for each CoD variation
2. Related pedagogy - the four key pedagogies, each related to a CoD
3. Pedagogical relevance structures - overall participatory pedagogical considerations
4. Epistemological context - related pedagogy in theoretical context

A simple relational flow diagram can illustrate the fluid relationship between these four tiers of considerations (Figure 22).

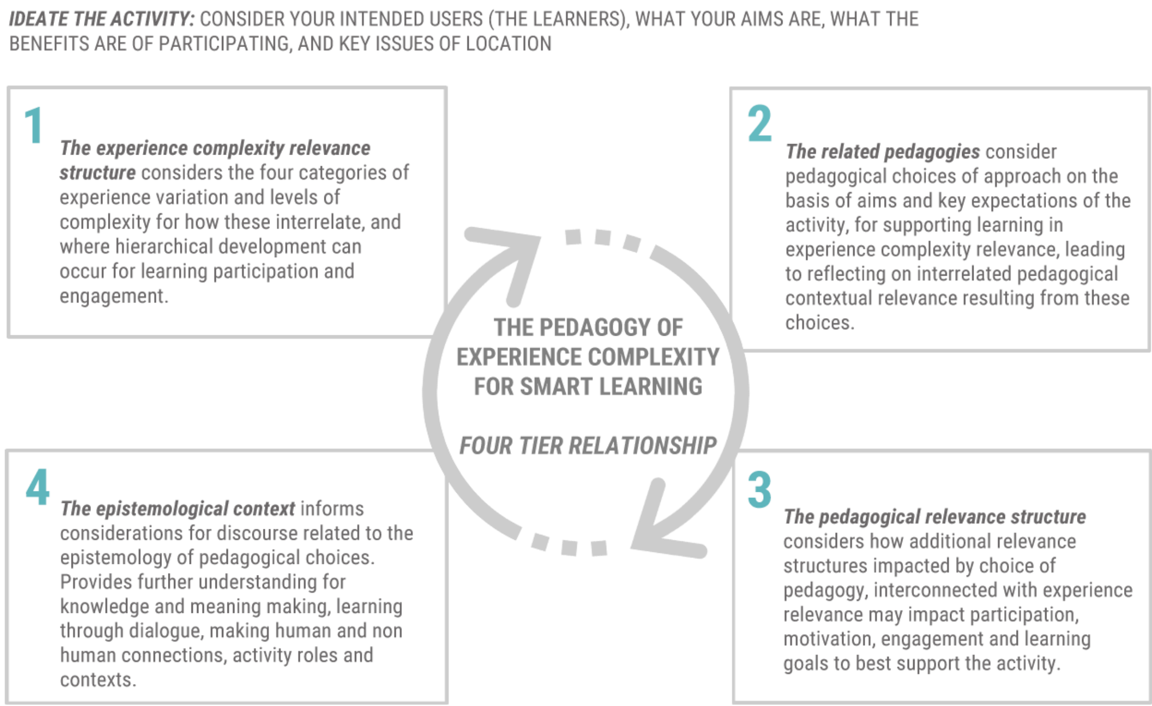

Figure 22 Fluid relationships between the four tiers of the pedagogy of experience complexity for smart learning

This can be further illustrated using an expanding ring approach to show each related pedagogy with corresponding experience CoD, and further pedagogical relevance factors, expanding out to core theoretical underpinning (Figure 23). Figure 23 additionally incorporates a further relevance consideration for process and content of learning, discussed in chapter eight.

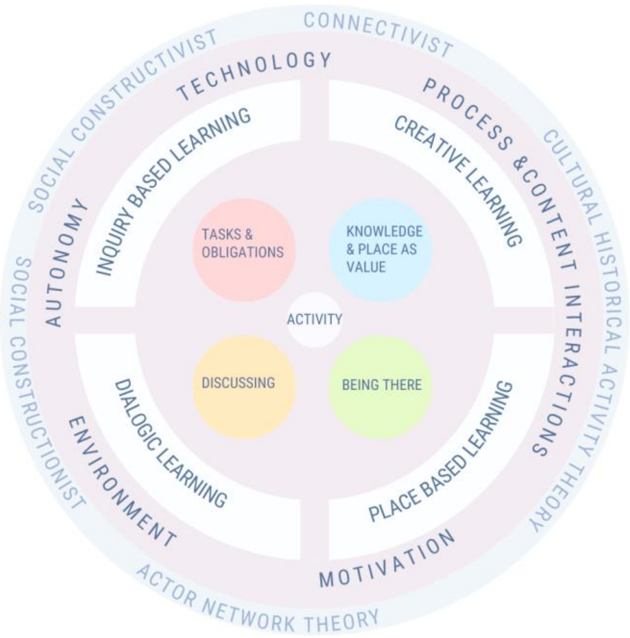

Figure 23 Visualisation of experience variation CoD, related pedagogy, pedagogical relevance factors and theoretical underpinning

Table 13 shows the experience variation CoD (shown in the experience relevance structure diagrams, Figures 16, 17, 18 & 19), with surface to deep learning descriptions for experience complexity, aligned with related pedagogy and summarised examples of pedagogical relevance for each CoD. This can then be further developed to have equivalent Bloom's and SOLO grading added.

	Cat A - TASKS & OBLIGATIONS	**Cat B - DISCUSSING**	**Cat C - BEING THERE**	**Cat D - KNOWLEDGE & PLACE AS VALUE**
Related pedagogy	Inquiry-based learning	Dialogic learning	Place-based learning	Creative learning
Level 4 complexity	*DEEP APPROACH shows intentionality for tasks, topic, knowledge and locations to contribute to argument; to understand further potential interpretation (inter/intra); ideas, application*			
Level 3 complexity	*SURFACE TO DEEP #2 moving towards 'argument' concepts; tasks and journey begin to be seen as indirectly relevant to wider settings; more reliant on imagination, creativity, inventiveness, inspiration*			
Level 2 complexity	*SURFACE TO DEEP #1 some engagement with 'viewpoint', building elements of meaning and connection resulting from the journey participation*			
Level 1 complexity	*SURFACE APPROACH shows intentionality of doing tasks as fact, 'arrangement' only. The bare minimum required.*			
Pedagogical relevance factors	About tasks and assessment. Relevance of activity to coursework or purposes, assessment, further usefulness	About discussion and collaboration. Considerations concern how to expand participation to include the 'dialogic space', collaborating, discussing, sharing.	About being in the place, support by showing learner how to engage in the place, with specific indicators and clues or prompts.	About value of knowledge in the place, specified by location, time and relevance to other categories. Applying, creating knowledge bound by place with value.

Table 13 Description of pedagogical alignment for experience CoD and surface to deep learning experience complexity of a smart learning journey

Figure 24 shows the combination of these equivalences and concepts, now including the Bloom's and SOLO approximate grading. This is essentially how the four tiers relate in a logical relationship.

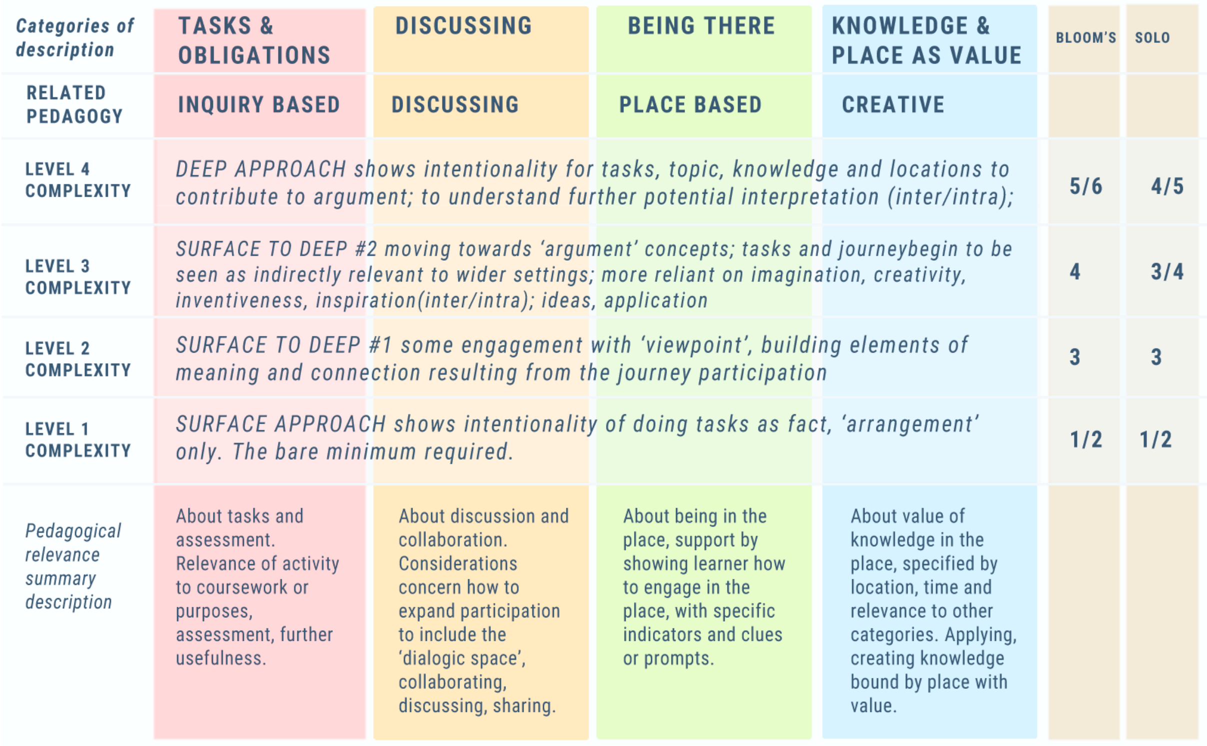

Figure 24 Pedagogical alignment for experience CoD and surface to deep learning experience complexity of a smart learning journey, with Bloom's and SOLO equivalences

Table 14 demonstrates at a glance the relationships between each layer or strand of the pedagogical guide, for application and relatedness. This table summarises this chapter that has described the four tiers of pedagogical consideration that form the Pedagogy of Experience Complexity for Smart Learning (PECSL). *(Refer to section 9.3.2 for the solution to research question 2.)*

SoA Category of Description	**Experience relevance structure**	**Related Pedagogy**	**Pedagogical relevance structure**	**Epistemological context** *(Selected related sources)*
Tasks and Obligations	Doing tasks, fulfilling obligations, developing to understanding wider relevance and interest in tasks, requirements or expectations.	Inquiry-based learning Discovery Exploratory Gamified Problem-based	Relevance should be explicit and clear. Extrinsic motivation and autonomy increase with relevance. Intrinsic motivation decreases in relation to increased instruction.	– Motivation to relevance; currency of content; closer to the point of doing; (Siemens, 2006c). – Primary focus on more global aspects of learning than on … the instructional setting (Marton & Booth, 1997, p. 41). – Research processes based on formulating and asking questions

				that will require critical thinking" (Seel, 2012, p. 1571). – Setting challenges, puzzles, quests, discovery trails… using gamified learning to increase levels of engagement and motivation (Özhan & Kocadere, 2020).
Discussing	Discussing who does tasks, how technology works, what is required, developing to discussing relevance of task, location, topic, to wider reflections, sharing content, knowledge and private experiences.	Dialogic learning Peer-learning Collaborative Cooperative	Discussion and sharing support value and engagement.	– Making things and meaning, by discussing with others (Shotter, 1993, p. 61-62, Papert, 1993, p. 74) – A diversity of opinions (Siemens, 2006a). – A "dialogical method" where learners are co-creating and sharing responsibility" for learning Breunig (2017). – Expanding the dialogic space to encourage learners in how they think and express ideas (Wegerif & Yang, 2011). – Dialogic learning … where "the focus is on … "pushing" the students "to go beyond the basic" (Cutajar, 2019).
Being There	Going to places to do tasks "and that's it", developing to high engagement with place, sense of being there, in the picture, following in the footsteps, reflective sense of place in time.	Place-based learning Environmental Creative learning	Engaging in places with purpose and guidance to encourage discovery, creativity and further reflection.	– Encourage interaction and immersion with the physical surroundings to support meaning making (Sacré et al., 2017, p. 39). – Students explore during the learning process, …to experience the world by doing things rather than passively listening to teachers, to think critically, and to develop problem-solving skills. (Ally, 2008). – 'Observe', 'judge' and 'act' factors for place-based learning (Simeone et al., 2017). – "…people exist in a cultural context and that acting on that context can change the person, the situation and the relationship people have with that context." (MacGregor, 2018, p. 205)
Knowledge and Place as value	No interest or engagement in topic, location or content (provided or made), developing to high engagement, content made, deep reflections of wider significance and value for place and knowledge.	Creative learning Student-directed learning Student as producer Place-based Discovery Inquiry-based	Creative, place-based, discovery, self-directed, research with learning, problem solving, project-based, interdisciplinary.	– Learning strategies are placed in the hands of the learners ... to find and construct learning either individually or in groups (Breunig 2017) – Non-formal education embeds learning content in activities across an array of settings providing wide latitude for self-direction and interpretation on the part of learners", (Breunig, 2017, p. 3)

				– Encourage interaction and immersion with the physical surroundings to support meaning making (Sacré et al., 2017, p. 39). – A "democratic and collective production of knowledge; and not just (..) a teaching and learning technique, but (…) a way of making the future…" (Neary, 2015) – To "support meta-learning, reflection, problem-solving and instructional scaffolding", stressing autonomy, intrinsic motivation, enculturation, discourse and collaboration, and reflection (Karoudis & Magoulas, 2017, pp. 110-111)

Table 14 Summary of relationships of the four tiers of the pedagogy of experience complexity for smart learning (PECSL)

7.7 Designing and measuring smart learning with the PECSL

Consideration of activity design and development leads to Figure 25, to illustrate possible process of design iteration, describing how this four-tier pedagogical model can inform the thinking, planning and scope of a smart learning activity set in real-world locations. This diagram is a modification of the user-centred design iteration process, derived from the Nielsen Norman group 'Design 101' approach (Gibbons, 2016). User-Centred Design (Saffer, 2010, pp. 33-35, Garrett, 2010) is an approach whereby iterative steps are taken to progress through a series of considerations for designing products or digital applications with user experience as central to the design process. This approach complements the aim of how the PECSL four tiers might be utilised, placing learner experience as central to the approach.

Figure 25 shows how this might be iterated for considering how to design an activity, including here an additional consideration of process and content discussed in chapter eight. Noting that iterative stages are repeated as necessary in any order felt relevant, for example that epistemological context can therefore inform understanding for experience relevance or for related pedagogical choices, and so forth, back and forward, as well as across the circle.

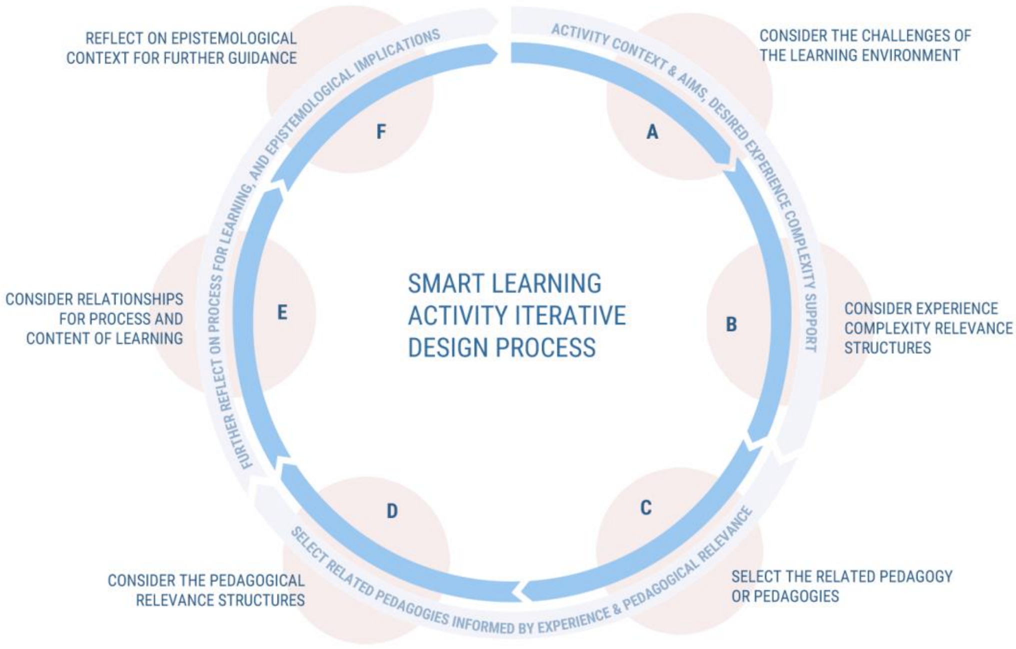

Figure 25 Iterative design process for a smart learning journey, using the four-tier model of the pedagogy of experience complexity for smart learning

These areas might be further refined as design process for an activity progressed in detail, to include only the aspects of the four tiers that were directly involved in the type of activity being designed. The importance here is that this is not a 'waterfall' process, where steps are taken in numerical order and not repeated. In the iterative process, the circle or repeating pattern are what is significant, attempting to refine understanding and detail of design for more successful outcomes over repeated iterations.

A separate document could be compiled with different types of activity case studies scoped and illustrated as a 'guide to using the PECSL', this approach being taken in Lister (2021d), to demonstrate using the PECSL with practical examples. For the purposes of this thesis, sufficient information is provided here to indicate how the PECSL described in this chapter might be used in pragmatic ways to support smart learning activity design with learner experience as central to that process. *(Refer to section 9.3.3 for the solution to research question 3.)*

7.7.1 Potential for measuring effective smart learning

Mechanisms for measurement of effective learning have been discussed as they emerged. In chapter five, a system for assessing LGC using experience complexity with alignment to Bloom's Revised and SOLO taxonomies was outlined. In preceding sections of this chapter the CoD experience complexity with aligned surface to deep learning descriptions (Table 13), then adding Bloom's and SOLO equivalencies, related pedagogies and pedagogical relevance structures of the PECSL (Figure 24) show further factors that may contribute to measurement of this complex array of learning.

Acknowledging the wide range of learning that might be taking place, the design of an activity may impact how any learning might be measured. Consideration should therefore be given to planned, unplanned and even covert learning strategies and aims, as well as explicit learning outcomes, as both conscious and more implicit 'unconscious' learning may be manifesting within the learner. *(Refer to section 9.3.1 for the solution to research question 1.)*

Carefully applied planning for the process and content of the learning involved in the activity is best considered within and alongside awareness of the tiers of the PECSL. Chapter eight reflects on the process and content of learning in light of the PECSL and the contexts of connectivist principles and of phenomenography, referring to Dron (2018), Dron & Anderson (2014), Greeno & Engeström (2014), Marton et al. (2004) and others.

7.8 Summary, chapter seven

The biggest challenge of Chapter 7 was the application of experience complexity findings to any pragmatic pedagogical guide. Whilst it was clear I could not make direct connection between statistical analysis and pedagogical claims, it was possible to make an association through planning for experience complexity and variation. I felt this was achieved with at least reasonable success, and offered appropriate practical flexibility.

The opposing positions of dualism in constructivism, constructionism and implicitly in connectivism, and the non-dualist stance of phenomenography, proved challenging yet rewarding to reflect on. Though the aim of this study was not to 'account for learning' in an epistemological sense, I considered this debate to be a useful layer of pedagogical considerations, to reflect on aspects dependent on the nature of an activity, as part of the development cycle.

Chapter eight goes on to discuss further theoretical and practical aspects arising from the pedagogical model and approach.

8 DISCUSSION

This chapter begins with two areas concerning smart learning and experience complexity: the process and content of learning, and the wider pedagogical positioning for the work. I follow with further implications, discussing aspects of the work relating to context-aware content delivery and 'smart' personalised intelligent system learning, with associated ethical and privacy issues. These issues may be particularly of relevance in a 'post-connectivist' era for context of learning with emerging technologies.

8.1 Introduction

Research into smart learning environment learner experience might have wide reaching relevance. Smart learning environments extend to almost any technologically enhanced setting, particularly in relation to widespread access of smartphones and good WiFi connectivity. In the near future technologies such as Google Lens[42] will permit context-aware knowledge content access via real world augmentation to become a standardised functionality of any smartphone.

The role of connectivist-inspired epistemologies in relation to the social and political landscapes of smart learning and learning cities, and need for increased digital literacy and lifelong learning (e.g. Blaschke & Hase, 2016) suggest currency of research considerations. Complementary relationships between this study and the European Commission Digital Competencies Framework, known as the DigComp 2.1 (Carretero et al., 2017), and large-scale support for initiatives to upskill citizens in digital literacies (Goggin, 2018; Hernandez & Roberts, 2018) additionally indicate relevance and potential for practical application.

[42] Google Lens see footnote 33

The role of smart learning in enhancing citizen life can therefore be seen as part of a larger landscape of smarter environments that embrace a higher quality of life and opportunities for learning both within formal learning settings and in ad hoc informal recreational or just-in-time needs (Blaschke & Hase, 2016, p. 29). Whilst I have researched learner experience using sample groups drawn from tertiary education students, I would argue that these groups in general represent various sets of stakeholders: future educators; those who may become involved in implementing citizen learning initiatives to support the goals of DigComp 2.1; general multi-cultural citizens of urban environments, lifelong learners. In this sense their experience is that of early adopter participants in experiencing these kinds of smart learning activities.

8.2 Concerning smart learning and experience complexity

I begin discussion with an exploration of the process for and content of learning for a smart learning journey in the context of the experience categories of description findings, of the pedagogical relevance structures and of phenomenography itself. This concludes with a summary on the significance of reflection as a part of the process of smart learning activity participation. I then further examine the role of place in pedagogical approaches relating to environment and experience, reflecting on philosophical positions, and the roles of community empowerment and communication.

I follow this by examining the pragmatic application of the Pedagogy of Experience Complexity for Smart Learning (PECSL). This fluid and hybrid guide should be able to accommodate a wide variety of smart learning activities to offer useful considerations that might be applied for multiple purposes of activity. I focus on the application of the guide for supporting European Commission Digital Competences Framework (the 'DigComp 2.1', Carretero et al., 2017) to enable potential for development of digital skills and literacies in citizen communities.

8.2.1 The process and content of smart learning

To consider question one of the study, how we might measure the effectiveness of learning for both the content of learning and the process for learning, it is necessary to outline what these terms might mean in the context of phenomenography and the connectivist-inspired smart learning activities in this study.

Process for learning is considered here as what the participant is thinking, doing, acting upon, deciding, experiencing or interpreting as part of the activity. The external social or digital interactions and internal individual intra-actions, the inner processes as reflected on and then self-reported by a participant as experience. These processes, both external learner agency and interactivity and internal continual reconstituting of meaning impact participant experiences of the process for learning. The act of learning (Marton & Booth, 1997, pp. 169-171) is considered as part of this process. Content of learning is interpreted here as some informational aspect of knowledge. Knowledge is not content, but content may need to be accessed and interpreted for knowledge to develop. 'Content of learning' here is considered as a part of the object of learning (Marton & Booth, 1997, pp. 156-163; Marton, 1994a, p. 4425; Wright & Osman, 2018, p. 262).

As discussed previously in chapter seven, connectivism appears to have an unclear position regarding the relationship between learning, content and knowledge. Siemens refers to "(t)he act of learning … is one of creating an external network of nodes…" (Siemens, 2006c, p. 5), thus indicating the process to access content is the act of learning. I note previously that Ryberg et al. find it problematic that connectivism equates knowledge with content (2012, p. 47), however Siemens states elsewhere "… learning is much more than exposure to content…" (2006c, p. 8). Downes refers to "the epistemological foundation of connectivism" as "connective knowledge", that a "property of one entity must lead to or become a property of another entity in order for them to be considered connected; the knowledge that results from such connections is connective knowledge", (Siemens citing Downes, 2006b, p. 16). Further, Siemens states (2006a) that " … learning is the act of recognizing patterns shaped by complex networks. The networked act of learning exists on two levels: 1. Internally as neural networks (where knowledge is distributed across our brain, not held in its entirety in one location); 2. Externally as networks we actively form (each node represents an element of specialization and the aggregate represent our ability to be aware of, learn, and adapt to the world around)" (2006a, p. 10). These systems of networks and nodes of content suggest types of classifications, and Dewey believes to "assert that knowledge is classification is to assert in effect that kind, character, has overlaid and over ridden bare occurrence and existence.... character, kind, sort, universal, likeness, fall within the universe of meaning … that having meanings is a prerequisite for knowing" (1929, p. 331, also highlighted in 1925, p. 19). When perhaps interpreted within connectivist principles, content nodes in a knowledge network form meaning through classification and categorisation, as a "process that people use to make sense of the world around them", and that "people understand things by working out in what ways those things are similar to some things and different from others" (McGarty, Mavor & Skorich, 2015, p. 186).

Dron reflects on a "connectivist generation of pedagogies" which share foundations and are "largely in response to the increase of adjacent possibilities afforded by the growth of the Web", (2018, p. 13-14), indicating that connected learning and meaning making are shared principles of much networked, connected learning (Dron & Anderson, 2014, p. 48). However, in the direct context of this study the networks of content nodes did not play an extended role, though were present for some participants. Information content was provided as predetermined selections relevant to each point of interest in the smart learning journey, participants referring to this in different ways. Category variations of experiencing this content were as 'of value in relation to place', 'of interest', 'not of interest' or 'too much'. This showed levels of consumption and possible associated meaning, varying from none at all (P6, P8, P10) through to deep engagement and sense of relevance (P11, P23). Additionally, learners' own content, either found in the networks (e.g. 'Googling it', P1, P3, P4) or learner generated (P7, P20, P22) tended to be more highly valued. The Google searching was "… in keeping with connectivist precepts, people know that the knowledge they seek resides in the network - even if they often do not need to retain it - but, in one way or another, they are seeking knowledge", (Dron & Anderson, 2014, p. 27). Created content was most valued and deeply engaged with when creativity superseded explicit topics of learning, yet had relevance to the participant (such as P21, P22 and P23). P22 showed strong disinterest in the provided content, hinting that perhaps it was because she had surrendered her phone for a co-learner to use (though she did not say that in so many words), but she was still fascinated by the experience of 'being there' and making content relevant to place, and reflecting on it deeply. For her, it could be argued that process for learning was about student directed meaning. She felt frustrated at all the reading, yet was strongly motivated to create her own media content relating to place.

8.2.2 The act and object of learning

Marton & Svensson (1979) reflect on the context, act and content of learning from a first and second order perspective, considering the (more common) position of researching the learner as the object of study from the researchers observed perspective (the first order), rather than assuming the perspective of the learner themselves (the second order). In this study, I am attempting to discover what sort of learning might be going on from the learners' perspective, rather than measuring any set learning goal that might be assessed, or making assumptions about learning achievements. In this sense, the process (act) and content (object) of learning are dependent on the perceived experience of the learner as reported to me. Participant interview reflections evidenced pronounced experience variation for tasks and obligations, to ‘do the tasks’, of what was expected of them, whether they were ‘doing it correctly’. This varied according to perceived interpretations of the smart learning activity demand structure as they saw it, but was often present. It was noticeable that some participants expressed their reflections in ways that could be in a context of ‘answering correctly’. All of this indicated that tasks, obligations and expectations as being of strong significance. This may reflect in concepts of the ‘act of learning’ that can often dominate the object of learning (Marton & Booth, 1997), and is increased the more instruction is introduced to the act. This can be referred to as technification of the act of learning, that too much ‘pointing out’ achieves an ‘erosion affect’ (Marton, 1976, in Marton & Booth, 1997, p. 169), wherein learners learn less, the more instructions are provided. Participants also placed emphasis on being with friends, being able to discuss things and get help from each other, attaching value to sharing relevant thoughts or prior experiences related to location points of interest in the activity. This indicates that the act(s) and object(s) of learning were not always known to them in terms of being consciously aware, similar to how Marton & Booth refer to “situations are usually taken for granted by the experiencer; they do not see them, they are not aware of them” (1997, p. 118). The participants did not see their ways of experiencing as ‘learning’.

The situation of the smart learning activity potentially allows for learning in multiple ways of experiencing - those intended by the tutor and other ways of learning that are unintended, but present. Greeno & Engeström (2014), citing Marton et al. (2004, p. 4) and Marton & Pang (2006), discuss Marton’s “three aspects of the learning object, namely the (a) instructor’s intended object of learning, (b) the enacted object of learning that “defines what it is possible to learn in the actual setting” … and (c) the eventual outcome as the student’s lived object of learning” (Greeno & Engeström, 2014, p. 133). Then noting “(e)specially for studies of learning in activity systems, Marton’s conceptualization is problematic. The intended object is depicted as a monopoly of the instructor. However, learners also have intentions…” (p. 133). This appears to concur with the participants experience variation of where value was present in the smart learning activity - for some, the topic itself (the intended object), for others, the social, collaborative and shared experience, for others the feelings and past memories about tours and places of interest, for others the value of knowledge and place as a wider set of reflections. These other aspects, aside from the intended object, are partially enacted object (what is possible to learn in the setting) and aspects of the students' lived object of learning, though they may not have perceived it as such. Greeno & Engeström go on to suggest an 'extended view' of Marton's three aspects of learning object, emphasising learner agency, and adding 'learners object of vital interest", (Greeno & Engeström, 2014, p. 134). This may reflect more accurately what is observed in the experience of the participants regarding 'process for' and 'content of' learning.

What participants achieve in the activity is often not consciously explicit learning, though when pressed to reflect on their experience, they begin to discover what they have thought and done, and in so doing they remark on their learning. This was evident, both in participant interviews and in class scenarios where I taught 'smart learning' to young educators, discussed in following sections.

8.2.3 Figure ground reversal

Zerubavel (2015) describes figure and ground as "(w)hether we actually notice something … is to a large extent a function of the way it is perceptually situated as a figure, to which we focally attend, against some background (or simply "ground"), which we effectively ignore" (Zerubavel , 2015, p. 11), "(a)lthough originally conceptualized specifically within the context of sensory perception, the figure-and-ground model is nevertheless applicable to non-sensory modes of cognition … the basic principles underlying the processes of visual and auditory focusing also capture the essence of the process of mental focusing" (p. 20).

Marton (1981) describes figure-ground learning relationships with "content as being figure, and process as being ground in a figure-ground relation"… (Marton, 1981, p. 184). If a learner reflects on their experience of learning, they may come to know their process for learning, and it might be considered that a figure-ground reversal takes place. A learner becomes consciously aware of what they have learned, and their own learning process is elevated to figure, while content (object of learning) recedes to ground. "This shift (leaves) no alternative but to adopt a deep approach" to learning (Marton & Booth, 1997, p. 149). Marton continues that "(p)rocess and content are two different aspects constituting a logical unity; there can be no process without a content and there can be no content except in terms of a mental activity…" (Marton, 1981, p. 184). This illustrates that the focus of the learner is usually on the object of learning - the content - and process recedes to ground in their awareness. He clarifies what 'content' means as "we use 'content' in the sense of apprehended content, the act of apprehension is a necessary tacit assumption" (p. 184), apprehend meaning ‘to understand’, as he is describing content in relation to “mental activity” (p. 184). In this study ‘apprehended content’ might be the understanding and learning about the intended object of learning, that is, the topic of the smart learning journey, but may also be numerous other aspects of learning and development as indicated by participant experience: the enacted object of learning, what is possible to learn in the setting, the student lived object of learning, and additionally Greeno & Engeström’s ‘learners object of vital interest” (2014, p. 134).

When participants reflect on their experience of a smart learning journey, they begin to ‘see’ what has happened, and how they reacted, what they had thought and felt. This is evident in some participant interviews, for example P19 “I think I said more than I thought before, by coming…”, or P20 “… I clearly remember having said to one person in my team that … this type of learning activities (sic) is really meaningful and motivational…” and “I think that's also part of the learning, coping with the different … reactions, and perspectives … I was so motivated because I know that we can all just learn something and that learning might not necessarily be useful to you right there and right then, but at some other point in some other context you might refer to something … that you learnt back then”, (P20).

This was also particularly evident during class sessions, teaching young educators about ‘smart learning’ (Lister, 2022). As I briefly mention in chapter seven, I came to realise the importance (to pedagogical understanding) of relevance structures when taking classes of young educators to teach them about smart learning, and using a ‘phenomenographic focus group’ approach to discussion sessions in class. I had asked them to try to discover what they had experienced when they had participated in a smart learning journey, and to think of all the many aspects that might be a part of that experience. Allowing for emergent but gently guided discussions to take place permitted students to reflect deeply on what they had experienced. The students remarked that as they discussed they learned much more about their experiences, reflecting far more deeply than they may have done without such a discussion. This appeared to confirm to an informal level what I was hearing and seeing in the transcript data, both for category description variation, as well as the figure-ground reversal referred to by Marton (1981) and Marton & Booth (1997, p. 149). As the students discussed, they made notes (see Figure 26). Though this is anecdotal evidence rather than data collected under ethical permissions conditions, nevertheless it offers insight into the life world of the experience of the learner participating in a SLJ. This especially sheds light on how they saw their own learning, and perhaps emphasises some pedagogical aspects of it.

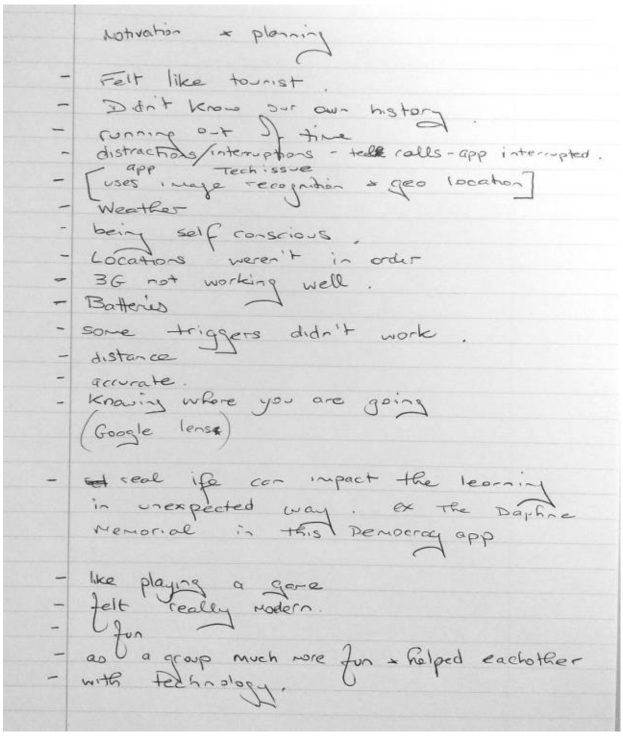

Figure 26 Student notes made in class during emergent focus group discussion on experience of the SLJ in Malta (used with permission)

8.2.4 Intentionality

Referring again to the non-dualist constitutionist epistemology of phenomenography, learning is considered a qualitative change in the relationship between person and world, based on the notion of intentionality, that all mental acts are directed towards something, something beyond themselves (Wright & Osman, (2018, p. 260). The concept of intentionality originates from Brentano (Marton, 1986, p. 40), that "everything that is psychological refers to something beyond itself" (Marton, Dall'Alba & Beaty, 1993, p. 296), indicating that the "conception of learning hence encompasses two main component parts: a way of seeing what is learned and a way of seeing how it is learned", (p. 296). Sandberg describes intentionality as an "individuals' consciousness is not closed but open and always directed toward something other than itself" (Sandberg, 2005, p. 48). Referring to Husserl, he continues: "individuals' various modes of consciousness such as perceiving or imagining are always related to something, which is not consciousness itself but intentionally constituted in a particular act of consciousness" (p. 48). This means that there is intention towards interpretation, understanding, reconstituting the relationship between person and world.

In a smart learning journey, participant experience describes this intentionality either simply and overtly ('doing the tasks, going home', P8) or less explicitly, when describing things like 'the bell chimes in the distance when visiting the old pubs of the City of London, and it not being 'like a postcard'' (P3). This indicates an awareness and willingness to reshape interpretation of place, and the value of that, within the subjective consciousness. Sandberg notes “ the role of the subject in the process of constituting meaning” (Sandberg, 2005, p. 48), as “(a)lthough the object transcends the subject, its appearance is dependent on a subject; that is, it is intentionally constituted”, such as P3 experiencing her thoughts about the emotional impact of place on her constituted experience of the City of London.

This experience process of learning can be individual (e.g. P5) or with a group (P3, or P20), further considered by Dahlin (1994) as socially constructed. “There is often a negotiation of the meaning of things among people involved in the same or similar practical undertakings; and … within the individual there is an interaction between personal contingencies of experience and the pre-established categories of meaning taken over from the surrounding culture”, (Dahlin, 1994, p. 103-104). Dahlin remarks (in a footnote on page 102) on why people conceive of things in different ways as a variation in capacity for perception and thinking, “not only inter- but also intra-individually”. This intra-individual negotiation of meaning is perhaps more constructivist, however in non-dualist terms it is the individual continually reconstituting their own relationships with the world, and if learning is a qualitative change in that relationship.

8.2.5 Learning, experience and reflection

Aspects of experience and reflection in action learning are relevant to the process and content of a smart learning journey. In action learning emphasis is placed on reflection as an end in itself (Lin, Galloway & Lee, 2011, p. 55), and the importance of collaboration, or in the case of a smart learning journey perhaps groups of co-learners participating together in some way, to promote reflection amongst peers. Lin et al. describe action learning as “performed in groups so individuals can learn from each other”, with “a task designed or assigned for action and participation” and “reflection is the end product”, (2011, p. 55). Quoting McGill & Beaty (cited in McGill & Beaty, 1996) with “individuals learn with and from each other by … reflecting on their own experiences” … (1996, p.21), they add “(t)he authors emphasise that action learning is based on the relationship between action and reflection, and action learning involves a group of people. Thus, action learning places stress on collaboration” (Lin et al., 2011, p. 55). This echoes the experience I had in class teaching the young educators, and how significant the reflective emergent discussion was to support deeper learning and awareness (Lister, 2022). Though this is somewhat different to action learning as it is not work based (Raelin, 1997), it is about reflection as peer debate, with co-learners contributing to understanding. Lin et al. go on to remark that “the process of learning should include the elements of action (experience) and reflection" (Lin et al., 2011, p. 62), referring to Kolb (1984), who "believed that students would change their conceptions or opinions through experience" (Lin et al., 2011, p. 72). This leads to smart learning experiences being potentially interpreted as aspects of action learning, where reflection is an end in itself, and where emphasis is placed on collaboration and the importance of the role of experience in the learning process.

I have noted elsewhere how models of smart learning environments "tend to see learning as the achievement of specified learning goals, rather than a complex conversational process that can and usually does lead to much that is of value beyond what is planned" (Dron, 2018, p. 3). This 'unplanned' learning can take place in the experience of learners, and noted in Harrington (2008) is not 'tested' and therefore goes unnoticed. In this study I am attempting to capture, through described experiences of the phenomenon, what and how the participant is learning, whether they are consciously aware of their learning or not. Herein is the challenge of what might constitute effective learning in smart learning journeys - the object or content of learning might be a mixture of aspects, both planned and unplanned, (intended and unintended), interwoven into an activity situation, both extrinsically expressed and intrinsic to the participation of the activity. As Siemens stated in 2006, "… do we design learning? Or do we design environments in which motivated learners can acquire what they need?", (2006b, p. 119).

8.2.6 Place and experience

Conceptions of place are central to learning activities based in points of interest that form journeys in real world (potentially urban) locations. Citing others, Buell (2005) provides descriptions from different perspectives of place as "a space to which meaning has been ascribed", "centers of felt value", "discrete if 'elastic' areas in which settings for the constitution of social relations are located and with which people can identify", (2005, p. 67). Jayanandhan (2009) notes the "tenets of Dewey's philosophy of education seem particularly germane to the concerns of place based education: environment (in Dewey's particular use of the term), experience, and democracy", (Jayanandhan, 2009, p. 106). Utilising both Buell (2005) and Jayanandhan (2009), here I reflect briefly on ideas about place, relating this somewhat to earlier commentary regarding Dewey (in chapter 7 and earlier in this chapter), the nature of experiencing place, acknowledging relevance to participant experience utterances.

Jayanandhan (2009) reflects on a 'pedagogy of place' and the relationships between John Dewey and Beull's conceptions of place as 'gestures' in three directions, described by Buell as "environmental materiality, toward social perception or construction, and toward individual affect or bond", (Buell, 2005, p. 62). Relating 'environmental materiality,' as the "built and social environments of a given location", Jayanandhan offers Dewey's meaning of environment as 'the things that are noticeable to or important to a person" (2009, p. 106), and that "place based educators argue that the educator's responsibility is to bring those aspects of environmental materiality into students' experience" (p. 106, see also Dewey, 1916, p. 9). This chimes with the phenomenographic internal horizon focus of a structure of awareness in which meaning is derived for a participant. Units of meaning discovered in the experiences (as reported by participants in activities) attach significance to what appears to be most relevant or significant to the participant, and reflects in the commonality or variation across the collective. The individual will attach meaning as past memory, emotion, useful or interesting knowledge, associated value, sociability or fun, and the importance or significant presence of meaning is indicated by the participant and across the collective experience variation. For example, meaning can be very personal (such as P15, who was family-related to one of the characters in the history of Palazzo Fererria in Malta), whilst for others is orientated toward civic pride (P11 felt proud of her country after she had taken part in the Malta Democracy journey).

Jayanandhan reflects that experience has what Dewey calls 'an active side' (e.g Dewey, 1916, p. 30), which "changes in some degree the objective conditions under which experiences are had. Thus, experience has not only an individual but a social constructivist dimension", (Jayanandhan, 2009, p. 107). Further, that "social groups share experiences, which shape social places and conditions… (Dewey's) description of experience proceeds from the social context of sharing and passing on group knowledge and identity, to the individual context of learning and growth … the inevitable connection between individual and social experience… adding social construction of shared meaning and value" (p. 107). Again this is reflected in participant experience through the 'Discussing' category, and then in the system element categories for 'collaboration'. Sociability, fun, shared discussions for who does what (of tasks), of prior relevant experiences of similar places, talk about cultural differences all indicating aspects of Jayanandhan's comments.

Jayanandhan relates Dewey's social constructivist dimension of experience to Buell's 'social perception or construction'. (Noting Buell uses the expression 'social … construction' (2005,

p. 62), these distinctions are blurred and may mean similar things relating to co-constructing of meaning.) Then following this by relating Dewey's philosophy connected with social construction to his understanding of democracy. Dewey describes democracy as "a mode of associated living, of conjoint communicated experience" (Jayanandhan, 2009, p. 107; Dewey, 1916, p. 46), uniting "the individual and social aspects of education: a learner should learn how to be a good citizen for the good of both", Dewey grounding democracy in Buell's 'environmental materiality'", (p. 108).

Buell's 'affect or bond' (2005, p. 62) reflects in Dewey's understanding of experience as Dewey emphasizes the role of affect or disposition in shaping experience, as "something that sets up desires and purposes", and "emphasises the bond or affinity of the individual in place…" (Jayanandhan, 2009, p. 107; Dewey, 1938, p. 38). This is reflected in the feelings and emotional reactions of participants in a smart learning journey, as previously highlighted. It is also of relevance to note that 'fear' is mentioned by both Buell (2005, p. 63) and Jayanandhan. Jayanandhan cites social geographers "who have written about the role of fear in shaping place, provide a telling example of affect as a moving force. Fear influences the locations people do and do not go, and therefore the environments and experiences they are open to", (2009, p. 107). Buell offers a description of place as "seen, heard, smelled, imagined, loved, hated, feared, revered" (2005, p. 63). This may be pertinent to this study in the sense of participants from Group 1 (the London group) who may not have wished to visit the City, as it is perceived by some as largely populated by 'City boys', that is, young, successful, mostly white male financial industry workers who 'live fast', often drinking large amounts of alcohol after work. This is a personal anecdotal observation on the part of the researcher relating to possible underlying issues for some participants in Group 1, however, certain ethnic or faith groups may not always be welcome in London's City district, and this would be known to the participants. Awareness of such cultural or faith sensitivities is therefore a vital component of planning for the kinds of urban situated smart learning journeys that are the subject of investigation in this study, and highlights the complexity of this terrain. Beull refers to place as a "rich and tangled arena" (Beull, 2005, p. 62), acknowledging the complexity of the environment and multi-faceted strands of the phenomenon of a smart learning journey that are reflected in the experience variation of participant transcripts.

It is interesting to note Jayanandhan's later comments regarding the need to avoid standardisation and impoverishment of experience in experiential education "through a process of time-limited, commodified, out of the box activities and formulaic, mechanical reflection" (2009, p. 108). The pertinent 'second lesson of Dewey's pedagogy of place' (p. 109), is that "place-based education must include an element of meta-analysis: learning how to learn how to be in a place…" (p. 109). This is in relation to the fluid, mobile global communities that make up modern communities, but is also here closely related to my assertion that effective smart learning is learning to learn, to do and to self realisation (Liu et al., 2017b, p. 209).

8.3 Citizen learning in smart spaces

The pragmatism of the pedagogy of experience complexity for smart learning (PECSL) seeks to offer useful pedagogical considerations for many kinds of smart citizen activities. The four tiers of consideration: the experience complexity relevance structures, related pedagogies, pedagogical relevance structures and epistemological contexts on which these draw can guide planned, unplanned or covert learning strategies. This approach might potentially better accommodate participant experience complexity in a smart learning journey activity. Contexts for applying this pedagogical approach and how it might assist particularly in further support for digital skills and literacy development in citizen populations (Lister, 2020) are now discussed.

The pragmatism of the pedagogical four-tier model (the PECSL) devised in this study responds to the research questions, and seeks to enable usefulness in real world situations. Carroll & Rosson (2013) see the local community as "a living laboratory" for Human Computer Interaction (HCI) "in the wild" (Carroll & Rosson, 2013, p. 1) referring to HCI as an action science existing "to produce practical knowledge, (…) that is actionable and effective, not merely accurate and precise descriptions, analyses, or theories", (p. 1). The central focus of much of their research was "sustainable community learning and innovation" (p. 6) to support "building community with community informatics" resulting in a "self-sustaining and distributed process of informal learning and technology adoption" (p. 20). This chimes with the work of this study and what might result in relation to ongoing future-present (Ireland & Johnson, 1995; Kitchin, 2019; Lister, 2022) in-the-wild smart learning activities in urban communities.

Smart cities emphasise the importance of enhancing citizen quality of life (e.g. De Lange & De Waal, 2017), and civic learning (Sacré & De Visscher, 2017) can be a part of this. Carroll et al. (2017) "are most concerned with the challenge of enhancing awareness, engagement, and interaction pertaining to individual and collective human experiences, meaning making, activity, intentions, and values" (Carroll et al., 2017, p. 2). They suggest an Internet of Places (IoP) at community-scale for hyperlocal neighbourhoods, which "transcend spatially indexing physical data" (p. 2) and enable "incidental meanings and emotions evoked by … places (to) be associated with and shared through location" (p. 5), and "IoP should integrate community activity" to "provide new ways to participate in community life" and "support interactions with and participation in local anchor institutions…" (Carroll et al., 2017, p. 5). These are closely related to smart learning journey activities, within concepts such as writing the city of community memory previously discussed (Jordon, 2015, Sacré et al., 2017). Carroll et al. (2017) align this as "the next generation infrastructure for community networks" in the tradition of the Berkeley Community Memory[43], the first use of a digital bulletin board to record and disseminate community information in the 1970s (Carroll et al., 2017, p. 2). They emphasise that "(p)laces are fundamental constructs that structure social practices, cultural history, memory, experiences, emotion, and material environment that people live in. The physical environment and the meaning, identity, sense of attachment and belonging are facets of places that are profoundly significant and inseparable", (p. 4). Smart learning activities are potentially at the heart of embracing this kind of community participation digital integration.

Existing case studies from recent years exemplify the kinds of activities utilising ad-hoc smart technologies that manifest this kind of community digital integration, such as Wood Street Walls, Hackney Community Maps, Tokyo Paper Hunt or Smart Learning Feedback Maps, discussed further in Lister (2020). These activities occupy similar positions to the activities in this study, albeit working with citizen rather than student participants. Technologies that are used by the activities are often available for free, or use simple technology that can be implemented by a reasonably skilled technical developer. Bespoke apps are therefore often not needed, with all the extra cost and funding that may incur. With further planning, these kinds of citizen led activities might be positioned to also facilitate digital skills and competences development, without necessarily even making this aspect of learning an explicit purpose.

[43] Berkeley Community Memory https://en.wikipedia.org/wiki/Community_Memory

8.3.1 Critical pedagogies in smart learning

The laudable aims of enhancing citizen life highlighted by De Lange & De Waal (2017), Carroll et al., (2017), Vinod Kumar (2019) and others are challenged by significant inequality of access to participation. Barriers exist in digital device access, digital literacy, time-poor citizens or more defining divides such as gender, ethnicity, language, socio-economic class or 'special' needs learners. This merits brief scrutiny of critical pedagogies in light of smart learning environments. In a previous publication (Lister, 2021b), I note that considerations for pedagogies of smart learning activities may not always begin with the learning itself, for example in the concept of lifelong learning, perhaps somewhat closely related to these kinds of activities (e.g. in Karoudis & Magoulas, 2017). Schreiber-Barsch (2017) argues that 'inclusive' lifelong learning implies an opposing exclusivity, described as "not merely a pedagogical issue, but in essence a negotiation of citizenship and politics" (Schreiber-Barsch, 2017, p. 67). These exclusions are often in terms of an explicit pejorative division, as "for centuries, segregation was based on a deficit-oriented categorization of learners into 'normal' and 'special' learning institutions along the able/not-able divide" (p. 69). Inequalities of accessibility for physical needs (Hempel-Jorgensen, 2015), gender or socio-economic class (Liasidou, 2012) continue and remain fundamentally challenging. However the context of some kinds of smart learning activities may offer ways of overcoming or at least mitigating a more equal citizen participation. For example, the subsequent discussion in this chapter of support for citizen digital literacies to help counteract the digital divide in an increasingly digitised society, acknowledging complex issues relating to societal interpretations of skills and competences. This is also mentioned in chapter 7 as part of pedagogical relevance structure considerations. Here I draw attention again to ideas about the self-realisation of the citizen (Lui et al., 2017b; Vinod Kumar, 2019), empowering their own development and 'liberation'.

In Freire's Pedagogy of the Oppressed (2005), originally published in 1970, he notes a "distinction between systematic education, which can only be changed by political power, and educational projects, which should be carried out with the oppressed in the process of organizing them" (2005, p. 54). If it can be assumed for the purposes of this discussion that 'the oppressed' are the disenfranchised groups who may be either partially or wholly excluded from some forms of (formal, 'systematic') education, then engaging these groups in 'educational projects' that empower them for community or civic change for mutual benefit might mitigate inequality and barriers. However, Friere warns that a liberating pedagogy (pedagogy of the oppressed) "cannot be developed or practiced by the oppressors. It would be a contradiction in terms if the oppressors not only defended but actually implemented a liberating education" (p. 54). In this way, smart learning activities envisaged as citizen led initiatives to improve and benefit the local community for all are perhaps an opportunity for the liberating pedagogy that Friere describes. In Lister (2021d) I further expand on the SLA case studies mentioned in the preceding section of this chapter to illustrate practical examples of smart learning activities with different participant groups and purposes, some of which are 'social-justice' orientated. These 'imaginary' learning activities demonstrate applying the PECSL model in a variety of 'use case' scenarios, and outline how pedagogical relevance structures might be interpreted and considered in a practical activity design. In those examples I particularly focus on socio-cultural interpretations, however, clearly, other learner-world relationships can negatively impact learning in place.

MacGregor (2018) acknowledges that place-based education "has a strong foundation, emerging from the works of Dewey who emphasised the importance of experiential learning that connects communities with students' lives" (p. 205). Dewey, in 'Democracy in Education' (1916), draws out the relationship between citizenry, politics and education. Discussing civic efficiency, good citizenship "calls attention to the fact that power must be relative to doing something, and to the fact that the things which most need to be done are things which involve one's relationships with others…" expanding this to incorporate 'social efficiency', as "capacity to share in a give and take of experience … (an) ability to produce and to enjoy art, capacity for recreation, the significant utilization of leisure, are more important elements in it than elements conventionally associated oftentimes with citizenship" (1916, p. 63). To me, this encapsulates many aspects and purposes of citizen smart learning, either developed by citizens themselves or in partnership with local civic organisations, and complements Sacré & De Visscher's (2017) ideas about civic learning.

Enhancing quality of life, with greater or lesser emphasis on learning are at the heart of smart learning activities in real-world settings. Whether or not this incorporates the sometimes contested notions of 'social justice' (Liasidou, 2012, p. 169) within critical pedagogy remains to be seen, as ideas about smart cities are still embedded within opportunities for commercial interpretations of technological infrastructure development. The socio-political examination of smart city education (e.g. Williamson, 2015a) appears to confirm these suspicions, and this leads to further related debate in subsequent sections of this chapter concerning data, privacy, ethics, machine learning and smarter networks of knowledge delivery.

8.3.2 Digital skills and literacies support

According to the European Commission Joint Research Centre, "(c)reativity, entrepreneurship, learning-to-learn, digital competence and other 21st century skills and competences are emerging as more and more important for innovation, growth and participation in a digital society and economy..." (EU Science Hub, 2019). Increasing digitisation of societal services, support and access to enhanced quality of life means that large segments of urban citizens are at risk of being left behind (Bailey, Perks, & Winter, 2018) without adequate skills to navigate these new digitised services necessary for their lives (Lister, 2020). The increasing need to develop the digital skills and literacies of urban populations (Goggin, 2018; Bailey et al., 2018), particularly lower income groups, lower educational achievers and women (Goggin, 2018) may align well with ad hoc participatory digital smart learning activities situated within community spaces. For example, Avram's (2017) citizen-driven "city hacking", where augmented reality is used as "functional graffiti", to "'relieve social pressure, draw attention or change how people see problems' (citing Saitta, 2014)", (Avram, 2019, p. 129-151). Again noting Taylor's (2017) work (discussed in chapter seven) to support digital literacy development with bodies-in-place at the scale of the city. Hobbs & Holley's (2016) use of AR and video to develop soft skills in Computer Science students adds further perspective. "Previous studies showed the value of using an interesting and inherently engaging technology […] to facilitate group work and to promote broader skill acquisition…" (Hobbs & Holley, 2016, p. 113). This is certainly an area rich in potential for further research.

The European Commission Digital Competences Framework (known as the DigComp 2.1) (Carretero et al., 2017) offers a clear mechanism by which digital skills and literacies can be developed, designed with at risk groups in mind (Vosloo, 2018). Applying the PECSL within these parameters to citizen smart learning activities may provide additional guidance on how to conceptualise aspects of even covert learning strategies through supporting participation experience complexity development. Additionally, the DigComp 2.1 utilises Bloom's Revised taxonomy (Anderson & Krathwohl, 2001) to match digital competence levels to cognitive domain, which further assists in uses if considered in relation to this study's PECSL guide.

Though there are other frameworks for skills and competences development (e.g. found in Lister, 2020), the DigComp 2.1 is pragmatic and flexible, offering a wide scope of how to envisage levels of skills for different aspects and purposes. An accompanying European Framework for the Digital Competence of Educators, the 'DigCompEdu' (Redecker, 2017) supports this framework for educators, however the DigComp 2.1 can act as a stand-alone reference, and is already widely adopted in other project initiatives, research and case studies (e.g. those in Valentini, 2018).

Connectivist principles and the European Commission Digital Competences Framework

Connectivist related pedagogical principles are reflected in the DigComp 2.1, appearing as a good match to the smart learning activities as envisaged in this study, focusing as they do on participation, knowledge finding, collaboration and autonomy. The DigCompEdu (Redecker, 2017) additionally reflects connectivist-inspired pedagogical principles.

8.4 Further Implications

Having discussed the potential for smart learning activities relating to support for developing digital skills and literacies for urban citizens, here I briefly note additional aspects that have arisen in the course of running the activities and analysis of the data. I first discuss potential for configuring smart learning activity experience variation digital interactions data as a set of variables that may contribute to richer learner analytics, going beyond ‘time on page’ or user journey option choices, to support personalisation of learning experiences. I follow with brief examinations of current terrain in the potentially problematic areas of machine learning, personalised data, ethics and privacy that are increasingly becoming priority considerations in any digitally mediated set of experiences (whether for learning or other purposes). I conclude with further thoughts on the need for a smarter ‘knowledge commons’ (Lister, 2018) that content knowledge might integrate more efficiently with future augmented reality supported learning experiences that utilise context aware information.

8.4.1 Experience complexity as data variables

In applying the experience complexity table as a method for analysing the LGC in this study, I began to realise that this method might be potentially further developed to incorporate machine learning techniques, so as to match categories of description for experience variation to LGC, either text, images or even audio or video. The experience complexity ‘rubric’ developed during the LGC analysis (shown in chapter five, ‘Analysing LGC using experience complexity’) and further discussed in chapter six, bore the hallmarks of a set of ‘data’ measurements. I began to think of this as ‘learner experience variables data’, and thought about how it might work as a set of machine learning principles on which digital interactions might be analysed, potentially enabling more personalised user journey provision, or merely to collect helpful anonymised data on the experience of citizen learners in smart learning activities. Because learner experience variation data is analysed collectively it is looking only at variations in content according to experience variation CoD, not associating these with individual identifiable demographic factors.

Precedent has been set for how to teach machines to learn about the diversity of human emotion and experience through use of divergent creative data, such as use of descriptive poetry to analyse types of handwriting in the work of Vapnik (Brown, 2016). Vapnik asked a professor of Russian poetry to write poems describing the numbers 5 and 8, for consumption by his learning algorithms. The results were creative metaphors of what numbers looked like when written in very different handwriting styles. Using a combination of poetic descriptions and associated attributes, much deeper and more flexible analysis was achieved. By use of metaphor, that “encodes knowledge derived from experience” (Brown, 2016), it may be that better data can be captured to identify and then deliver more effective learner experiences. Beginning with first utilising a human assignment of experience variables to LGC, then developing databanks of such data, one might then ‘feed’ this to machine learning algorithms to assess LGC in citizen smart activities (for example) to analyse learner experience, developing more data and so on. This might develop accuracy and usefulness of certain aspects of the experience variation showing in the LGC machine analysis recognition.

Tsai (2018) states that using “robust image recognition technology will allow Facebook to collect more meaningful data about its users, which Facebook can then monetize by enabling its advertisers to target content more strategically” (Tsai, 2018, first section). Whilst smart city learning grapples with issues around the problematic reliance on developing intelligent personalised learning systems that are too dependent on ‘learner ontologies’ (Rezgui, Mhiri & Ghédira, 2014), use of anonymised experience variation data may offer an alternative. Machine learning is able to analyse through textual analysis, and image, location and face recognition. For example Facebook already analyse image content with reasonably sophisticated annotations, a recent outage of Facebook image loading (Vincent, 2019) showed this clearly. I captured some screenshots myself during the outage that provide an idea of what is tagged by their artificial intelligence image recognition. I show in Figure 27 and 28 in simple terms how this might be matched to LGC experience data variable assigned grade. The rubric discussed in chapter five (Table 11) and six (Table 12) shows how Bloom’s Revised (Anderson & Krathwohl, 2001) and SOLO (Biggs & Collis, 1982) taxonomies can be part of this type of recognition of experience variation.

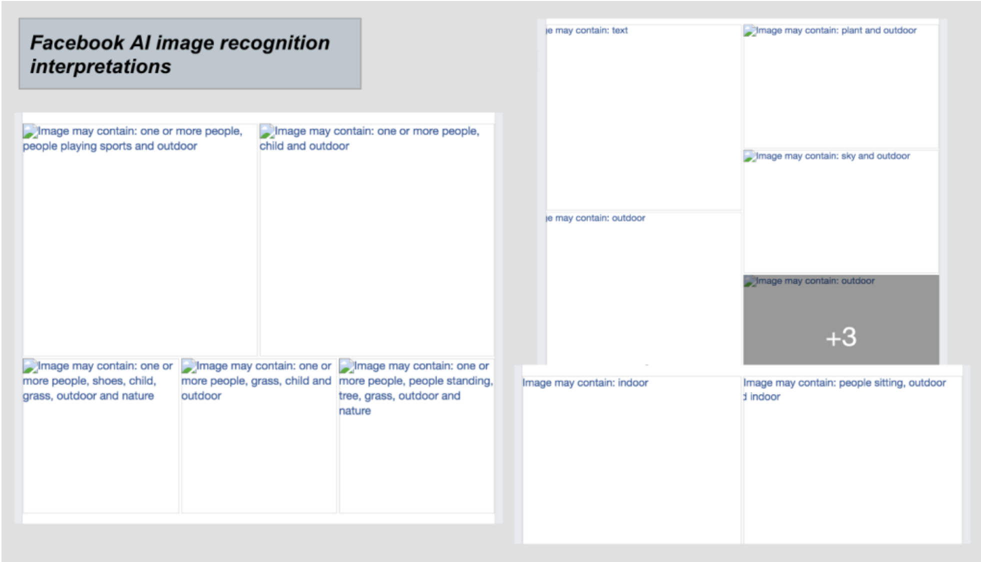

Figure 27 Facebook image recognition attributes during the outage of July 2019

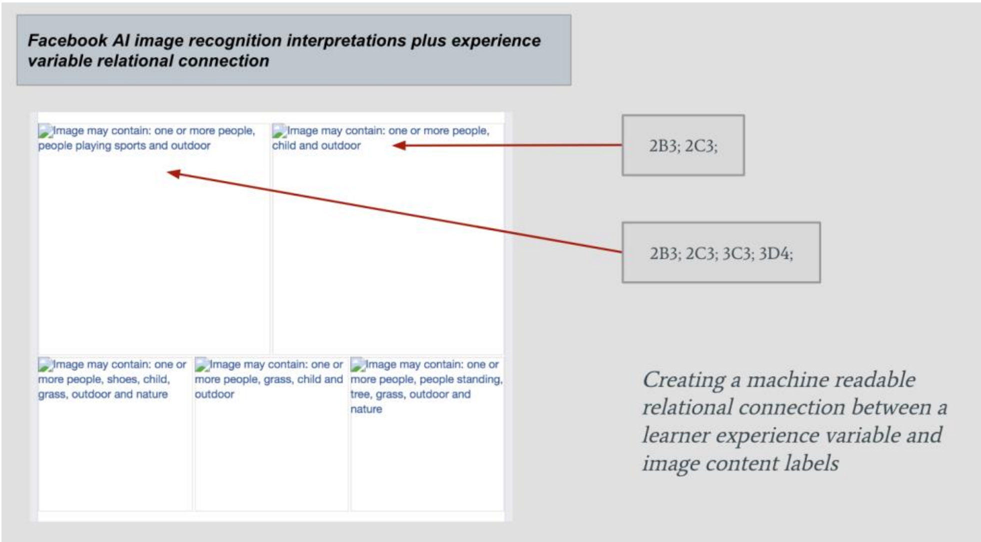

Figure 28 Facebook image recognition attributes with associated experience variation data variables including Bloom's grade

In November 2019 I presented these ideas in a talk at the University of Oxford, UK, Artificial Intelligence in Education series, hosted by the IT Learning Centre.

8.4.2 Implications of machine learning

> *"… education as a social institution is beginning to encounter smart software that can itself learn from the data it processes and analyses - through processes such as machine learning, whereby algorithms are 'trained' on data to perform the desired calculations of their producers" Williamson (2015b) citing McKenzie (2015).*

Having described in brief terms how 'learner experience variables data' might be incorporated into analytics and machine learning (ML) for intelligent content delivery (8.4.1), it is useful to examine some of the contested areas of ML. A purpose and motivation for illustrating the 'learner experience variables data' concept was to emphasise potential for completely anonymised learning interactions data that might inform guided content choices in smart learning user journeys, thereby avoiding the dilemma of personally identifiable data gathering. Nevertheless, I acknowledge the problematic nature of ML itself, and that ML is increasingly viewed with (justified) suspicion and scepticism. Williamson (2015b) describes the 'sociotechnical imaginary' that currently populates the 'dreamscapes' of educational institutions, citing Jasinoff's (2015) critique: "(i)t often falls to ... institutions of power to elevate some imagined futures above others, according them a dominant position.... Imaginaries, moreover, encode not only visions of what is attainable through science and technology, but also of how life ought, or ought not, to be lived" (Williamson, 2015b, p. 2). This brings to mind Friere's declaration that "(m)ore and more, the oppressors are using science and technology as unquestionably powerful instruments for their purpose: the maintenance of the oppressive order through manipulation and repression" (2005, p. 60).

Williamson (citing Ruppert et al., 2015) draws attention to the 'data practices' that generate digital data, "to acknowledge that the ways these data are interpreted and made meaningful are also generative of particular effects and social implications, since data and the algorithms that process them are consequential to 'what is known,' and can influence decision-making and other activities" (Williamson, 2015b, p. 2). Increasingly, issues of bias in algorithm analysis design and subsequent interpretation, particularly relating to ethnicity and gender, are gaining prominence. Silva & Kenney (2018) describe a rapidly growing literature on software-based ethnic bias, arising since the USA Obama led administrations commissioned two reports into digital discrimination (2014, 2016). Noting that "digital technologies have become more sophisticated even as they have become progressively more intertwined in social and economic decision-making" (Silva & Kenney, 2018, p. 9), they highlight that "(a)lgorithms are used to make decisions or advise on decision-making in nearly every part of social life" (p. 11). Defining an algorithm as "a process or set of rules to be followed in calculations … especially by a computer" (p. 11), they explain: "(b)ecause bias is profoundly and deeply integrated into the fabric of society, it consequently can be expected to appear in data used for algorithmic decision-making" (p. 12). For example in Internet word associations, if intelligent systems learn the properties of language enough to understand and produce it, in the process they also acquire historic cultural associations, "some of which can be objectionable" (p. 12). This has been the subject of various social media promoted advertising targeting methods (p. 12). Similarly, Sun et al. (2019), describe algorithmic gender bias in parallel ways. They note that “(t)he propagation of gender bias in Natural Language Processing algorithms poses the danger of reinforcing damaging stereotypes in downstream applications” (p. 1). In allocation or representation bias this can result in unfair allocation of economic resources, for example in automating review of job applications searching for male applicants. Sun et al. give some concerning examples of how different systems of analysis are deeply flawed in terms of gender bias for language processing (p. 2).

In educational terms, data sets and their analysis are described by Mayer-Schönberger & Cukier (2014) as ‘reshaping learning’, ‘datafying the learning process’ via real-time feedback, individualization and personalization of the educational experience, and optimize what students learn (summarised in Williamson, 2015b, p. 6). Williamson notes that educational data science is not simply a technical field of expertise in statistical analysis, but deeply rooted in ‘learning science,’ largely defined by concepts and methods from the cognitive sciences (p. 7). Added to these potentially somewhat simplistic interpretations of learning is the enormous challenge of collecting and storing vast data silos of highly detailed personalised data. Stored in, for example, the National Pupil Database (highlighted in Williamson, 2015b, p. 4), they exist in perpetuity to impact further on opportunities for the citizens contained in them. Mayer-Schönberger & Cukier note this danger of “the permanence of information about evanescent aspects of our lives, which can give them undue significance. There’s also the risk that our predictions may, in the guise of tailoring education to individual learning, actually narrow a person’s educational opportunities” (2014, p. 46).

The debate around data and ‘software as a service’ in learning contains other problematic aspects. For example, the proprietary technological industry benefiting from vast amounts of financial venture capital investment through data service provision at national (or even supra-national) scale. Digital data services being offered to educational institutions expand exponentially every year. Global Market Insights (Wadhwani & Gankar, 2021) predict that E-learning sector value will expand to greater than $1 trillion by 2027, noting that growth might have been exacerbated by the global pandemic and the forced uptake of online learning. It might be argued that many offered services to institutions are (allegedly) not needed and perhaps sometimes don’t even really exist except as the sociotechnical imaginaries that populate the ‘dreamscapes’ of educational institutions. My own opinion is that ICT providers and procurement practices at institutional, national and international levels manipulate the lack of technological understanding by those who make decisions at senior institutional level.

I draw the reader's attention to related sections of this debate - the section that follows this one (8.4.3), for issues related to personalised learning and the generation of data trails, such as ethics, privacy and the digital surveillance society. Additionally, the following section (8.4.4) and chapter two (2.1.4), for issues regarding problems of intelligent 'smart learning knowledge delivery' (Lister, 2018).

8.4.3 Personalised learning experience and privacy

As much as learner experience variables data may be one potential way of rethinking provision for a smarter more personalised but anonymised learning, the challenge remains that intelligent personalised learning is often emphasised as a central approach of smart learning cities (Koper, 2014; Nikolov et al., 2016; Badie, 2018; Henning, 2018) without adequate consideration for the ethical position of data. Relying on personal learning ontology data (Rezgui et al., 2014) is now a growing problem regarding privacy issues. In 2012, Ryberg et al. presciently point out the problematic nature of data gathering in technology-enhanced learning. They explicitly highlight surveillance, as well as potential behavioural changes: "Personalisation requires the collection of user data and raises serious concerns in terms of privacy and surveillance. It may also have unintended consequences as once it is known that a system is monitored, user behaviour will adapt to the perceived requirements of the monitoring", (2012, p. 47). Taking one example, Henning's 2018 concepts of "each small and indivisible (atomic) Knowledge Object … contributing a single bit to a possible very large string describing a cognitive position of the learner" and "the accumulation of precise meta data about the learning process" (Henning, 2018, pp. 282, 283) paints a rather ominous picture of precise surveillance detail, including the learner's mood from the speed of typing and tracking eye movement across a text or image (p. 284). This may not now be seen as an advantageous position by which we conceptualise smarter learning systems, in the context of the growing 'surveillance capitalism' (Zuboff, 2019) that now pervades much technological implementation.

My study has taken the approach of using ad-hoc free mobile apps, put together for purposes in the community 'in the wild', envisaged as something any citizen could do without the need for sophisticated infrastructure or heavy expenditure. While it is certainly true that data is still collected, and that participants would be using accounts with usernames and passwords, the control of each learner is stronger, and the nature of data collection is not centralised into a single database. In this researchers mind, a way forward might be to focus more on agnostic platform application programming interface [44](API) connectivity between any number of apps and learning management systems, and the knowledge networks they seek to access or contribute to. This might act as a guardian of data ownership and a gateway for personal control of permissions. By removing the personal profile ontology aspect of learner experience data gathering and recommender system approaches, privacy is more protected, and ownership of data becomes distributed.

8.4.4 Smarter knowledge networks

In light of Siemens prescient quote: “(w)hat happens when the knowledge we require is presented to us without having to consciously seek it (artificial intelligence)?", (2006b, p. 55), the question remains of what a ‘smart pedagogy’ might look like, and how it is relevant to smart learning activities. When Siemens writes: “… do we design learning? Or do we design environments in which motivated learners can acquire what they need" (Siemens, 2006b, p. 119), he alludes to smart environments as we see them perhaps especially in technological terms. Dron doubts the pedagogical value of technology to make a learning environment smarter (Dron, 2018), yet technological mediation of access to information has become commonplace through the pervasive uptake of apps such as Google Lens[45], an information augmented reality camera that can recognise more than a billion items (Synek, 2018). Information has the potential for smarter delivery, as apps such as this, or What3Words[46], potentially another method by which context aware knowledge might be accessed just-in-time (Schiltz et al., 2007; Blaschke & Hase, 2016, p. 29), become ubiquitous smartphone functionality. Siemens outlines the difference between fixed taxonomies and information ‘streams’, saying “(w)e do not yet have the tool that permits ‘stepping into the stream’”, (2006b, p.54), but in 2020 we do have the tools, or at least some of them, to access the information ‘streams’ in multiple different ways.

Considerable research exists relating to methods by which information can be delivered in smarter ways (e.g. Gyrard, Patel, Sheth & Serrano, 2016; Zouaq, Jovanović, Joksimović & Gašević, 2017). I have argued in 2018 that the knowledge commons[47] might make use of simple metadata properties from the Open Graph[48] (Lister, 2018), with perhaps only one or two additional useful pedagogical properties being added to those already existing, similar to Badita (2016). This topic can be a contentious issue amongst researchers, with different

[44] API https://en.wikipedia.org/wiki/API
[45] Google Lens see footnote 33
[46] What3Words see footnote 34
[47] Knowledge Commons definition: https://en.wikipedia.org/wiki/Knowledge_commons
[48] The Open Graph https://ogp.me/

groups researching different methods, chief among these and potentially most popular with educators are the Open Educational Resources Schema[49], based on Google Schema[50] or the Learning Resource Metadata Initiative[51], based on the Dublin Core[52] metadata system. The key challenge with these or other systems are that they are only partially interoperable, and are often not actually used by those who publish knowledge content (Pospelova, 2014). This remains an ongoing issue for those who aim to connect the Internet of Things and Places to the connected knowledge seeker, with no end in sight. Hillenbrand (2016) alludes to this problem, when he says "(t)hese wild debates occur primarily within the technical community. The result is an echo-chamber debate that bears little connection to the nontechnical problems faced by businesses, especially consumer-facing businesses" (2018, p. 214). Replace 'businesses' and 'consumer facing business' with 'educators and 'citizen-facing educators' and the issue is the same.

8.5 Summary, chapter eight

The discussion in Chapter 8 contributes further significant pedagogical considerations that in some respects could be included in the pedagogical model, however this would have complicated the clarity and purpose of the four tiers. The discussion of the 'process for and content of' learning is of value to the study both in relation to the research question and relating to overall pedagogical design concerns. The additional reflections on pedagogy of place reintroduce aspects of CHAT and Dewey's ideas of good citizenship, and again are expansions of aspects present in the PECSL model. I have also attempted to provide brief reflections on mitigating issues regarding aspects of technology in society, and possible scenarios where SLJ activities may be most relevant and useful. Personally I found this chapter very rewarding to write, uncovering much that I had not previously encountered or developing existing ideas more fully. Of particular interest for an additional paper is the exploration of sociomateriality in smart learning environments.

Chapter nine covers the validity and reliability of the research, the limits of the study and scope for further research. I then summarise my responses for solutions to the research questions, and end with final concluding remarks.

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[49] Open Educational Resources Schema http://oerschema.org/docs/
[50] Schema.org http://schema.org/docs/about.html
[51] LRMI https://www.dublincore.org/specifications/lrmi/lrmi_1/
[52] Dublin Core https://www.dublincore.org/

9 CONCLUSIONS

Here I sum up the work by acknowledging the limitations of the study, my responses to the research questions, areas of future research and final concluding remarks.

9.1 Validity and reliability of the research

I have attempted to mitigate potential weaknesses of validity of findings by undertaking several precautionary procedures in the processes for data gathering and analysis in this study. Whilst the phenomenon of investigation, the smart learning journey, is novel and thereby difficult to predict risk, the principal research instrument of interview is generally accepted as a co-constructed meaning of an intersubjective lifeworld (Sandberg, 2005; Kvale, 1996). Understanding potential limitations of self-reported experience and of language itself are briefly discussed in a subsequent section of this chapter. Here I examine the study for ontological position, and in relation to validity, transferability and bias.

The ontological and epistemological positions of this study are placed in a context of the 'constitutionalist perspective' non-dualist position of phenomenography (Wright & Osman, 2018; Prosser & Trigwell. 1999, p. 13, 139; Marton, 1996a, pp. 172-177), discussed in chapter three and elsewhere. Ireland et al. (2009) sum this up as informed by an interpretivist paradigm, where "focus is on the relation between the experiences of individuals (within a group and as a group of individuals)… describing and identifying the relational view of their experience in a given social situation or phenomenon…" (Ireland et al., 2009, p. 6). The object of interpretivist research is the "individuals' and groups' lived experience of their reality" within a "phenomenological idea of life-world", (Sandberg, 2005, p. 47). The "life-world is the subjects' experience of reality, at the same time as it is objective in the sense that it is an intersubjective world. We share it with other subjects through our experience of it…" (p. 47). This is a socio-culturally constructed continuously reconstituted reality, as we are “constantly involved in negotiations with other subjects about reality in terms of our intersubjective sense making”, (Sandberg, 2005, p. 47; Roisko, 2007, p. 51; also e.g. Shotter, 1993, p. 129).

Noting that Marton rejects both individual and social constructivism (e.g. Marton & Booth, 1997, pp. 6-12, p.139), and that this is contested by for example Richardson (1999, p. 65), nevertheless I have attempted to reconcile the epistemological positions of learning theories that somewhat challenge the assertion of non-duality entailed in phenomenography (Marton, 1996, pp. 172-177). I feel this is partially successful through examining Dewey’s positions on experience (in Dahlin, 1994; Jayanandhan, 2009) in the context of the phenomenographic position of research to adopt a second order perspective (e.g. Marton, 1996, p. 185; Sjöström & Dahlgren, 2002, p. 340), interpreted as parts of the intersubjective lifeworlds (Sandberg, 2005) of participants in smart learning journeys.

9.1.1 Validity and transferability

The assertion of the researcher is that findings (results) and tentative conclusions contributing to a pedagogical guide for smart learning are valid within acknowledging the nature of these as a ‘snapshot’ (Trigwell, 2000, p. 81; Åkerlind et al., 2005e, p. 81) of potential ways of experiencing smart learning journeys. Overall, usefulness of research to apply in further contexts relating to the pedagogy of experience complexity for smart learning is therefore subject to acknowledging these limitations.

Booth (1992) nominates three areas to consider the validity and trustworthiness of phenomenographic research as Content-related validity, Methodological validity and Communicative validity (Booth, 1992, pp. 65-69). Content-related validity means that the research “has to be grounded on a sound understanding of the subject content” and that “the researcher must understand and identify with the topic which is at the heart of the study” (pp. 65-66), further described by Collier-Reed, Ingerman & Berglund (2009) as “a researcher having a comprehensive grasp, or understanding, of topics related to the phenomenon under investigation”, (2009, p. 7). In this study I have provided my background suitability as a researcher, demonstrating prior knowledge, awareness and experience of early smart and location based technologies, as well as pedagogical understanding and relevant professional experience, outlined in chapter one, ‘My position as the researcher’. I assert that though this provides solid grounding for the research, it is not ‘close enough’ to have influenced data gathering or analysis with any presupposition. Methodological validity, as described by Booth

(1992, p. 66), is “the match between the goals of the study, its design and execution” (p. 66). That is, the suitability of research design, the participant sampling and that data is relevant for what is being studied. Additionally that analysis should be grounded in “sound practice” (p. 66). This study has utilised suitable sample populations (tertiary education level students) to examine participatory experience in smart learning activities, carrying out interviews in empathetic and responsive ways. Analysis has been sensitive to concepts and understanding of the discovery of units of meaning, from which the outcome space categories of description are derived, subsequently richly articulated to communicate findings. Booth describes Communicative validity as when “conclusions are presented to the community it relates to in terms it can understand such that they recognise themselves in the world the study describes”. In a phenomenographic study, this can be thought of as “the world in which the subjects of the research interact with the phenomena of interest to the study”, (Booth, 1992, p 67). In this study, the phenomenographic findings contribute to a wider set of conclusions regarding (potentially) useful pedagogical considerations informed by the data, and as such are absorbed into a wider world of interpretation.

This introduces the concept of applicability and transferability (Lincoln & Guba, 1985). The ‘transferability’ (Lincoln & Guba, 1985, p. 297; Sin, 2010; Collier-Reed et al., 2009) of the research findings to apply in other situations, either the experience complexity categories of description themselves, or the pedagogy of experience complexity for smart learning that arises out of them, can be thought of as an exercise in venturing into the lifeworld of a participant in a smart learning journey, that may be relevant to other situations. Collier-Reed et al. (2009) refer to this as drawing on the notion of “applicability” of research outcomes (Collier-Reed et al., 2009, p. 3). Citing Lincoln & Guba, (1985, p. 298), they argue that the original enquirer cannot know to what their findings might be transferred and applied to, but that the appliers can and do (Collier-Reed et al., 2009, p. 4). The emphasis on the original researcher is to provide sufficient detail and description to enable the reader to make a judgement between study and applied scenario. This supports Cope’s (2004) and others emphasis on the significance of process and research setting being articulated in detail with “thick, rich descriptions” (Creswell & Millar, 2000, p. 128; also Creswell, 2009, p. 200; Mertens & McLaughlin, 2004, p. 107). I have attempted to provide detailed articulation of data gathering, analysis and findings such that this might support relevant interpretation for further transferable application in settings that might be somewhat similar to those of this study.

Booth refers to reliability in a phenomenographic study as somewhat like a journey of exploration: "(t)he very design of the study is akin to planning an expedition … like following an outline chart while simultaneously ensuring that potentially interesting ways are followed and striking features are noted", (Booth, 1992, p. 68). Booth argues that results are "in the end a description of the territory in terms of what has been seen and experienced", and "it would not be expected that a second explorer, even charged with the same task, could tackle the journey in the same way and may therefore arrive at a different description", (p. 68). This reflects my own early thinking at the beginning of this thesis that the whole study might be referred to as a pilot study of smart learning journeys. This is not only in ways to interview or analyse data to discover meaning in experience, but perhaps even in how to formulate the phenomenon of study, and to construct meaningful conversations about it.

9.1.2 Bracketing, bias and the research process

I was aware that I needed to be watchful of types of questions and the orientation of interviews, and as such I kept questions as general as I could, only actively probing for any system element aspect that had not emerged naturally. I asked questions such as "tell me how such-and-such worked" or "tell me more about that", attempting to avoid any sort of leading, within a mutually co-constructed conversation. This helped to be "oriented toward describing what constitutes the experience under investigation, rather than attempting to explain why it appears as it does", and to "direct the individuals to the research object and what it means to them" (Sandberg, 2005, p. 60). In this study, I am investigating experiences of a smart learning journey rather than conceptions of it (Roisko 2007, p. 91), therefore explanations for why things are interpreted by participants the way they are is not of interest to the research unless it is of interest to the participant.

By using two perspectives of analysis, the primary perspective of experiencing the smart learning journey as a whole, and then the secondary system element perspective, I have sought to demonstrate the position of the perspectives of analysis by showing the contrast between them. This aids the communicability of the research, analysis and findings (Cope, 2004; Creswell & Millar, 2000, p. 4). Additionally, for 'co-judge' (Booth, 1992, p. 68) interjudge reliability (Sandberg, 1997) I employed a detailed and comprehensive second review analysis for all outcome spaces carried out by another researcher that attempts to demonstrate communicability and reliability through consistency of interpretation for the perspectives of analysis.

A further precaution of not analysing introductory questionnaire responses at any point before, during or after interviews was felt to bracket risk of subjective assumptions I may have drawn about either quantitative or qualitative reactions of participants. Volume of viewed content, number of visited locations, positive or negative responses to technology, content or reactions to the nature of activities may all have influenced how I thought about units of meaning, or how I might have interpreted categories of description. By only looking at the emergent interview transcripts I attempted to maintain a completely open mind about what was said, so that I should be "oriented to how the research object appears throughout the research process. … to be attentive and open to possible variations and complexities of lived experience", (Sandberg, 2005, p. 60).

I have felt justified in using an applied CoD findings method to analyse the LGC in this study, thereby again avoiding unbracketed presuppositions about interpreting meaning in LGC in favour of attempting a new method by which to utilise findings of interview transcript analysis. Maintaining a fresh perspective after having analysed interview transcripts would have been impossible, and likewise to have attempted analysis of the LGC before I analysed the interviews would have meant that prior assumptions from the LGC analysis were unavoidable when beginning the interview analysis.

All these precautions and methods to bracket assumptions and presuppositions in order to maintain validity and reliability have been employed to attempt the clearest and most open position of analysis. The CoD outcome spaces of both perspectives, particular the primary outcome space that was first to be analysed, have benefited from this by permitting a genuinely emergent discovery of experience variation and commonality that results in the table of experience complexity for smart learning and the resultant four tier model of pedagogical considerations.

9.1.3 The fullest range of experience variation

In terms of the range of experience variation, it is impossible to know if this study captures the full range of variation, though I have made an effort to distil the range as I have discovered it to be present across the collective of transcripts in the participants of the smart learning journeys in this study. I have taken two distinct perspectives of analysis to support discovery of ways of experiencing, looking first at the experience 'as a whole', and then second, in its board constituent elements. Åkerlind states "(i)deally, the outcomes represent the full range of possible ways of experiencing the phenomenon in question, at this particular point in time, for the population represented by the sample group collectively”, (2005b, p. 323). It is difficult to state fully whether or not ‘the outcomes represent the full range of possible ways of experiencing’ a smart learning journey for ‘the population represented’ in this study. A wide range of culturally diverse undergraduate and postgraduate students studying Education, Adult Education, English Literature and Creative Writing make up the sample groups, so perhaps within reasonable parameters of expectation, this might have been achieved. Yet, it does not account for many other reconfigured aspects of the phenomenon of a smart learning journey that may yet be researched and further articulated in other studies or projects. This relates to the applicability and transferability of the research from researcher to the applier, as they interpret it, as I discuss earlier in this section.

9.2 Limits of the study

There are several areas of this study that should be acknowledged as potential limitations, or may indicate would benefit from further research. The recruiting challenges for participants in the study, the limits of self-reported experience and of language itself, limited subject discipline scope of participants, potential gender bias and the possible impact of technology may all have influenced how data came to be analysed in the way it was.

9.2.1 Recruiting challenges

The purposive, convenience (Reed, 2006, p. 6; Edwards, 2005, p. 22; Souleles et al., 2014, p.4) voluntary participation of the sample meant that I was unable to select participants using criteria of age, gender or further relevant subject disciplines to attempt to have a wider representational balance. I was also dependant on academics who were prepared to try out this new way of learning in their current learning and teaching and available study modules.

I was able to carry out twenty-four participant interviews and though this is sufficient in number, perhaps the study would have benefited from a wider selection of participants across all groups. Participants recruited were six BA English Literature & Creative Writing, three Bachelors in Education, six Teaching & Learning MA (two separate cohorts) and nine International MA in Adult Education for Social Change. Limited subject disciplines are represented, and though they are relevant, topic area and context of study are potential influencers in the experience of a participant in a smart learning journey. In this study, topic, relevance and role of activity are impactful, bearing out Marton & Booth’s discussion of different constituent thematic fields, that “the very situation the learner is a part of provides the immediate context for learning, the sort of tasks being presented, the nature of the stuff being learned, the expectations of students, peers, teachers; forms of assessment…” (Marton & Booth, 1997, p. 141). This is discussed in some depth in chapters seven and eight in the context of experience and pedagogical relevance structures, and is worthy of further investigation in future research.

9.2.2 Gender balance

Male participant representation is low, due partly to the low number of possible male participants available in the cohort groups, and to the voluntary nature of participating (e.g. Souleles et al., 2014, p. 4). This problem is not uncommon in other studies, and any conclusions drawn here acknowledge this potential skewing of findings. Cutajar states that “(a) balanced sample in terms of gender was much harder to achieve because of the much higher incidence of male students choosing to study computing at post-secondary level”, (Cutajar, 2016, p. 52), (also Cutajar 2017, p. 5). Zhao encounters this for reasons more similar to mine, as “(i)deally the numbers of male and female subjects should be equal, but I found that this was very difficult to achieve because of the limited number of male volunteers”, (Zhao, 2016, pp. 143, 144). Notably, Reed (2006, p. 6) states that “(i)n determining the individuals most likely to provide … variation in ways of experiencing, consideration is not necessarily given to being inclusive of gender … A researcher applies his/her mind to selecting critical cases without regard to what are, in a phenomenographic sense, artificial distinctions”. Though I have had to rely on voluntary recruiting, Reed’s ‘artificial distinctions’ regarding gender may apply. This is an area of potential future research discussed subsequently.

9.2.3 Self-reported experience

The challenges of self-reported experience are various, and discussed by numerous others (Uljens, 1996; Säljö, 1997; Sandberg, 1997, 2005; Kvale, 1996; Rubin & Rubin, 2012) both in a context of phenomenography and in the wider relevant setting of the qualitative semi-structured interview. In my study, self-reported experience, placed in the recollection of a distinct past activity (Vermersch, 1996), has been interpreted and analysed acknowledging potential limitations. “What precisely is 'being talked about' in a conversation … is often at many points in the conversation necessarily unclear; we must offer each other opportunities to contribute to the making of agreed meanings”, (Shotter, 1993, p. 27). In this sense, meaning is mutually negotiated and clarified: “people mutually judge and correct both each other and themselves as to the 'fittingness' of their actions to what they take their reality to be. As Wittgenstein … insists, 'if language is to be a means of communication there must be agreement not only in definitions but also (queer as this may sound) in judgments'", (Shotter, 1993, p. 40).

In this study, I acknowledge the potentially limited number of ways of talking about a phenomena as perceived in a particular situation and that utterances made by people and then transformed into categories of description may not mean the same thing in the different contexts (Säljö, 1997). Data collected and then "transformed into categories of description" (Säljö, 1997) are regarded as 'snapshots' (Trigwell, 200, p. 80; Åkerlind et al., 2005e, p. 81) of how groups of people at a specific moment in time, relating to a specific past event, chose to express their experience. In this sense I am not attempting to formulate a theory, rather a way of understanding or interpreting such conversational experience articulations in the context of the study.

Åkerlind's (2005c, p. 66) assertion that hypothetical idealised practice or ideas are valid aspects of a phenomenographic interview is both reassuring in the context of my own work, but can also be contested when considered in the light of giving opinions. My own view in relation to analysis of transcripts is that a self-reported opinion is an aspect of experience in the sense of the past event and its context as experienced and interpreted by the participant. Further considering what may constitute an experience, Säljö remarks on the learned and endlessly recycled ways in which the stories of experience are retold, "(w)hat I talk about as my experience of a phenomenon or a situation, is an account borrowed from stories that other people have been telling before me (and that I use in innovative and unique combinations)…" (1997, p. 184). In this way, we socially construct our mutually understood reality (Shotter, 1993). Cultural differences, background, ethnicity, ways of expressing, articulating and use and context of the English language all impact how an interview proceeds, and the mutual constructing of meaning that interviewer and interviewee establish over its duration. The age and maturity of the participants, their ability to express themselves, the self confidence to discuss and reflect on their own thoughts and feelings, in a further complex context of higher education power structure and hierarchy can additionally impact roles in an interview setting, much of this having been previously discussed in chapter three.

The issue of leading participants in the way of co-constructing meaning is acknowledged here, (though again is substantially discussed in chapter three). Kvale makes clear his position regarding amount of questions and 'leading the witness':

> *The fact that the issue of leading questions has received so much attention in interview research may be due to a naive empiricism. There may be a belief in a neutral observational access to an objective social reality independent of the investigator, implying that an interviewer collects verbal responses like a botanist collects plants in nature or a miner unearths precious buried metals. In an alternative view, which follows from a postmodern perspective on knowledge construction, the interview is a conversation in which the data arise in an interpersonal relationship, co-authored and coproduced by interviewer and interviewee. The decisive issue is then not whether to lead or not to lead, but where the interview questions should lead, and whether they will lead in important directions, producing new, trustworthy, and interesting knowledge. (Kvale, 1996, p. 159)*

This quote is relevant especially to Bowden's (2005, p. 12) position on asking as few questions as possible, appearing to place himself in the way of 'naive empiricism' that Kvale alludes to here. Again I reiterate that interviews are potentially the only way that individuals may communicate their interpreted meanings of experience and as such need to establish shared definitions (e.g. Reed, 2006, p. 5), and understanding "in an interpersonal relationship, co-authored and coproduced by interviewer and interviewee" (Kvale, 1996, p. 159).

9.2.4 Technology Impact

The combination of apps and services that provide the technically mediated interactions and functionality of the smart learning journey activities in this study were in general found fairly easy and understandable to use. For example, it was noticeable that participants did not talk about the icons and the AR interface used in the AR triggers, as all seemed to know how to use them, and what the icons were for (what they meant). It is possible that this is part of a process that "technologies and people fold into each other. Human and non-human actants are in a co-constitutive relationship" (Thompson, 2012, p. 160). Thompson refers to Actor Network Theory, which "advocates that actants – human or non-human – are co-constituted in webs of relations with other actants", (p. 160). Jones (2018) cites Thompson in similar context (p. 42), and Gourlay & Oliver (2018, p. 83), outline a "sociomaterial model which seeks to include the material in how we conceive of agency", also citing Fenwick et al. (2011). This reaffirms observations made in chapter two, and in chapter seven (Tier 4) regarding the potentially important role of CHAT and ANT for the epistemological intertwining of learning, technology and socio-cultural setting. Though it was noticeable that technology was not at the forefront of a majority of participants minds in terms of the emphasis and context of what they talked about, many reported some experience focus where the AR technology provided a structural aspect of variation that contrasted with another referential theme of meaning. For some it may also have provided the referential, the meaning. It was up to participants how they may have chosen to talk about technology, some emphasising its role, others hardly mentioning it at all.

Participants reported that sometimes the augmented reality (AR) did not ‘work’. This may have been for numerous reasons, hard to define unless participants themselves were fully familiar with the technical aspects of HP Reveal and able to articulate them. P12 referred to instructions being easy, and P8 to fellow students not following instructions. P11 noted she had not followed instructions at first, but after she did, it was easy. P9 noted that AR success was not ‘to do with brands’ of phones, P15 to sunlight or lack of it affecting the ability for HP Reveal to trigger the AR interfaces, and so forth. Some participants also reported that the AR worked ‘straightaway’ (e.g. P23). Sometimes, using the Google map of the journey may have also been challenging (e.g. P7), or how to save links of website pages. The secondary perspective of analysis for the system element of ‘Technology’ permitted the ability to discover experience variation and commonality for these technological aspects, which may have also included conversations about use of other apps such as Facebook or WhatsApp in learning activities, as well as the apps used in the smart learning journeys. This discussion is developed further in my forthcoming HCII2022 paper, ‘Ways of Experiencing technology in a Smart Learning Environment’.

In discussions in class with those activity participants who were not directly part of the research it was a useful exercise in reflection about how technology may impact user experience of an activity. I was able to reflect on the ‘future-present’ (Kitchin, 2019; Ireland & Johnson, 1995; Husman & Lens, 1999 in Lister, 2022) nature of the technology used, as no single app yet existed to achieve what we were doing. I would use words like ‘it’s a bit clunky, but gives us an idea of what it could do’, and so forth. This was generally greeted with an awareness of the situation, as even though participants had never used augmented reality context-aware content triggers, there appeared to be an understanding of what they were or could be.

This study was not investigating the technology of the activity, and does not set out to examine human-computer-interaction factors, app user-experience or digital interaction design parameters. As such I did not make any express effort to establish any technical lines of questioning beyond a most general probing for thoughts on technology if it had not emerged naturally. I did not seek to have any information about participant prior knowledge and experience of digital skills and literacies. It was up to a participant if they wished to talk about these aspects, as some did, for example P10 or P15 referred to themselves as not very technical, but others such as P7 were very interested in the technology, regarding herself as fairly experienced yet still admitting she was not familiar with Google Maps. These anecdotes emerged naturally, and informed the participant experience as they saw it.

9.3 Solutions for the research questions

The Pedagogy of Experience Complexity for Smart Learning (PECSL) has emerged from analysis of interview transcripts and learner generated content provided by participants in smart learning journeys. It has come about as a natural progression of considering this data in contexts of related pedagogy to support planning for experience complexity, and the nature of the connectivist inspired activities that formed the smart learning journey phenomenon of investigation. This fluid pedagogical guide offers potential pragmatic solutions to issues raised in the research questions, described in detail in chapter seven and further discussed in chapter eight. Here I summarise how I see these solutions in their direct relationship to respond to the research questions.

9.3.1 1. How can we measure the effectiveness of smart learning experiences considering both content of learning and process for learning?

This study has attempted to shed light on how learners perceive learning in a smart learning journey. Participants have shared their experiences of participating in these activities and in so doing have given clues about what may constitute aspects of learning to them (Roisko, 2007, p. 23). I have attempted to define effectiveness of this learning in smart learning journeys as reflecting principles of transversal skills such as participation, empowerment, self-realisation and efficient, engaged learning (Dron, 2018; Liu et al., 2017; Spector, 2014). This learning is planned and unplanned (Dron, 2018), explicit and also hidden (Marton & Booth 1997, p. 140), noting intrinsic and extrinsic motivation (Dron, 2018) and the wider relevance of learning beyond immediate obligations or tasks that may impact activity effectiveness (Marton & Booth 1997, pp. 143, 169). Measuring this wide range of learning is therefore challenging.

The primary outcome space for experiencing the smart learning journey as a whole may offer some understanding of how learning might be experienced in a range of complexity, the categories of description and levels of complexity in each indicating process for learning and content of learning as an intertwined relationship. This can be interpreted as levels of surface to deep learning (Marton & Säljö, 1976) engagement, and as such may offer ideas and understanding for measurement through progression towards deeper levels of rich and complex experience for each of the categories (and potentially others not yet known or discovered). Noting that process for and content of learning are intertwined in these kinds of activities, it is significant that any attempted measurement would acknowledge this symbiotic relationship, utilising activity plan and tasks to harness potential process activity interactions feeding directly into engagement with content and knowledge (see also chapter seven). Expanding concepts for process and relationships to relevance structures in the PECSL may offer support and ideas for achieving this.

By articulating surface to deep learning descriptions (referring also to Hounsell, 2005) with equivalent categories and levels of experience complexity for smart learning, then adding the Bloom's Revised (Anderson & Krathwohl, 2001) and SOLO (Biggs & Collis, 1982) taxonomy related values, possible mechanisms by which we can measure these ranges of surface to deep experience complexity and their equivalent learning are defined. By conceptualising appropriate criteria using this system, measurement of effectiveness of learning in this fluid and flexible scenario might be achieved. Table 15, reproduced from chapter five, and Figure 29, reproduced from chapter seven, provide at a glance relationships to illustrate potential measurement of pedagogical factors with these cognitive domain taxonomies.

	Cat A Tasks & Obligations	**Cat B Discussing**	**Cat C Being There**	**Cat D Knowledge & Place as Value**	**Surface to deep learning relationships**	**Bloom's Revised**	**SOLO**
Level 4	4A	4B	4C	4D	DEEP APPROACH shows intentionality for tasks, topic, knowledge and locations to contribute to argument; to understand further potential interpretation (inter/intra); ideas, application	5/6	4/5
Level 3	3A	3B	3C	3D	SURFACE TO DEEP #2 moving towards 'argument' concepts; tasks and journey begin to be seen as indirectly relevant to wider settings; more reliant on imagination, creativity, inventiveness, inspiration	4	3/4
Level 2	2A	2B	2C	2D	SURFACE TO DEEP #1 some engagement with 'viewpoint', building elements of meaning and connection	3	3

					resulting from the journey participation		
Level 1	1A	1B	1C	1D	SURFACE APPROACH shows intentionality of doing tasks as fact, 'arrangement' only. The bare minimum required.	1/2	1/2

Table 15 Description of surface to deep learning with Bloom's & SOLO taxonomies in relation to CoD levels of complexity using code representations (RQ1 solution)

Categories of description	TASKS & OBLIGATIONS	DISCUSSING	BEING THERE	KNOWLEDGE & PLACE AS VALUE	BLOOM'S	SOLO
RELATED PEDAGOGY	INQUIRY BASED	DISCUSSING	PLACE BASED	CREATIVE		
LEVEL 4 COMPLEXITY	*DEEP APPROACH shows intentionality for tasks, topic, knowledge and locations to contribute to argument; to understand further potential interpretation (inter/intra);*				5/6	4/5
LEVEL 3 COMPLEXITY	*SURFACE TO DEEP #2 moving towards 'argument' concepts; tasks and journeybegin to be seen as indirectly relevant to wider settings; more reliant on imagination, creativity, inventiveness, inspiration(inter/intra); ideas, application*				4	3/4
LEVEL 2 COMPLEXITY	*SURFACE TO DEEP #1 some engagement with 'viewpoint', building elements of meaning and connection resulting from the journey participation*				3	3
LEVEL 1 COMPLEXITY	*SURFACE APPROACH shows intentionality of doing tasks as fact, 'arrangement' only. The bare minimum required.*				1/2	1/2
Pedagogical relevance summary description	About tasks and assessment. Relevance of activity to coursework or purposes, assessment, further usefulness.	About discussion and collaboration. Considerations concern how to expand participation to include the 'dialogic space', collaborating, discussing, sharing.	About being in the place, support by showing learner how to engage in the place, with specific indicators and clues or prompts.	About value of knowledge in the place, specified by location, time and relevance to other categories. Applying, creating knowledge bound by place with value.		

Figure 29 Pedagogical alignment for experience CoD and surface to deep learning experience complexity of a smart learning journey with Bloom's and SOLO equivalences (RQ 1 solution)

By further utilising representational data variables to indicate levels of experience complexity present in LGC, hence measuring levels of surface to deep learning that might be evident, another concept for measurement of learning effectiveness has arisen from this study. Thinking about experience complexity as data variables permits creative thinking around concepts of machine learning for smarter delivery of user-learner journey interactions,. This could support more relevant content choices or process activities to encourage and support engagement in deeper, richer experience complexity. This is further discussed in chapter eight.

9.3.2 2. Can we formulate a practical pedagogical guide for smart learning activities based on connectivist principles?

The outcome of this study is the Pedagogy of Experience Complexity for Smart Learning (PECSL), a four-tier model of considerations that may offer support for scoping, planning and designing smart learning journey activities. The basis of this model has been derived from the categories of experience variation emerging from the self-reported experiences of participants in two smart learning journeys that have been analysed within a phenomenographic approach. A summary overview diagram of this model is provided below (Figure 30), indicating CoD, related pedagogy, key pedagogical relevance factors and relevant theoretical underpinning. Further detail, diagrams and tables are found in chapter seven.

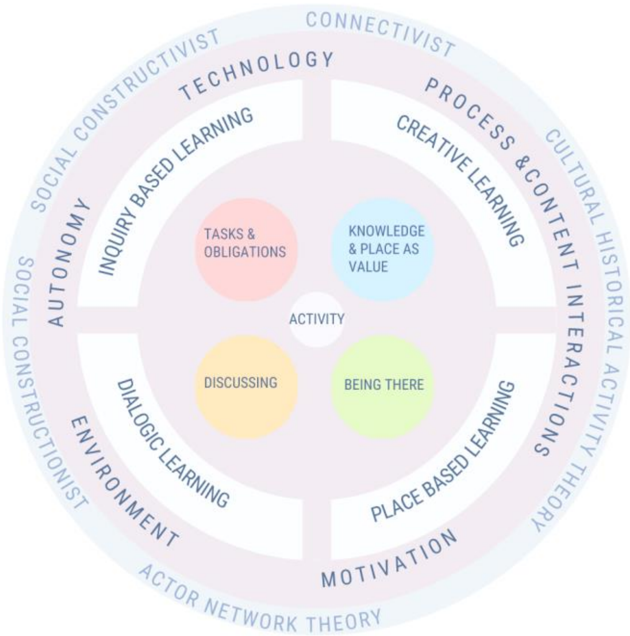

Figure 30 Visualisation of the four-tier model of the Pedagogy of Experience Complexity for Smart Learning, (1) the CoD experience variation relevance, (2) related pedagogy, (3) pedagogical relevance factors and (4) theoretical underpinning (RQ2 solution)

Connectivist principles are shared by numerous other pedagogical positions, noted as common to a 'connectivist generation of pedagogies', (Dron, 2018). Many of these factors may be reflected in connectivist inspired smart learning activities, but perhaps not all at the same time in the same activity. Connectivist principles formed the basis for the learning activities in the smart learning journeys of this study, emphasising factors of participatory, collaborative, autonomous and connected learning. Activities were not obligatory and were not assessed, though tasks were set, and instructions were provided. Aspects noted in Dron (2018, p. 14) considered as key features of these activities would be that learning is primarily a process of connection and creation and should be both innately personal and social. Additional considerations of the challenge of surplus knowledge resources, that learning may reside in human and non-human entities, and of knowing where to find knowledge were partially impactful. Augmented reality was used to access prescribed curated content that may have been supplemented by learner discussions and/or LGC (found or created) in these activities. Therefore, in the sense of a general pedagogical approach, connectivist principles are at the heart of the PECSL, but may not adequately account for the learning that is going on from an epistemological perspective.

The PECSL has based itself in data gathered from a phenomenographic investigation of experiencing a smart learning journey. Focus is on “the relation between the experiences of individuals (within a group and as a group of individuals)… describing and identifying the relational view of their experience in a given social situation or phenomenon…”, (Ireland et al., 2009), and on learning as they experience it. Roisko offers precedent for this position, as her research addressed “the learners’ perceptions of their learning experiences and therefore does not even try to distinguish actual (real) learning from perceived learning”, (Roisko, 2007, p. 23). In this context, epistemological foundations for the PECSL have been conceptualised as an integrated mix of the ‘constitutionalist perspective’ non-dualist position of phenomenography (Wright & Osman, 2018; Prosser & Trigwell. 1999, p. 13; Marton, 1996a, pp. 172-177) in a pedagogically social constructivist and constructionist interpretation of connectivist inspired activities that formed the smart learning journeys. It has been noted that cultural historical activity theory and actor network theory additionally play a part in attempting to account for the kinds of learning going on in a smart learning journey.

In light of the relational structure of the PECSL, a key pedagogical factor of learning experience might be that of motivation. Siemens refers to the significance of motivation and its relatedness to relevance as: “(a) learner must be able to see relevance. If relevance (determined by the individual) is not ascertained, motivation will not be enacted. Lack of motivation results in lack of action … (r)elevance, however, is not only about the nature of content. The process of ensuring currency of content/information is critical…” (2006c, p. 8). This highlights the relational connection between the relevance structures of the PECSL and the noted importance of motivation in a connectivist context. Noting that currency of content for learning may be “more of an issue for some subjects than others” (Smith, 2010, p. 251) motivational relevance may be as much impacted by global aspects of learning (Marton & Booth, 1997, p. 141) and the wider hidden agendas of how activities are positioned within the perception of the learner. This indicates importance for how relevance structures - experience complexity and pedagogical - can impact any pedagogical or epistemological considerations. Overall, the PECSL is considered as having a basis in connectivist principles - perhaps with a small ‘c’ (Dron & Anderson, 2014, p. 48), placed within these relevance structures and the resulting pedagogical practices and epistemological contexts.

Connectivist inspired smart learning may be best suited to informal or non-formal learning, as "in connectivist space, structure is unevenly distributed and often emergent, with that emergence seldom leading to structure that is optimally efficient for achieving learning goals", (Anderson and Dron, 2011, p. 89). This supports the types of emergent non-mandatory non-assessed activities of this study, and may be relevant when considering the relevant application of this pedagogical guide to other activities.

9.3.3 3. How does this pedagogical guide inform the design of smart learning?

In acknowledging the potential nature and measurement of effective learning that might be derived from the PECSL, several key areas are impacted for design of learning activities. These are summarised below, having been previously discussed in chapter seven as an iterative learner-centred design process. They may not be enacted in the same order for every type of activity, however, importance of environment and experience complexity are perceived as significant to inform this process. Figure 31 (reproduced from chapter seven) illustrates the circular stages of iteration.

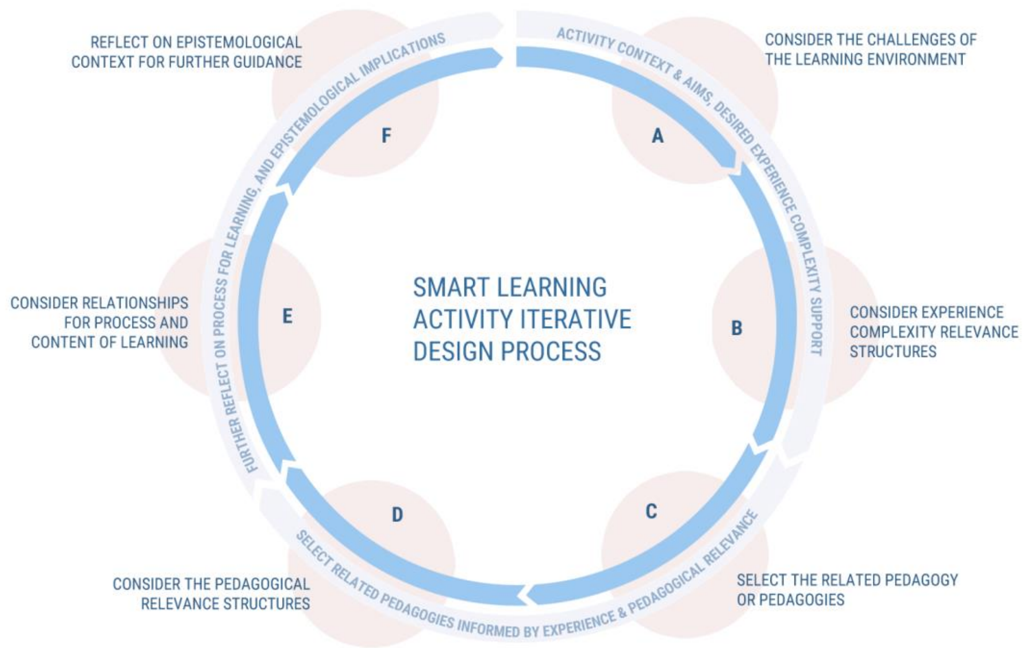

Figure 31 Iterative design process for a smart learning journey, using the four-tier model of the Pedagogy of Experience Complexity for Smart Learning (RQ3 solution)

A) Consider the complexity of the environment

Siemens asks: "… do we design learning? Or do we design environments in which motivated learners can acquire what they need?" (Siemens, 2006b, p. 119). Having examined the complexity of the smart learning environment in chapter seven, I offer key aspects for consideration. Chief among these are Goodyear & Cavalho's (2012) three layer architecture: the physical of tools and (digital and other) material world resources, the social of interpersonal relationships and the epistemic of knowledge and ways of knowing (Goodyear & Cavalho, 2012, pp. 49-60). As Dron notes, "smartness emerges as a result of structure and interaction, whether or not either aspect is mediated or enacted through digital technologies", (Dron, 2018, pp. 2, 3).

B) Plan for experience complexity

Experience complexity is present, whether planned for or not. Being able to plan beforehand for the kinds of experience that may be possible, desirable or indeed problematic can aid the overall integrated structure and interaction of the activity. Technology is only a part of this consideration, perhaps impact of activity relevance, tasks, topic, social, cultural or environmental considerations being equally significant.

C) Consider the choice of related pedagogy

Depending on the nature of the activity, the choice of related pedagogy will determine the type of relevance that the learner perceives. This needs appropriate framing, just as in any other learning and teaching context.

D) Plan for the pedagogical relevance of motivation

Consider the 'global aspects' of learning, the hidden agendas that may be present (as perceived by the participant), and how these impact the activity, motivation and engagement. The situated-ness of the activity is as much part of how it is experienced as the activity itself.

E) Plan for process and content integration

Consider the significance of how process for learning in the activity interrelates with the knowledge content provided, or created by participants (see chapter eight). These are two sides of the same coin, a symbiotic intertwined relationship that can work effectively together to enable deeper and richer experience complexity for the participant.

F) Reflect on epistemology

Reflect on roles for individual and social construction of meaning, the continual reconstituting of the person-world relationship (Wright & Osman, 2018; Prosser & Trigwell. 1999, p. 13, 139). Consider how connections in digital networks might impact access to knowledge and therefore meaning making with both human and non-human agents. Consider the cultural context, rules, division of labour and other aspects of socio-cultural activity, that situated place is as much cultural as task or topic, that expectations or assumptions of activity purpose can be impacted and informed by epistemological contexts.

This is an iterative, circular, learner-centred design process, where stages can be revisited and reimagined in any order as the design of the activity progresses. This permits flexibility, adapting to any type of activity, refining design as considerations might indicate.

9.4 Further scope for research

Within the scope for further phenomenographic research arising from this investigation, a number of areas are evident. I summarise these here, utilising the headings of activity, pedagogical and smart territories.

9.4.1 Activity territories

Particularly with relevance to supporting citizen engagement, digital skills, literacies, activities might be researched that either already exist or that could be implemented with relevant community organisations using free apps and working with suitable local stakeholders. The need to establish how different kinds of smart activities might be positioned to support digital skills and literacy development whilst at the same time fulfilling a more immediate need is potentially a pressing and highly relevant area for current research focus.

Activities such as urban renewal feedback, city garden planning or local arts features might support community development in wider settings and increase digital skills literacies as a consequence of the activity, while not being an explicit aim or purpose. Case studies cited in Lister (2020) indicate that many kinds of relevant activities are already taking place that may be suitable for research into phenomenographic user experience investigation, additionally re-adapted for attempting to support digital skills training and advocacy. Citizen initiatives are well positioned for this dual-purpose approach, as I argue in chapter eight.

9.4.2 Pedagogical territories

For tertiary education, investigating different subject disciplines at different levels of study in the use of situated smart learning activities might offer very useful data to contribute to the PECSL pedagogical guide I have formulated in this study, and may highlight alternate categories of experience variation that may be relevant to some subject areas but not others. The role of activities is highly flexible, with a wide variety of options for formative and summative assessment. Group project-based creative learning in long form study units with interdisciplinary collaborations across faculties, such as the module that the Literary London smart learning journey was part of, offer rich potential for longer investigations across disciplines.

For school age students, examining this kind of activity for possibilities of design and role is as yet a novel area of research. Taking into account issues regarding young student autonomy in safe locations, encouraging student self directed learning in younger learners, and exploration of free apps for limited time use and user account duration (thereby assuring data protection over time) might tell us more about how young students react to participating in this kind of semi-autonomous self directed and technologically mediated experience.

Gender bias may be an issue as previously highlighted, and this may deserve more careful and deliberate research using a phenomenography methodology. Phenomenographic experience data is gathered using narrative forms of interview or written reflection that may be more suited to females (Entwistle, 1997, p. 132) but in phenomenographic investigations relating to technology enhanced learning it appears that males may be more represented overall than females (Souleles et al., 2014, p. 4; Cutajar, 2016, p 52 and 2017, p. 5). It is worth citing Reed (2006) again, when he states that gender may be an ‘artificial distinction’ in the phenomenographic sense, when determining individuals most likely to provide ways of experiencing (Reed, 2006, p. 6), however within the scope of pedagogical approaches to the design and implementation of smart learning journey activities this may offer a rich area for future investigation.

9.4.3 Smart territories

The terrain of available apps for ordinary citizens, often free, is in continual change, with even the augmented reality (AR) app used in this study, originally called Aurasma, then renamed as HP Reveal, now being completely defunct as of Spring 2020. No other augmented reality app yet exists (as far as I have been able to establish) that offers a free or cost effective way of creating AR information content delivery for use in short-life activities, though Google Lens offers unique and engaging access to at least a billion objects, which include buildings, monuments, plants, animals and so forth. In conjunction with other free apps such as DBPedia Places, What3Words and 3WordPhoto, and a wealth of other nature and urban walking apps, there is a strong presence of third party smartphone apps circulating that might be utilised for creative and engaging smart learning activity research. This terrain is in perpetual flux therefore needs to be undertaken with that in mind, however that may be part of the researched phenomena of interest, to review this wealth of app choices and purposes.

As previously described in chapter six regarding the findings of learner generated content, it may be possible to undertake research to establish greater understanding of how to utilise experience variation for smarter delivery of knowledge content, and greater engagement flexibility for participant users without compromising data privacy. Measurement of levels of experience complexity using variation data representation, this in conjunction with established learning taxonomies, might contribute to machine learning algorithm approaches that do not depend on basic website analytics such as time on page, duration of video played etc., or amount of interaction clicks. This is new territory and would require careful thinking and working alongside data specialists and machine learning researchers more familiar with behavioural data techniques.

9.5 Concluding Remarks

In my concluding remarks I reflect on various aspects of the study: the problematic nature of defining smart learning, my position regarding connectivism, reflections on the methodology and on the study itself.

Investigating smart learning was always going to be somewhat of a challenge. Even to make working definitions of smart learning or smart pedagogy are fraught with ‘conceptual uncertainty’, dependent on the perspective of the argument at hand (Budhrani et al., 2018). Depending on the reader, different assumptions, expectations and understandings of what it means to be ‘smart’ influence how this type of study is interpreted. Dron (2018), perhaps considered as outside ‘the paradigm of smart learning’, candidly observed that the smartest learning environment is the one-to-one teaching scenario, because that is ‘where learning occurs’. It is not possible to argue that ‘smart pedagogy’ has one paradigm or any established epistemological position, only that perhaps pedagogical approaches are often associated with technical systems. Literature explicitly describing ‘smart learning’ repeatedly calls for new pedagogies (e.g. Hwang, 2014; Gros, 2016a; Kinshuk et al., 2016), with debate focused on ‘novel’ technologies, automated learning systems and personalised learning, though occasionally learner-centred strategies co-exist within these contexts. I have attempted to summarise this broad and unpredictable ever-changing terrain of digitally connected learning in chapter one and two.

My aim in this study was to find a pragmatic, authentic way of investigating what and how learners might be learning in digitally augmented environments, and to find pedagogical solutions for design and development of creative activities in a wide range of scenarios, based on research findings. If this offered any mechanisms for measurement of learning then perhaps that was a bonus, when considered in light of the highly divergent nature of these smart learning environments.

To foster a position of real-world authenticity, the study investigated ad hoc ‘in the wild’ (Carroll et al., 2013) smart learning activities using freely available smartphone apps to create two smart learning journeys based in connectivist principles. These activities were located in the City of London, UK and in Valletta, Malta. I conducted semi-structured emergent interviews in a context of phenomenographic methodology with twenty-four participants who volunteered to take part in the research. Focusing somewhat on potential pedagogical aspects of interest, I analysed interview data to the best of my ability using the phenomenographic method of interpreting participant structures of awareness from the participant point of view, to ‘put myself in their shoes’ (Badie, 2018).

The primary phenomenographic outcome space of the study, ‘Experiencing the Smart Learning Journey’, consisted of four categories of description with four levels of experience complexity. I asked myself the question, how could I plan for this kind of experience variation and complexity? By considering the primary outcome space as experience relevance structures I was able to scope related pedagogies, subsequent pedagogical relevance structures and epistemological underpinning. These layers of considerations became known as the Pedagogy of Experience Complexity for Smart Learning (PECSL). The PECSL is proposed as a ‘thinking and planning’ model rather than a set of instructional design guidelines, and was inspired in part by UCD techniques (e.g. Garrett, 2010). I realised through consideration of similar frameworks (e.g. The DigComp 2.1, Carretero et al., 2017) and related literature (Newton & Martin, 2013; Taylor & Cope, 2007; Badie, 2018) that introducing cognitive domain equivalences using learning taxonomies could assist in interpretations of the PECSL model for developing learning measurement. This system is tentatively proposed as a foundation for potential rubric design approaches, dependent on the nature of the activity (and possible learning goals) being designed for.

In using the phenomenographic approach to investigate the complexity and variation of participant experience in smart learning activities, I have sought to establish the nature of learning effectiveness from the perspective of the participant. This has led to further understanding that unplanned or incidental learning may form significant parts of this kind of learning experience. Being able to plan for and measure this multilayered learning is a challenge, and the PECSL is one attempt to do this. Other studies investigating smart learning activities may discover different aspects of significance, depending on the nature and areas of interest in their study. Though not intended as a definitive guide, the PECSL model may act as a roadmap of understanding some experience complexity in smart learning.

Since the conception of connectivism in 2005 much digital learning has taken place, most of which would not describe itself as connectivist, and in this study I interpret connectivist principles as the broad range of shared digital learning pedagogies as described by Anderson & Dron (2011). I have not attempted to 'account for learning' that may be going on in a smart learning activity, but to reflect and contrast epistemological positions relating to activities being investigated. I contrasted relevant connectivist, social constructivist and constructionist ideas, activity and actor network theory further contributing to discussion in their potential relationships to the activities in the study. This discussion forms the fourth tier of the PECSL model and is offered as a layer of epistemological considerations for those who design and develop similar activities.

My own view of connectivism as an epistemology is that it is 'of its time', arising out of the burgeoning World Wide Web. Ryberg et al. (2012) state that connectivism "provides an interesting and fresh view on how knowledge artefacts flow in complex social or personalised networks - particularly at levels of aggregation outside the exclusive control of the individual … (h)owever, … it leaves us with few, or unclear, analytical and theoretical notions in terms of how people make sense of and use these resources in actual practice" (Ryberg et al., 2012,

p. 55). The original intention of connectivism appears more relevant to accounting for the process of learning in digital online connections and networks such as the MOOC model, and is perhaps more suited as an epistemology for that type of distance learning. Nevertheless, the prescient observations by Siemens especially regarding smart delivery of knowledge content remain highly relevant to smart learning and pedagogies, and to digital content delivery in a general sense.

Investigation of smart learning through examination of phenomenographic learner experience is novel, and as far as is known, does not appear in literature. The phenomenographic approach to interview analysis lends itself to the experience of participating in a smart learning journey, as offers a wide possible range of what might constitute meaning and knowledge making for a learner. Being able to step into the lifeworld (Ashworth & Lucas, 2000; Sandberg, 2005) of the learner in these complex learning environments and see learning ‘from the inside’ (Berglund, 2001) can shed light on the ‘complex conversational process that can and usually does lead to much that is of value’ to which Dron alludes (2018).

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11 APPENDICES

This section provides an overview of content, key documentation relevant to the body of the thesis, and guide to supporting files submitted as digital data.

11.1 Appendix 01 Ethics & Permissions

Key ethics and permissions documents and guide to supporting information submitted as digital files.

Standard consent

Doctoral Research into Smart Learning

Participant Consent Form

Student (Undergraduate/Postgraduate)

Participant No.

1. JOURNEY AND ACTIVITIES FOR LEARNERS				
RESEARCH ACTIVITY (PLEASE TICK)	**QUESTIONNAIRE**		**INTERVIEW**	
JOURNEY (TOUR) TITLE			**CODE** *(leave blank)*	
2. PARTICIPANT DETAILS				
NAME			**M**	**F**
AGE				
EMAIL				
DEGREE TITLE AND YEAR OF STUDY				
4. DIGITAL CONTENT: COMMENTS, IMAGES OR VIDEO				
PERMISSION TO ACCESS MY CONTENT	**YES**		**NO**	
5. AUDIO RECORDING (Interview and/or Think Aloud)				
PERMISSION TO RECORD MY VOICE	**YES**		**NO**	
6. SIGNATURES				
(PARTICIPANT)			**DATE**	
(RESEARCHER) Pen Lister			**DATE**	

Guarantees

- All data collected will be treated in the strictest confidence. All responses will be separated from names and emails, to ensure full confidentiality.
- Please note that names, emails, gender, current undergraduate/postgraduate course of study and year of study will be recorded, in order to evidence that responses are true and accurate, and to make relevant reference to your demographic factors.
- If it becomes relevant to associate a particular response with the source individual, prior permission will be sought.
- **You can withdraw at any time and are under no obligation to complete any session**. No further information will be sought in relation to reasons for your withdrawal.
- Data collected will be stored in a password-protected laptop and once the dissertation will be published, all data will be destroyed.
- There will be nothing in the data collection process that will deceive you.
- Conclusions from the research will be communicated to you either verbally or in writing.
- **The research is for academic purposes**, to shed more light on the effectiveness of smart city learning in various Maltese locations, and how that might impact further adoption of such learning experiences in other urban spaces. This research will appear in the PhD dissertation and further publications.

Standard introductory questionnaire

Smart Learning Feedback Questionnaire

A few simple sections on what you thought and did when you took part in the smart learning journey. This is not a test, there are no wrong or right answers. Just tell us what you did and thought.

Name

Email

Name of Degree

Name of learning journey or activity

---

1. LOCATIONS: How much do you remember about the places you went to? *Tick one answer that best fits*

- ❍ I remember nearly everything about everywhere we went
- ❍ I remember a few things about one or two of the places
- ❍ I remember quite a lot about a few of the places
- ❍ I don't really remember anything at all about where we went

2. LOCATIONS: What do you think about being in a place that's relevant to what you're learning about? *Select all that apply*

- ☐ Being in the place makes things more distracting
- ☐ Being in the place makes things more confusing
- ☐ Being in the place didn't make any difference to learning
- ☐ I didn't like it really, it was boring
- ☐ Being in the place brings aspects to life, makes it real
- ☐ Being in the place means I understand more about what I'm trying to learn
- ☐ I didn't think it felt like learning at all because we weren't in a classroom
- ☐ I find it hard if I'm outside with friends to concentrate on what we are doing
- ☐ I don't know

3. CONTENT: How much did you read of the webpage text in the provided learning content? *Tick one answer the best fits*

- ❍ About 25%
- ❍ About 50%
- ❍ More than 50%
- ❍ I can't remember/don't know

4. CONTENT: What do you remember about ANY of the website, images and video content? *Tick all that apply*

- ☐ I remember the website text that was provided
- ☐ I remember the images, text or video that I created
- ☐ I remember the video or images that were provided
- ☐ I remember the images, text or video uploaded by others in my learning group
- ☐ I don't really remember anything

5. CONTENT: Did you upload any of your own images or videos? *Tick all that are true*

- ☐ No images
- ☐ 1-3 images
- ☐ More than 3 images
- ☐ No videos
- ☐ 1-3 videos
- ☐ More than 3 videos

6. CONTENT: Try to describe how you felt about the content you remember, using the choices below. *Select as many as apply to how you feel*

- ☐ I preferred what our group made to what was provided
- ☐ The text in some of the websites was interesting
- ☐ I don't remember any content well enough to make any comment on it
- ☐ The video I shot was useful to remind me of things
- ☐ The photos I took were funny
- ☐ The images or video I saw from others were useful for the assignment
- ☐ I didn't think a lot of the provided content was very good
- ☐ I thought the videos weren't very relevant
- ☐ The photos I took were interesting
- ☐ Something else ___________________________

7. COMMENTS: Did you make any online comments about any of the content? *Select all that apply*

- ☐ I commented on some of the videos or images from the provided content
- ☐ I didn't make any comments
- ☐ I commented on my own content
- ☐ I can't remember/don't know
- ☐ I commented on other learners content in our group
- ☐ I commented on some of the website links
- ☐ Something else ___________________________

8. COMMENTS: Do you think being able to comment and discuss things makes it easier to learn? *Select all that apply*

- ☐ Comments make things more interesting
- ☐ Comments are usually a waste of time
- ☐ Discussing the assignment in my group helped us to keep notes of our ideas
- ☐ I could ask questions and they'd get answered later, by the tutor or by other learners
- ☐ It made it a bit distracting and pointless
- ☐ I don't know

9. SHARING: Did you share any content or comments with your group? *Select all that are true*

- ☐ I shared website links for good sources
- ☐ I always shared only to our group
- ☐ I shared sometimes into the main class feed
- ☐ I shared photos uploaded by others in my group into new posts
- ☐ I shared comments from others
- ☐ I shared notes from other learners in our group
- ☐ I shared my own notes
- ☐ I shared some website content provided by the tutor/journey
- ☐ I shared my own photos or other images I'd found
- ☐ I didn't share anything as far as I remember
- ☐ I don't know

10. APPS & WEBSITES: How did you feel about using the mobile apps and websites? *Rate them for ease of use and if you had problems*

	Really good, no problems	*Quite good, seemed OK*	*Quite bad, a few problems*	*Really bad, lots of problems*	*Don't know*
EDMODO					
AURASMA/ HP REVEAL					
ANY OTHER APPS USED					
WEBSITES					

Name any other app you used: ___________________________

11. APPS & WEBSITES: Do you think using a few different apps and websites makes it hard or difficult to learn? *Select all that you think apply*

- ☐ It was confusing
- ☐ There were too many apps
- ☐ I thought the different apps or websites were interesting
- ☐ I didn't know which website I was looking at
- ☐ It didn't make any difference
- ☐ I knew about some of those websites already
- ☐ It was the same as any other Internet stuff
- ☐ I wanted to experiment more with the apps
- ☐ Something else ___________________________

12. OVERALL: What did you like or not like overall about the smart learning activity and journey? *Tick one box for each choice*

	Really liked	*OK*	*Didn't like*	*Don't know*
The mobile apps				
The places we went to				
The images or videos other learners made				
The images or video I made				
The website knowledge				
The images and video provided in the main learning content				
Being outside				
Sharing content with others				
Making or sharing comments				
Using my smartphone for learning				
Everything!				

Confidentiality

ALL YOUR ANSWERS ARE COMPLETELY CONFIDENTIAL AND YOUR NAME AND EMAIL WILL NOT BE SHARED WITH ANYONE OTHER THAN UNIVERSITY EXAMINERS AND SUPERVISORS AS PROOF OF YOUR TAKING PART.

Thank you

That's it, thanks for your feedback. All your answers are only used as part of my doctoral research at University of Malta. To find out more, go to http://smartlearning.netfarms.eu.

/ Pen Lister 2018

Standard information sheet

Doctoral Research into Smart Learning

Information and Recruitment sheet

Student (Undergraduate/Postgraduate)

I am Ms Pen Lister, a PhD researcher at the University of Malta and former senior lecturer at London Metropolitan University. I am currently carrying out research into smart learning at the Department of Leadership for Learning and Innovation at the Faculty of Education in Malta. In this research I would like to explore how people learn in technology-rich open environments through various designed learning journeys.

This research is about smart learning environments. It concerns using mobile personal technology (smartphones or tablets) to access and interact with location-based learning and augmented reality via Wi-Fi. A smart learning experience includes accessing digital content for information or to view videos, discuss topics in private or public online spaces and uploading a learner's own content to share and discuss with others. Often these learning experiences are a journey, visiting several locations connected by a single topic or issue. A map is used to see where locations are and how to get there. Usually the journey is within walking distance.

Example: a learner might go to a specific location, for example the Palace Armoury in St George's Square, Valletta, and use an app to view a specific sign or statue. By looking at this feature through the app camera it will reveal digitally accessible content 'attached' to the real world feature that can be clicked on to access websites or videos. Learners would be requested to carry out tasks, answer questions, take their own photos or videos or discuss topics online about this content.

Participant recruitment

I would be very grateful for your participation and would like to invite you to contribute to this research project, as you have taken part in a mobile augmented-reality learning journey.

1. QUESTIONNAIRE

Questionnaires used in this study are designed to include about fifteen questions, to be clear and easy to understand, and simple to fill out. These are made available online as it helps participants to take part and can be more convenient. Questionnaires can be made available in paper form if preferred. Questionnaires ideally should be completed prior to interview and can be done in the same session as the interview.

Why questionnaires are useful for Smart Learning research

This method is being used to find out what learners think about some general aspects of learning while in real world locations. All the questions are short and straightforward and can help to get the interview off to a good start. Questions are usually multi-choice or graded using a 5-point scale.

2. INTERVIEW

The interview session is a discussion with no set questions or right or wrong answers. There might be a few topics listed down to get the conversation going in the right direction, but these can change to focus more on something that comes up in the discussion, but which wasn't predicted before. The important thing is that your real thoughts about what they did and what they thought about it can be made clear to the researcher. INTERVIEWS WILL LAST FOR ABOUT 30 MINUTES.

Doctoral Research into Smart Learning

Why interviews are useful for Smart Learning research

I'm using this method to find out what a learner is actually thinking while they take part in a learning journey and what they might remember about it afterwards. This can tell the learning designers which kind of pedagogy works best, whether the technology being used is off-putting or difficult to understand, or how much the user is engaged in the learning and participation.

Audio Recording for Interview

So that I can remember what you've said, I need to record the interview session, or what you're saying as we progress along a learning journey. I'll record using a small pocket-sized audio device. I then transcribe the recording (write down everything that is said) for my research analysis. If I would like to play back short sections of what you say to others, I would ask your permission first. Your name is never given in connection with your voice recording. ***If you don't want this, I can just take notes.***

Types of digital content from learners

I am interested in all learner activity in a learning journey, for example what you click on or choose and the content or text comments you might make when you take part. Interactions made by learners may include uploading photographs or videos, discussing learning topics or sharing content into their own social media. I will ask for your permission to access your digital content.

Locations for research activities

- Locations for interviews will be at a mutually agreed suitably quiet location for the interview to take place and be recorded, most likely on the university campus.

Data anonymity

All data from any participant is treated in the strictest confidence and anonymised from personal details, to ensure your privacy and objective analysis. Please refer also to the full 'Promises and Guarantees' section.

Ways I make your data anonymous

- All participant names are replaced by a respondent code – for example R1, R2 etc. This allows me to know which participant said or did what, but also allows me to report on findings without disclosing actual names.
- For any digital apps you use during the research I will assign you a unique username and password wherever possible, and this corresponds with your respondent code.
- Only I know which respondent code matches each person's identity.
- If you choose to share anything into your own social media channels I will remove your identity from any data I select as important or significant for reporting and again, this would correspond to your respondent code. I will ask your permission before I do this.
- If any of your data is shared into my Smart City Learning social media (Facebook page or Twitter account) it will not include any of your personal or respondent code details.

Promises and Guarantees

- All data collected will be treated in the strictest confidence. All responses will be separated from names and emails, to ensure full confidentiality.
- Please note that names, emails, gender, current undergraduate/postgraduate course of study and year of study will be recorded, in order to evidence that responses are true and accurate, and to make relevant reference to your demographic factors.

Doctoral Research into Smart Learning

- If it becomes relevant to associate a particular response with the source individual, prior permission will be sought.
- **You can withdraw at any time and are under no obligation to complete any session**. No further information will be sought in relation to reasons for your withdrawal.
- Data collected will be stored in a password-protected laptop and once the dissertation will be published, all data will be destroyed.
- There will be nothing in the data collection process that will deceive you.
- Conclusions from the research will be communicated to you either verbally or in writing.
- **The research is for academic purposes**, to shed more light on the effectiveness of smart learning in various locations, and how that might impact further adoption of such learning experiences in other urban spaces. This research will appear in the PhD dissertation and further publications.

***NB** This research is not connected in any way to your unit assessment, any participation is voluntary and will not have any bearing on grades.*

Contact details

Ms Pen Lister email – penelope.lister.16@um.edu.mt

11.1.1 University of Malta

List of digital folders with supporting documentation:

- University of Malta Ethics permissions 2016
- University of Malta updated Ethics permissions 2019
- Letters & emails of declaration and permission. (Digital files)
- Sundry Documents: final extension, approval of title change, MPhil upgrade, title change and question order and wording supporting material. (Digital files)

Main Ethics permissions (letter), University of Malta

L-UNIVERSITÀ TA' MALTA
Msida - Malta
UFFIĊĊJU TAR-REĠISTRATUR

UNIVERSITY OF MALTA
Msida - Malta
OFFICE OF THE REGISTRAR

14th December, 2016

Ms Pen Lister (1509303)
Apt 25, GT Court D, Triq Jean De La Valette
San Pawl il-Bahar SPB3142

Dear Ms Lister

I refer to your request for permission to contact students from the University of Malta to participate in your research project.

The Office of the Registrar finds no objection to your request, subject to the approval of the University Research Ethics Committee.

Yours sincerely

V. Grech

Veronica Grech
Registrar

Modified ethics permissions (emails), University of Malta

Marie Therese Farrugia <marie.t.farrugia@um.edu.mt> Sat, Jan 12, 2019 at 2:04 PM
To: Pen Lister <penelope.lister.16@um.edu.mt>
Cc: Philip Bonanno <philip.bonanno@um.edu.mt>, Sandro Caruana <sandro.caruana@um.edu.mt>, Simone Galea <simone.galea@um.edu.mt>, Isabelle Warrington <isabelle.warrington@um.edu.mt>

Dear Ms Lister
Thank you for the documents in which you explained modifications in relation to your PhD study (EDU-075-16). FREC finds no ethical issues in terms of content and procedure. Under the new review process established by Senate, and in force as of 1 December 2017, UREC approval is not needed due to the fact that your study does not deal with sensitive, personal data.

You may therefore proceed to collect data from the requested University groups using the tools/documents attached in your e-mail.
regards

Dr. Marie Therese Farrugia

Chairperson, Faculty of Education Research Ethics Committee (FREC)
Faculty of Education, University of Malta

Pen Lister <penelope.lister.16@um.edu.mt> Tue, Jan 15, 2019 at 8:10 AM
To: Marie Therese Farrugia <marie.t.farrugia@um.edu.mt>
Cc: Philip Bonanno <philip.bonanno@um.edu.mt>, Sandro Caruana <sandro.caruana@um.edu.mt>, Simone Galea <simone.galea@um.edu.mt>, Isabelle Warrington <isabelle.warrington@um.edu.mt>

Dear Dr Farrugia,

Thank you for your help in this matter.

Could you please confirm in writing that data already collected (as indicated in the documents submitted) using the modified procedure is therefore admissible - as this is not made explicitly clear in your previous email.

Regards

Pen

Ms. Pen Lister MSc MA MBCS FHEA (PhD candidate, University of Malta)
PhD website - smartlearning.netfarms.eu
@penworks | skype: penworkz

[Quoted text hidden]

Marie Therese Farrugia <marie.t.farrugia@um.edu.mt> Tue, Jan 15, 2019 at 1:41 PM
To: Pen Lister <penelope.lister.16@um.edu.mt>
Cc: Philip Bonanno <philip.bonanno@um.edu.mt>, Sandro Caruana <sandro.caruana@um.edu.mt>, Simone Galea <simone.galea@um.edu.mt>, Isabelle Warrington <isabelle.warrington@um.edu.mt>

I confirm that the data already collected is admissible.
Regards

Dr. Marie Therese Farrugia

Senior Lecturer in Early Childhood and Primary Mathematics Education
Room 237, Department of Early Childhood and Primary Education
Faculty of Education, University of Malta

Chairperson, Faculty of Education Research Ethics Committee (FREC)
Faculty of Education, University of Malta

11.1.2 London Metropolitan University

List of digital folders with supporting documentation:

- London Metropolitan University Ethics permissions 2017
- London Metropolitan University Risk Assessment
- Forms & Letters

Main Ethics permissions (email), London Metropolitan University

Marie Therese Farrugia <marie.t.farrugia@um.edu.mt> Sat, Jan 12, 2019 at 2:04 PM
To: Pen Lister <penelope.lister.16@um.edu.mt>
Cc: Philip Bonanno <philip.bonanno@um.edu.mt>, Sandro Caruana <sandro.caruana@um.edu.mt>, Simone Galea <simone.galea@um.edu.mt>, Isabelle Warrington <isabelle.warrington@um.edu.mt>

Dear Ms Lister
Thank you for the documents in which you explained modifications in relation to your PhD study (EDU-075-16). FREC finds no ethical issues in terms of content and procedure. Under the new review process established by Senate, and in force as of 1 December 2017, UREC approval is not needed due to the fact that your study does not deal with sensitive, personal data.

You may therefore proceed to collect data from the requested University groups using the tools/documents attached in your e-mail.
regards

Dr. Marie Therese Farrugia

Chairperson, Faculty of Education Research Ethics Committee (FREC)
Faculty of Education, University of Malta

Pen Lister <penelope.lister.16@um.edu.mt> Tue, Jan 15, 2019 at 8:10 AM
To: Marie Therese Farrugia <marie.t.farrugia@um.edu.mt>
Cc: Philip Bonanno <philip.bonanno@um.edu.mt>, Sandro Caruana <sandro.caruana@um.edu.mt>, Simone Galea <simone.galea@um.edu.mt>, Isabelle Warrington <isabelle.warrington@um.edu.mt>

Dear Dr Farrugia,

Thank you for your help in this matter.

Could you please confirm in writing that data already collected (as indicated in the documents submitted) using the modified procedure is therefore admissible - as this is not made explicitly clear in your previous email.

Regards

Pen

Ms. Pen Lister MSc MA MBCS FHEA (PhD candidate, University of Malta)
PhD website - smartlearning.netfarms.eu
@penworks | skype: penworkz

[Quoted text hidden]

Marie Therese Farrugia <marie.t.farrugia@um.edu.mt> Tue, Jan 15, 2019 at 1:41 PM
To: Pen Lister <penelope.lister.16@um.edu.mt>
Cc: Philip Bonanno <philip.bonanno@um.edu.mt>, Sandro Caruana <sandro.caruana@um.edu.mt>, Simone Galea <simone.galea@um.edu.mt>, Isabelle Warrington <isabelle.warrington@um.edu.mt>

I confirm that the data already collected is admissible.
Regards

Dr. Marie Therese Farrugia

Senior Lecturer in Early Childhood and Primary Mathematics Education
Room 237, Department of Early Childhood and Primary Education
Faculty of Education, University of Malta

Chairperson, Faculty of Education Research Ethics Committee (FREC)
Faculty of Education, University of Malta

11.1.3 Image permissions (individuals)

Permissions for images used in relevant sections indicated. These are submitted as digital files for confidentiality reasons.

- LGC content images
- Image of student notes made in class during emergent focus group discussion

11.2 Appendix 02 Smart Learning journey Activity Details

The smart learning journey: details for Literary London and Malta Democracy activities.

For information/reference: *The stages of a start learning journey development (pdf)*

11.2.1 Literary London

- Assignment given to students
- Journey of PoI with AR content links
- Literary London HP Reveal studio – screenshots *(digital files only)*

Assignment

SJ6056 assignment 001. Group project and discussions but individual submissions. Choose ONE of the following groups.

1. Developing and sharing ideas

- Develop a proposal for an original representation of an author's work or a period of history relating to a London author or London literature studied in weeks 1 to 6, that will use text, images, video or all three. This could be along the model of an exhibition you might see at the British Library or the Museum of London.

2. Collecting and gathering to remix

- Collect a number of links, sources and reflections relating to a topic
- Collect a number of video clips/found sources relang to London literature or writers studied in the periods covered by weeks 1 to 6
- Collate a number of Street view captures combined with photos and weblinks as a proposed basis for an online resource
- Collate digital images of literary, journalism or prose text from the period

3. Solving a problem

- Develop a series of critical notes and reflections about why an author wrote in the way they did or about certain topics in the periods studied between weeks 1 and 6
    - in relation to where a given author lived or worked
    - the writing style and/or content of a literary work
    - how historical events influenced a particular writer

4. Developing storyworlds

- Evaluate the literary style of poetry or prose text from a period studied between weeks 1 and 6
- Mimic in your creative work the narrative voice of a writer from a period studied between weeks 1 and 6
- create a dialogue between characters from from a period studied between weeks 1 and 6
- Critique (or review) a period author in the style of someone from the time
- Update the themes and preoccupations of a historical period into a current voice or vice versa, in relation to a period studied between weeks 1 and 6

Social interactions are required in these tasks. Ask questions in the group. Answer someone else's question or feedback on their work.

The journey content

St Olaves

- http://smartlearning.netfarms.eu/st-olave-literary-london/
- http://smartlearning.netfarms.eu/st-olave-resources/
- Video https://youtu.be/87jcGlLPhXI
- Gallery https://www.google.co.uk/search?q=st+olaves+hart+st&tbm=isch&source=lnt&tbs=sur:fmc&sa=X&ved=0ahUKEwjKscaHrdfWAhVJIcAKHYoHAL4QpwUIHw&biw=1279&bih=632&dpr=2

Leadenhall

- http://smartlearning.netfarms.eu/leadenhall-literary-london/
- http://smartlearning.netfarms.eu/leadenhall-resources/
- Video https://youtu.be/mYpS3OABI1o?t=53s
- Gallery https://www.flickr.com/search/?text=leadenhall%20market&license=2%2C3%2C4%2C5%2C6%2C9

Jamaica Wine House

- http://smartlearning.netfarms.eu/jamaica-wine-house-literary-london/
- http://smartlearning.netfarms.eu/jamaica-wine-house-resources/
- Video https://youtu.be/M7exBfe85P8
- Gallery https://www.google.co.uk/search?biw=1278&bih=632&tbs=sur%3Afc&tbm=isch&sa=1&q=%22coffee+house%22+london&oq=%22coffee+house%22+london&gs_l=psy-ab.3..0j0i5i30k1j0i8i30k1l2j0i24k1l2.3770.11839.0.12175.21.21.0.0.0.0.157.2300.0j19.19.0....0...1.1.64.psy-ab..2.19.2297...0i67k1.0.r0ZRL_9ebBs

George & Vulture

- http://smartlearning.netfarms.eu/george-vulture-literary-london/
- http://smartlearning.netfarms.eu/george-vulture-resources/
- Video https://youtu.be/i4Bxqy2q2QM
- Gallery https://www.google.co.uk/search?q=dickens+pickwick+papers&tbm=isch&source=lnt&tbs=sur:fc&sa=X&ved=0ahUKEwi2iPng_4bXAhWECBoKHfDjCKoQpwUIHg&biw=1920&bih=949&dpr=1

St Mary Woolnoth (with Walbrook and London Stone)

- http://smartlearning.netfarms.eu/st-mary-woolnoth-walbrook-london-stone-literary-london/
- http://smartlearning.netfarms.eu/woolnoth-resources/
- Video https://vimeo.com/43904106
- Gallery https://www.google.co.uk/search?q=hawksmoor+woolnoth&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjEmqu-oYTXAhUGWxoKHT2QC3AQ_AUICygC

Bread St and Watling Street

- http://smartlearning.netfarms.eu/bread-st-watling-st-literary-london/
- http://smartlearning.netfarms.eu/bread-st-watling-st-resources/
- Video https://youtu.be/oXWc5VQM_ag
- Gallery https://www.google.co.uk/search?q=bread+street+watling+street+EC4&tbm=isch&tbas=0&source=lnt&sa=X&ved=0ahUKEwjtt_PJqITXAhXBCBoKHUTfCXcQpwUIHg&biw=1920&bih=949&dpr=1

Paternoster Row (with Temple Bar Gate)

- http://smartlearning.netfarms.eu/paternoster-row-and-temple-bar-gate-literary-london/
- http://smartlearning.netfarms.eu/paternoster-and-temple-bar-gate-resources/
- Video https://youtu.be/9xHK9Xdta9E

- Gallery
https://www.google.co.uk/search?q=baynard%27s+castle+and+farringdon+map&tbm=isch&tbs=rimg:CbDeb9_1Ae7aYIjixLUTDZo_1Szw3H9WkKgVis9aIsTL53xibfavu14m9U6EsthbD7wIibcBjwafJFaE0sJPZccyrtOSoSCbEtRMNmj9LPEdf5FhfV5RvsKhIJDcf1aQqBWKwRCw6wqVbD91cqEgn1oixMvnfGJhEN6of5dDtmrCoSCd9q-7Xib1ToERm3cl7sKfvGKhIJSy2FsPvAiJsRTgES6F4WaVcqEglwGPBp8kVoTRHJUjFULI_10iSoSCSwk9lxzKu05EU_1PVvwgOdQb&tbo=u&sa=X&ved=0ahUKEwjf9JG2ofrWAhUF1hQKHY2NDuoQ9C8IHw&biw=1281&bih=632&dpr=2

Ludgate and Fleet

- http://smartlearning.netfarms.eu/ludgate-and-fleet-literary-london/
- http://smartlearning.netfarms.eu/ludgate-and-fleet-resources/
- Video https://youtu.be/JrJbWGNxC7c
- Gallery
https://www.google.co.uk/search?biw=1920&bih=949&tbs=sur%3Afc&tbm=isch&sa=1&q=fleet+street+ec4&oq=fleet+street+EC&gs_l=psy-ab.1.0.0i24k1l2.30945.32058.0.34761.3.3.0.0.0.0.456.786.0j2j4-1.3.0....0...1.1.64.psy-ab..0.3.782...0j0i67k1j0i8i30k1.0.JiKmQNP_t_Q

The Old Bailey

- http://smartlearning.netfarms.eu/the-old-bailey-literary-london/
- http://smartlearning.netfarms.eu/the-old-bailey-resources/
- Video https://youtu.be/zMijvruC5WM
- Gallery
https://www.google.co.uk/search?q=criminal+courts+newgate&tbm=isch&source=lnt&tbs=sur:fc&sa=X&ved=0ahUKEwj9lY-Dme3WAhWBJsAKHYapCxAQpwUIHw&biw=1278&bih=632&dpr=2#imgrc=_

Dr Johnson's House

- http://smartlearning.netfarms.eu/dr-johnsons-house-literary-london/
- http://smartlearning.netfarms.eu/dr-johnsons-resources/
- Video https://youtu.be/K5-_anHteMU
- Gallery
https://www.google.co.uk/search?q=samuel+johnson+dictionary+history&tbs=sur:fc&tbm=isch&source=lnt&sa=X&ved=0ahUKEwiZrZzWlITXAhWFWhoKHbcvB3QQpwUIHw&biw=1280&bih=632&dpr=2

11.2.2 Malta Democracy

- List of tasks (full draft)
- Screenshots of AR task panels
- Journey of PoI with AR content links
- Malta Democracy HP Reveal studio – screenshots (digital files only)

List of tasks

The raw list of activities, before they were edited for the AR trigger panels.

1. City Gate

Activity: Using photos & video clips discuss with your friends how the different versions of city gate manifest different aspects of the democratic process.
Activity: What does this historical snapshot into republic street say about Maltese society then and now?
Activity: Discuss how the different names of Republic Street relate to the evolution of the democratic process in Malta?

Using photos and videos, discuss in your Edmodo group:
How do different versions of the gate show aspects of democracy developing in Malta?
What do the snapshots of Republic Street say about Maltese society then and now?
How do different names for Republic Street show democracy developing in Malta?

2. The Parliament

Activity: Develop a multimedia representation (using text, images, video or all three. e.g. blogs, image galleries, videos, audio tracks or a mixture) to document the development of the Maltese parliament and its relationship to democracy. Share it with other colleagues and get feedback both with regards to the relation of parliament with democracy and also about your documentary.

Using photos and videos, discuss in your Edmodo group: "How has the Parliament developed in relation to democracy in Malta?"

3. Palazzo Ferreria

Activity: Discuss in Edmodo with your colleagues how Palazzo Ferreria / Francia represents different moments in the democratic development of Malta.

Using photos and videos, discuss in your Edmodo group, "How does Palazzo Ferreria / Francia represent different moments in the democratic development of Malta?"

4. Law Courts and Guido de Marco

Activity: Referring to practical examples, comment on the role of the judiciary system in the democratic process in Malta.

Using photos and videos, discuss in your Edmodo group: "Give some practical examples of the role of the judiciary system in the Maltese democratic process"

5. Great Siege monument

Activity: Discuss the role of the virtues (faith, fortitude and civilisation) in a democracy.

Using photos and videos, discuss in your Edmodo group: "What is the role in democracy of the monument virtues - Faith, Fortitude and Civilisation?"

6. Piazza Regina

Activity: What do the different names and history of Republic square tell about the development of democracy in Malta? Document this through commentaries involving photos, audio & videos.

Using photos and videos, discuss in your Edmodo group: "What do the different names and history of Republic square tell about the development of democracy in Malta?"

7. Grandmaster / President Palace

Using photos and videos, discuss in your Edmodo group: "How has democracy evolved over time in Malta?" Refer to the highest decision makers (leaders) of the Grandmaster's Palace.

8. Independence Plaque

N/A

9. Republic Plaque

N/A

10. Sette Guigno monument

Activity: Go back to Old Theatre street and walk down from Piazza Regina and the National Library to Old Bakery street. This was the street in which the crowds gathered and protested on the 7th June 1919 and where 3 of the victims died. Democracy needs to be protected at all times. What would be the concerns of these people if they were living today? Which aspects of democracy are being challenged today?

Using photos and videos, discuss in your Edmodo group: "What would be the concerns of the Sette Giugno protesters if they were living today? Which aspects of democracy are being challenged today?"

Go back to Old Theatre street and walk down from Piazza Regina and the National Library to Old Bakery street. This was the street in which the crowds gathered and protested on the 7th June 1919 and where 3 of the victims died.

Take photos to illustrate your points and upload to Edmodo, also comment on a classmates content. Discuss the points being made.

AR Task panels

The journey PoI & content

1. City Gate
UNESCO stone column, entrance, City Gate
    * http://smartlearning.netfarms.eu/republic-street-and-democracy-through-the-ages/
    * http://smartlearning.netfarms.eu/valletta-city-gate-past-and-present/
    * http://smartlearning.netfarms.eu/snapshots-of-republic-street/

2. Parliament
Parliament pillar signs
    * http://smartlearning.netfarms.eu/the-parliament-timeline/
    * http://smartlearning.netfarms.eu/the-site-of-the-maltese-parliament/
    * http://smartlearning.netfarms.eu/the-structure-of-the-parliament-house/

3. Palazzo Ferreria
Entrance into the social care of children department door, wall plaque on right
    * http://smartlearning.netfarms.eu/historical-timeline-of-palazzo-ferreria/
    * http://smartlearning.netfarms.eu/palazzo-ferreria-and-the-events-of-sette-giugno/

4. Law Courts and Guido de Marco
Information sign
    * http://smartlearning.netfarms.eu/timeline-of-courts-in-malta/
    * http://smartlearning.netfarms.eu/law-courts-and-democracy/
    * http://smartlearning.netfarms.eu/the-site-of-the-courts-of-justice/

    Statue plinth text
    * http://smartlearning.netfarms.eu/political-activity-of-guido-de-marco/
    * http://smartlearning.netfarms.eu/the-life-of-guido-demarco/

5. Great Siege Monument
Information sign
    * http://smartlearning.netfarms.eu/the-great-siege-of-malta-images-and-video/
    * http://smartlearning.netfarms.eu/great-siege-monument/

6. Piazza Regina
Crown emblem under Queen Victoria
* http://smartlearning.netfarms.eu/republic-square-piazza-regina/
7. Grandmaster Palace
Red pillar box, entrance to St Georges Sq
* http://smartlearning.netfarms.eu/the-grandmasters-palace-interior-function/
* http://smartlearning.netfarms.eu/the-grandmaster-palace-history-location/
8. Independence Plaque
Wall of grand palace
* http://smartlearning.netfarms.eu/independence-plaque/
9. Republic Plaque
Wall of grand palace
* http://smartlearning.netfarms.eu/maltese-republic-plaque/
10. Sette Giugno
Stone plinth text
* http://smartlearning.netfarms.eu/sette-giugno-uprising/
* http://smartlearning.netfarms.eu/sette-giugno-context-and-significance/

11.3 Appendix 03 Chapters: supporting content

A Word document is submitted digitally, containing the full list of tables indicated below. Key Tables F, G and I are included in this document, for ease of reference.

- Table A, Bracketing concerns (Ashworth & Lucas, 2000) *(digital file only)*
- Table B, Practical Guidelines (Ashworth & Lucas, 2000) *(digital file only)*
- Table C, Node-Sets working table *(digital file only)*
- **Table D, *Working table, structure of awareness for a smart learning journey, four category descriptions*** *(included here and in digital form)*
- Table E, NVivo 'case classification' table - primary outcome space *(digital file only)*
- Table F, System Element Category descriptions and SoA *(digital file only)*
- **Table G**, ***Descriptive guidelines for experience complexity of a smart learning journey*** *(included here and in digital form)*
- **Table H**, ***Descriptive guidelines for experiencing the system elements of a smart learning journey*** *(included here and in digital form)*
- Table I, Early 'pedagogical relevance' structure *(digital file only)*
- **Table J, *Bloom's, SOLO & Hounsell's descriptors*** *(included here and in digital form), plus notes made at that time, to clarify my own position.*

Table D, Working table, structure of awareness for a smart learning journey, four category descriptions

Early structure of awareness sketched out using Cope 2004 framework ideas.

CATEGORY OF DESCRIPTION	STRUCTURE OF AWARENESS		
	REFERENTIAL: meaning, reasoning, focus (theme)	**INTERNAL:** the theme; the 'near' thematic field	**EXTERNAL:** the further thematic field into the margin
Category A – Tasks/	Doing the tasks;	Questions, tasks, obligations,	Relevance to own work, grading,

Obligations Tasks Obligations Requirements	'what we had to do'; what is required	requirements, own assignment or coursework	'being marked', usefulness, reason to do it, time needed or set aside (available), purpose
Category B – Discussing? Social? Discussing helping working together being social	Discussing tasks, discussing things associated with tasks, discussing other things about the location	Working together to help each other, discussing the technology, working out 'who was going to do what', sharing technology	Thinking about collaboration as a help to learning, other social aspects, getting to know each other, other passers by, fun and enjoyment with friends
Category C - Being There Being there being in the place being there at that time	Being 'in the place', it 'being real', 'living it', 'living in the picture', walking in their shoes, at that time, in that moment	Seeing the close context, media and knowledge 'immediately' at the place, not wasting time, 'doing it now', not being like a book or online, technology mediation for discovery of place, feeling a place	Mood and atmosphere of place, weather, light, sounds, wider context of surroundings, knowing the locations on a map (the route), being like a tourist, taking notice of surroundings, inspiration, *imagination, visiting/ exploring other locations for learning and/or inspiration*
Category D - Knowledge & Place as Value/meaning? Knowledge, place for own sake Knowledge/place as gaining benefit	Personal research, motivation, own experience of the journey, the journey being of benefit, the journey as value for learning,	Personal reasoning, imagination, creativity, curiosity, own interest in topic(s), inspiration, learning something new	Potential use or purpose, for future practice, preparedness, prior or post research, additional knowledge construction or discovery, vi*siting/exploring other locations for learning and/or inspiration*

Table G, Descriptive guidelines for experience complexity of a smart learning journey

Descriptive guidelines (for the table of experience complexity) for a smart learning journey.

A Tasks and Obligations

1. Level 1 Do the tasks, usually the bare minimum, quickly. (arrangement) *[updated Dec 2019: or not doing, tasks not relevant; merges with D1]*
2. Level 2 doing tasks that are of interest, seeing interest in them. Coursework relevant only. (classic viewpoint)
3. Level 3 tasks become indirectly related to other things perhaps including other course work, or other related aspects of interest, seeing more purpose in them. (upper levels of viewpoint, lower argument)
4. Level 4 research of topic or interest in topic as a whole is clearly stated in some way. Seeing the wider reasoning, purpose, or feeling - the affective reactions also included here as a deep engagement. This could include deeper reflections on tasks, expectation or obligations. *Seeing the wider reasoning, purpose, value relating to task and obligation.* (Argument.)

B Discuss

1. Level 1 is talking about the task but only 'who does what'. not really about the task. Tech functions. (arrangement)
2. Level 2 talking about the tasks themselves, and helping each other with tech or location finding. (viewpoint)
3. Level 3 talking (also sociable, group) about the tasks in relation to locations and journey, and historical time. (upper levels of viewpoint, lower argument)
4. Level 4 is talking and sharing in content, knowledge, tasks and the wider relevance, related experience. *Seeing the*

wider reasoning, purpose, value relating to discussion, social, collaboration. (Argument)

C Being There

1. Level 1 is simple go and do it, very simple, facts only (arrangement). If direct relevance of locations is not evident to participant it results in low or no engagement, very little attention or not even going at all. (Arrangement)
2. Level 2 is mentioning one or a few locations, but in general only connected to the content of the journey itself (classic Viewpoint)
3. Level 3 is seeing more of the whole in relation to place and being there, but still focusing on content, own content too, ideas (upper levels of viewpoint, lower argument)
4. Level 4 is seeing the whole in relation to place and being there, the wider setting, saying this clearly, even in simple terms. Fully seeing the wider reasoning, purpose, or feeling - the affective reaction is also included here as a deep engagement. *Seeing the wider reasoning, purpose, value relating to place and being there at that time.* (Argument)

D Knowledge & Place as value

1. Level 1 not engaging, no interest, don't create any content, don't read information, don't know there is any information, think its pointless. May include not going if content perceived as pointless or 'can get online'.
2. Level 2 low interest, some tasks or information read, make screenshots of AR, take a very few photos or none
3. Level 3 more engagement with the topics and information, though location is still emphasised. Take a few photos, photos can be of topic, or of people or both
4. Level 4 a sense of the point of it for further personal gain, of value as a whole, deeper reflection on potential or possibility. Creating more content, tasks examined at a deeper level. Place and knowledge of it or related to it as being significant to value, creative, inspiring. *Seeing the wider reasoning and purpose of value for knowledge and place/being there.* (Argument)

Table H, Descriptive guidelines for experiencing the system elements of a smart learning journey

Descriptive guidelines for system elements of a smart learning journey

Place

- ***Being at the place:*** this is about being right there, at that time, in the moment of being there. Reading and thinking and finding out about a specific place while actually being there physically yourself, seeing what you see in the present, reflecting on the content while there 'at that time', 'living in the picture', 'walking in their shoes'…
- ***Being outside:*** not being in the classroom, physical sensations of outside, visual, auditory, walking, being in the weather. Also mood and atmosphere, the difference being outside makes.
- ***A tour or trip, a type of journey:*** a game or adventure, discovering things, targets, locations, possibly talking about collecting (scavenger hurts, like geocaching for example), treasure, also relationships between stops, feeling achievement for finding things or places.

Knowledge

- ***Interesting:*** this could be personal interest or interesting because of coursework, or related topics. Sparking interest in topic or related, making things more interesting, having researched it before, some kind of personal relevance or usefulness. Having connection with the knowledge.
- ***Not interesting:*** not finding any interest in the topics at all (or much), seeing no relevance in any of the content, finding it boring, tedious, pointless. Seeing knowledge as being easily available already (google, search etc), having

no personal interest, not wanting to be engaged much, didn't feel it was for them (was aimed at other people), not fun.

- ***Too much:*** too much reading, too many choices, too much content, overall. Overwhelming, too narrow in topic choice, too serious, too complicated, too dry.

Collaboration

- ***Sociable:*** this is about friends, groups of people, doing something fun together, people to talk to, keeping each other going, perhaps getting to know classmates
- ***Sharing:*** this is about helping, the discussing and sharing ideas, also sharing phones, sharing technology advice, sharing opinions, sharing tasks, working out together what should be done, how.
- ***Distracting:*** this is about other people in the group you might be with as annoying, their bad moods, demotivating, others not wanting to do it, or much of it, not seeing the value in it, too many people in the group, vying for space (to access the triggers, for example), others being in a hurry, not being able to do what you'd like, others lack of interest.

Technology*

- ***Problematic:*** it's not working, it's not very good, no data on phone, no Wi-Fi battery ran out. The technology is overwhelming, it's too complicated, it's difficult, it's tiring to use, the phone is obstructive to the experience, it's annoying, it makes participant self-conscious. Like 'tech zombies', it wasn't fair on people with different phones. Missing out die to not having a working phone.
- ***Novel:*** the novelty of the whole thing, futuristic, new. Modern, different, like science fiction. The wow factor, expectations of new technologies and what they can do, the potentials, teaching with technology.
- ***Helper:*** this is about the technology acting as a helper, or a help guide, supporting the activity. Convenience, an assistant, providing information 'right there', providing content you wouldn't know, sparking interest.
- ***Easy:*** the ease of using the tech, simple, it just works. It seems normal, straightforward, fast. the naturalness, the efficiency.

**NB the transcript utterances are about the augmented reality technology (HP Reveal). The use of Edmodo and Google Maps were rarely mentioned. Google Maps was occasionally mentioned. Edmodo was used at home with a laptop browser.*

Table J, Bloom's, SOLO & Hounsell's descriptors

Table matching Hounsell, Bloom's Revised and SOLO descriptors with interpretations for surface to deep learning in categories of description. This table was used to understand relationships and potential equivalences within a general scoping.

	MARTON & BOOTH, from Hounsell 1984. (NB, direct Hounsell quotes in other contexts in the study are from the 2005 3rd edition of this chapter).	**GUIDE TO USE THIS STUDY, in relation to experiencing the smart learning journey**	**Blooms Revised**	Blooms descriptors	**SOLO**	SOLO descriptors
ARRANGEMENT	*arrangement*, is defined as "an ordered presentation embracing facts and ideas" (p. 11 (sic)). Data is present in the shape of discrete ideas which are not related to any central argument or position. As far as organisation is concerned, students speak of using secondary sources for illustration rather than to make a point or support an argument and they emphasise conscientious coverage of the available sources more than the quality of their usage. Interpretation is lacking.	Concepts around *arrangement* might be construed here as references to 'the task' that are not related to any other context, to lists of tasks, to 'do the tasks' with no other purpose. This may also apply to 'having to do it' (the journey), or whether or not it is assessed, and that being a motivating factor. It may also apply to screenshots of the task that are not supported by any other context.	**Remembering and Understanding** **1, 2**	Recall of specific learned content, including facts, methods, and theories. AND Perception of meaning and being able to make use of knowledge, without understanding full implications.	**Unstructural** **2**	A single aspect is explored and obvious inferences drawn. Evidence of recall of terms, methods and names.
VIEWPOINT	*viewpoint* is characterised as "the ordered presentation of a distinctive viewpoint on a problem or issue" (p. 11 (sic)). Here interpretation is again the main element of descriptions of writing essays, supported by attention to organisation, but reference to data as providing evidence is relatively lacking.	Concepts of viewpoint here might be characterised as doing tasks and locations as coming to know more about smart learning within the context of classwork, listing relevant pedagogies or associated activities in a context of their own learning, but not beyond, leading to any other activity or realisation.	**Apply and Analyse** **3, 4**	Tangible application of learned material in new settings. AND Deconstruct learned content into its constituent elements in order to clarify concepts and relationships between ideas.	**Multistructural** **3**	Several facets are explored, but are not connected. Evidence of descriptions, classifications, use of methods and structured arguments.
ARGUMENT	*argument* is globally characterised as "an ordered presentation of an argument well supported by evidence" (p.109). The students talk in terms of interpretation, of ideas being "moulded" or "crystallised" into a single entity; they talk of organisation, making a logical and coherent presentation; and they talk of data, authenticating the argument with supporting evidence. Of the three indicators, interpretation is superordinate in this conception, which organisation and data supporting it	Concepts for argument might here be interpreted s seeing the SLJ as inspiring further research, or creativity, or finding further inspiration. As a bridge to further knowledge or activities either for self or in relation to future self or society.	**Evaluate and Create** **5, 6**	Assess the significance of material and value in specific settings. AND Judge the usefulness of different parts of content, and producing a new arrangement.	**Relational and Extended Abstract** **4, 5**	Evidence of understanding of relationships between several aspects and how they may combine to create a fuller understanding. Evidence of comparisons, analysis, explanations of cause and effect, evaluations and theoretical considerations. AND Arguments are structured from different standpoints and ideas transferred in novel ways. Evidence of generalisation, hypothesis formation, theorising and critiquing.

Notes on Hounsell and applied reasoning

These notes were compiled to build understanding for my own interpretations and descriptions of equivalences between taxonomies for cognitive domain and experience complexity.

Studies by Hounsell on essay writing can be employed to articulate some of the learning that may be present in the complexity of a smart learning journey experience. Hounsell's (1984, 2005) studies discuss (and are further discussed by Marton & Booth, 1997, pp. 27-29) levels of understanding that may be present in a learner as they participate in a learning activity, in this case, writing essays. Terminology appeared to be a useful way to think about levels of learning sophistication in SLJ experience complexity.

Hounsell's descriptive terms signal the constituent parts of an activity - the essay - to describe complexity of understanding. By deconstructing what was being described, I was able to think about the complexity of the smart learning journey experience in a similar way. His three conceptions of writing an essay were arrangement, viewpoint and argument, described as:

- Arrangement: "… an ordered presentation embracing facts and ideas."
- Viewpoint: "… the ordered presentation of a distinctive viewpoint on a problem or issue."
- Argument: "… an ordered presentation of an argument well-supported by evidence."

(Hounsell, 2005, pp. 111, 113)

Arrangement being the least sophisticated, concerned with arranging some facts that may not have much connection between them; viewpoint which begins to create more value in an argument using relevant (and more) facts with some context; and finally interpretation with takes on the business of a fuller understanding to construct argument supported by evidence, and making of conclusions. These conceptions had further 'sub-component' terminology of Hounsell (1984, p. 21), that helped to provide further understanding. Hounsell describes the sub components of data, organisation and interpretation thus:

- Data: The subject-matter which provides the raw material or bedrock of essays.
- Organisation: The structuring of essay material into a discussion of the topic which follows a particular sequence or order.
- Interpretation: The meaning or meanings given to essay material by the student.

(Hounsell, 2005, p. 112)

Using his concepts of arrangement, viewpoint and argument with their relative sub-component data, organisation and interpretation factors acting as a guide to levels of understanding, I began to recognise possible levels of learning for the progression of experience complexity, permitting mixtures (overlapping) of these components. Though I did not intend to create a granular prescriptive grid of component measurement, (this would be too restrictive, not flexible or hybrid enough), yet, these ideas contributed to thinking about learning in relation to my SLJ experience complexity.

In terms of the smart learning journey activity, I generally thought of the three conceptions as:

- Arrangement: the quantified set of locations, how many had to be done, what they needed to do in them, and at best, a few unrelated facts
- Viewpoint: a more understood version of the set of locations and associated facts, but still seeing them as distinct from any other relevance
- Argument: seeing the greater purpose for the activity, the locations, the idea of the journey, the relatedness of facts and the knowledge beyond

And the sub components were generally thought of as:

- Data: the locations themselves and the 'facts' and events that were associated to them
- Organisation: the locations that formed the journey, their order, relationship
- Interpretation: the understanding of the topic, the related locations, the value of being there, and purposes or knowledge beyond the activity

(September 2019)

11.4 Appendix 04 Key Quotes (Findings)

a) The system Element findings (version with discursive text in digital format).

b) Key quotes - These tables are only submitted as digital files because of volume of data.

11.4.1 Experiencing the System Elements of a smart learning journey

The Place system element

The 'Place' element enables thinking about aspects of being at locations, points of interest or the journey itself in ways slightly different to the 'Being There' experience variation as interpreted for the journey as a whole. Here the analysis statement is "experiencing place (in a smart learning journey) as….". It is therefore more possible to delimit the variations of the position place occupies in the awareness of the learner. There is clearly some duplication with the 'Being There' categories for the primary outcome space, yet still some additional light is shed on this element. Three categories in 'Place' were discovered:

- Being at the place
- Being outside
- A tour, a trip, a game

Category: Being at the place

- Referential (Meaning): Being at the place, there in front of it, at that time, in the moment of being there
- Internal Horizon: Being in front of it, really there (physically)
- External Horizon: Living it, being part of it, it being real, realistic, bringing information to life

Quotes

- Q02: "For example the idea of Victorian Christmas in London with all the snow. You can read about that all over the place but whether or not it was based on anything other than a postcard image of what Christmas is, whereas when you're actually in the place you can get a more realistic sense of what something was like. "; (P4)
- Q04: "It's more interesting being there and learning at the same time, like for example the things I've seen in pictures now I am seeing them in real life (…) like you're a tourist again. Like you're seeing the Lonely Planet at that time"; (P7)
- Q06: "… you can imagine maybe how it was in the past no, you can say oh my God I am staying in that, I'm in the same place that I am reading about and all this happened all those years ago"; (P11)
- Q09: "like this video of like a chariot going by, and then in real life we're taking a video of like you know, this guy playing guitar, and singing. And like you know, people walking through, and baby strollers, and stuff, (…) like what we are really seeing are very different but its the same, the same exact place you know, its been there for hundreds of years and I love that."; (P23)

Category: Being outside

- Referential (Meaning): Outside, not in the classroom, out and about
- Internal Horizon: Seeing, hearing, being outside, walking
- External Horizon: The outside atmosphere, the mood and ambience, the difference of being outside, the weather

Quotes

- ◦ Q02: “when I went to Lambeth North what I was looking for was mosaics and then I found them and whilst I was standing like underneath the trains I kept thinking about like I was hearing the sound of the trains overhead and it made me think about Blake and his art and these ideas in general. ”; (P5)
- ◦ Q03: “So yes the experience was good in the sense that we were outside and we were experiencing the, everything else at first hand”; (P9)
- ◦ Q08: “I think the best part was just like getting outside and doing something different though, because like a lot of people in our group hadn’t actually been to Valletta to explore, yet.”; (P22)
- ◦ Q09: “…when you’re like there and you can see with your own eyes and feel the wind blowing in your, body, your hair and smell food or hear people talk, like it’s just a whole different thing, it’s just like er, I feel like its a sense, it’s a very integral experience ”; (P24)

Category: A tour, a trip, a game

- Referential (Meaning): A tour, game, discovering, hunting
- Internal Horizon: Finding, guide or tour, scavenger hunt, treasure, game
- External Horizon: Sense of reward for going to stops, the progression, connection between stops, challenge, discovering, finding

Quotes

- ◦ Q03: “it’s like an adventure with a map that’s how I felt (…) finding the locations even though at the end you’ll win nothing but you’ll win, like get knowledge out of it instead”; (P7)
- ◦ Q05: “In the sense that it’s like a treasure hunt. (…) It’s like you have tasks and you have to accomplish them for the sake of the journey itself for the sake of the game”; (P13)
- ◦ Q06: “ It felt very much like er, you know like a scavenger hunt? In a way (…) going to different places and just trying to (…) find things that are hidden about that place … like a scavenger hunt ”; (P17)
- ◦ Q08: “… similar things where you go to a tourist attraction or something like that and they give you some sort of digital or like interactive experience, and I think it, I think it adds to it”; (P23)

The Knowledge system element

Looking at the ‘Knowledge’ element for how information is experienced, variation is reasonably clear to see: it is interesting, or it isn’t, or there is just too much (even though this can be interesting or not interesting). Analysis of how information is viewed by the participant as a part of the whole SLJ means it is possible to separate that part from the other parts. This is especially useful when considering learning activities. Three categories in ‘Knowledge’:

- Of interest
- Not of interest
- Too much

Category: Of Interest

- Referential (Meaning): Relevant, useful, of interest
- Internal Horizon: Useful for coursework, of general interest, love the topic
- External Horizon: Sparks interest, researched before or after, triggers memories

Quotes

- ◦ Q01: “I think by that point we weren’t really worrying about the app so much and we were taking our own pictures because we were just generally like genuinely interested in the buildings”; (P1)
- ◦ Q03: “well I can see why it’s interesting I’ve been to the Globe Theatre a couple of times and it’s really cool to think you know Shakespeare was here”; (P6)

- Q04: “My context was I was interested I wanted to learn about the actual places or whatever but I knew that other students just me maybe they weren’t. They saw it as just they had to do it and that’s because they don’t really know the value of this”; (P8)
- Q06: “So images give you like the instant learning, like oh wow it looked like this before and now it looks like this and then you just go and look at the, the bridge, is the bridge there, and then where is the gate?… like, and so it spikes sparks curiosity ”; (P16)

Category: Not of Interest

- Referential (Meaning): pointless, not useful, dull, boring
- Internal Horizon: could Google it, could be a book, not my taste, didn’t look
- External Horizon: not relevant, didn’t know it was there, meant for someone else, not video

Quotes

- Q02: “We walk around use the app where you move your phone over it and it gives you information. It’s kinda like I can get that information if I just Google it and searched a few things couldn’t I? (…) I kind of felt that I could get the information that I needed to, I had already had a very clear idea of what I was going to write about”; (P6)
- Q03: “We, we rushed through it so we didn’t stay at the places with the four tasks, so we just rushed it… maybe some of us don’t really care … you know? ”; (P8)
- Q05: “we got bored midway. Cos we didn’t want to read all the text. You know, I thought, it would have been better if it’d been, if there’d been like videos, so I wouldn’t have to engage cognitively, as much (laughing!)”; (P17)
- Q09: “the content of the course for me was perhaps its just not, not something I personally felt an affinity with so much and so I found some of the questions and some of the tasks a bit … much … or a bit heavy”; (P21)

Category: Too Much

- Referential (Meaning): Too much reading, too much information
- Internal Horizon: Overwhelming, too much choice
- External Horizon: Too serious, too political, too much content, too complicated

Quotes

- Q01: “we didn’t think we were going to retain that much of the information because there was so much on there, there was so many links for each kind of sort that we eventually just kind of stopped looking at the information.”; (P1)
- Q03: “well in a way it is because when we went on the tour I could see some of the information that was displayed at every location and I could see it was a lot of information and a lot to read and I don’t know”; (P5)
- Q06: “The content… was … interesting. I personally found the topic sometimes a bit overwhelming? … erm, just the history and the dates and the names I felt it was quite erm… maybe quite dense at times?”; (P21)
- Q07: “overall we were … trying to make it happen, together and trying to be a group because it did feel overwhelming, like to read all that information which we didn’t do in the end”; (P24)

The Collaboration system element

Though the categories of ‘Collaboration’ have significant overlap with the ‘Discussing’ category in the primary outcome space of experiencing the journey as a whole, ‘Collaboration’ enables a further drilling down of focus. Collaboration was how I chose to acknowledge the direct or indirect impact between people on the smart learning journey system element experiences. It could be argued that people form part of all aspects of the smart learning journey system, perhaps especially as interconnections. Rather than having ‘people’ per se, which would have been too broad an element, ‘Collaboration’ created a broad category, but with some focus on narrowing down the experiences between people. Emphasising that the system elements were an overview of what might be discovered about more delimited aspects of smart learning journeys, three categories were found. The three categories in ‘Collaboration’ were:

- Distracting
- Sharing
- Social, engaged

Category: Distracting

- Referential (Meaning): Too many people, annoying, bad moods, (demotivating)
- Internal Horizon: People compete for space, bad mood in friends, people not wanting to do it, others being in a rush
- External Horizon: Demotivation from others lack of interest, not being able to do what you’d like to, having to fit in with others

Quotes

- Q01: “I think I would’ve continued the tour had I been alone, but I was with others so they didn’t want to go on. And so I decided to stay with them”; (P5)
- Q02: “maybe there’s more of a focus alone (…) because you’re taking in all the information yourself, you know, there aren’t any distractions from other people who maybe don’t want to work, so that was something that was important to me”; (11)
- Q04: “… being in a place like being with people especially, I think doing it alone is different but doing it with people there’s just, at least for me I’m very distractable…”; (P18)
- Q07: “like I think it definitely just made everyone just drag bit instead of like you would think that maybe it would, like, everyone would get excited and share and it would be more of a team building, but I think probably less”; (P22)

Category: Sharing

- Referential (Meaning): Helping each other, discussing, sharing tasks and opinions
- Internal Horizon: Sharing phones, tasks, working out the technology
- External Horizon: Group work, teamwork, negotiating, diverse opinions

Quotes

- Q04: “… I was intrigued by the idea of being able to share a lot of pictures and have a shared space where you can post things and see a lot of pictures that other people have taken, comment and you know… virtually no one in my group posted anything so I felt that there could’ve been some interesting discussions to make on the space, (but) we didn’t have, er, nothing came out of it.”; (P5)
- Q05: “Well I did it on my own so at the moment so I think if I have to do it with my friends it would’ve been much more interesting because we would be looking at things and discussing”; (P7)
- Q08: “I believe its essential to be honest to have someone who is with you and is doing the same journey with you. Because, (…) er, especially to discuss democracy and stuff, so basically having different opinions, different experiences are essential to the development of the journey. ”; (P13)
- Q09: “I wanted to experience this with others because (…) I thought it might help me learn better … erm … and others might help me with my, er, with you know the, er, using the technology that I was not familiar with.”; (P16)
- Q10 “being with the group and getting there, like I said, we were helping each other out with you know, using the apps, finding the locations, erm, and the conversations that we have along the way, you know, discussed this or that …”; (P17)

Category: Social, engaged (sociable)

- Referential (Meaning): Friends, classmates, together, engagement, fun

- Internal Horizon: More fun and engaging, someone to chat to, enjoyable, feeling of doing it together
- External Horizon: Made it less serious, more motivating, keep each other going

Quotes

- Q01: "… I think you're more likely to continue it longer and get more out of it if you're with someone because you have company and company you're going to enjoy it for a longer period, I think most people work that way"; (P1)
- Q03: "We met some other people, groups that was fun as well talking to them what they did, they are ready and we are just coming."; (P8)
- Q04: "…the fact that we got to meet with the rest of the group. That was a positive thing as well … because we were just six in the unit and the rest were a bigger group. They were there so we could meet up with them … Because like some of them we hardly talked to them especially during this unit since we are separated … So it was interesting to go there and they actually helped us and we them so you know, that was a nice experience."; (P9)
- Q10: "because when you're also in a group, its like inevitable not to be affected by peoples opinions and attitudes and … perceptions and comments, (…) you inevitably build your own concepts or your own opinion also taking in from what others are saying…"; (P24)

The Technology system element

The Technology system element permitted a drilling down of the structure of awareness for 'Technology' in a smart learning journey. Technology topics nearly always emerged completely naturally in conversations but were not at the forefront of most participants minds. This was noted early in the study and helped me to understand how to discover 'meaning' in utterances for the journey as a whole, as oppose to seeing meaning in ways I (initially) expected to find it. This might be considered as an overt process of bracketing. Many comments about the experience of technology were about how augmented reality (AR) worked, and this caused both a sense of 'wow factor' as well as frustration when things didn't work. Other comments were about the potential of AR for interacting with the environment for civic as well as learning experiences for the young professionals in Education. The English Literature students did not talk so much about potential, so range of experience is likely impacted by subject area. This is reflected on later in 'Further scope for research' (chapter nine). Four categories in the 'Technology' system element emerged:

- Easy
- Helper
- Novel
- Problematic

Category: Easy

- Referential (Meaning): Simple, easy to use, works
- Internal Horizon: Fast, normal, straightforward, works
- External Horizon: The normality of it

Quotes

- Q02: "If you have to check about it before you would get it, it's a simple technology but on the day on the task they couldn't set it up or whatever… because they haven't paid attention"; (P8)
- Q04: "… I was quite scared of it at first but like now it makes more fun, You know it's fun going into different things and just pressing a button and, and saying oh my like wow a video popped up"; (P11)
- Q05: "I think its much easier with technology (…) I said this, that you are immersed in the technology, you are not just there. You are immersed in the visual sphere"; (P13)
- Q09: "… it was very easy to tap on individual things, erm, and my data was working well, so I had a really quick internet response, so when I clicked on the links, I was able to load pretty quickly, erm, so, I, er, yeah, thought it was great."; (P23)

Category: Helper

- Referential (Meaning): Guide, helping, convenient
- Internal Horizon: Convenient, right there, personal assistant
- External Horizon: Providing content you would not know about, sparking ideas and interest

Quotes

- Q02: "what it does is in putting you in the place it almost gives you another level of access to something that really we don't have anymore, get a deeper understanding of what that part would've been like at a certain time and what was going on around that time. I think, I think it did help."; (P3)
- Q04: "It's more alive, It's like you're a tourist and seeing the sights of Malta and at the same time learning about them it's like you have a person but a personal digital assistant telling you about the place, the historical background about the things you are seeing…"; (P7)
- Q06: "the most significant part was using our smartphones in this learning experience like you could access the content that's very important just by taking a photo of that monument for example "; (P15)
- Q07: "… without your phone, you're looking at a building, which is pretty, and there's a couple of statues, and a small plaque, but that's all you get. Whereas with the phone there are like all these other facts and figures and videos and pictures and stuff and impulses for questions to ask and answer"; (P21)

Category: Novel

- Referential (Meaning): Novel, new, futuristic
- Internal Horizon: Sci-fi, modern, new, different
- External Horizon: Expectations of new technologies, potentials

Quotes

- Q01: "I really liked the idea because I've never done a kind of augmented tour before. I liked the idea of going to a place and even though it's mediated and you have to do it on your phone it's as close as you're maybe get to going to a place like, which isn't going to provide you with kind of a document of its history."; (P4)
- Q05: "I guess to capture their emotions like how they looked when they were revealing the content like it was something unusual so they were like wooaaa oh my god"; (P16)
- Q06: "the interactions that the app provides with the environment, that to me was very interesting. Feels a little … sci-fi?"; (P17)
- Q08: "… when it worked we were like oh that's actually quite cool, like, I don't know because it's a bit like magic, you know, like tschoo *(makes sparkly noise)* and suddenly it's there. That's kind of cool."; (P18)

Category: Problematic

- Referential (Meaning): Not working, not good
- Internal Horizon: Not working, no wifi, no data, no battery
- External Horizon: Overwhelming, too complicated, difficult, tiring, obstructive, self conscious, tech zombies

Quotes

- Q01: "on the app I think I remember that things were quite layered they was kind of quite a lot of information on the screen at once so it was a little bit overwhelming"; (P1)
- Q8: "but like I hate that because it's like people walking around and looking just like zombies and not paying attention to anything or anyone you know like they're in this beautiful park and all they're doing is like looking at their phones"; (P22)
- Q9: "we did run into a couple of issues at the very end being we, I wanted to continue doing the walking tour but all of our phones were dying. And I didn't have a power bank or anything"; (P23)

◦ Q10: "I was trying to make it happen, and, like, it did pop up at the beginning and then when I er, clicked on one of the icons, that's where it started hanging, started crashing and went crazy."; (P24)

The consideration of this study in the practical human computer interaction (HCI) aspects of technology are not what is being studied, though clearly are an issue. I created a 'future-present' (Ireland & Johnson, 1995; Kitchin, 2019; Husman & Lens, 1999) version of real world AR interactivity that will likely become a much more streamlined set of technical interactions in the not too distant future with apps such as Google Lens[53], What3Words[54] and others perhaps integrated with a Virtual Learning Environment (VLE) and Application Programming Interface (API) connectivity. I discuss this further in chapter nine.

11.4.2 KEY QUOTES (Summary of tables)

- Table of early key quotes
- Ten key quotes for the levels of Categories of Description for Experiencing the Smart Learning Journey
    - Category A, Key Quotes Level 1-4
    - Category B, Key Quotes Level 1-4
    - Category C, Key Quotes Level 1-4
    - Category D, Key Quotes Level 1-4
- Ten key quotes for each category of Experiencing the system elements of a Smart Learning Journey
    - Place, Key Quotes
    - Knowledge, Key Quotes
    - Collaboration, Key Quotes
    - Technology, Key Quotes

11.5 Appendix 05 Data Analysis (Process)

These are only submitted as digital files because of volume of data.

- Analysis for categories of description
    - *A ReadMe text file describing the contents in this folder*
    - NVivo case classification exports
    - NVivo files
    - Second Review Analysis
    - Xls files
- Analysis for LGC content
- Interview Audio
- Transcript data (raw, and with annotation)
    - Transcript rough first versions not corrected for coding
    - Transcripts *thirdcoding* exports 17-7-19

[53] Google Lens https://lens.google.com
[54] What3Words https://what3words.com

11.6 Appendix O6 Participant Details

These files are only submitted as digital files for reasons of confidentiality.

- Consent Forms - completed
- Questionnaires (for interview icebreaking) – Completed