

A User-Experiences-Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City

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To Nina

*May you always dream big, let your creativity soar, and embrace the
wonderful person you are becoming!*

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Abstract

This study explores the design, development, and evaluation of SALTT-CITY, a connected bilingual language intervention tool for Maltese-English-speaking children aged between five-to-eight years old, namely those diagnosed with Developmental Language Disorder (DLD). Given the scarcity of local, evidence-based gamified resources for bilingual intervention in Malta, this research seeks to investigate the need for innovative, user-centred tools that combine traditional play with connected technologies.

Using a user-centred research design and a mixed-methods approach, the study integrated qualitative and quantitative data collection to explore the diverse perspectives of speech and language pathologists, caregivers and children on the SALTT-CITY board game and companion app. Semi-structured interviews, questionnaires, and thematic analysis were used to scrutinise how connected technologies stand to enhance engagement and accessibility and support both implicit and explicit language intervention approaches.

The findings suggest that SALTT-CITY has the potential to facilitate more tailor-made and engaging intervention experiences by aligning with tiered service delivery models and promoting collaborative learning. The study identified key design considerations for integrating connected technologies into language intervention while highlighting challenges related to usability, personalisation, and clinician adoption.

Ultimately, this study contributes to the evolving field of gamified and connected therapeutic tools by offering a look into their role in language intervention. Through the bridging of traditional and digital play, SALTT-CITY brought forth a scalable model for the enhancement of language therapy practices, with further implications for future technology-assisted therapy.

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List of Abbreviations and Acronyms

ASD – Autism Spectrum Disorder

ASR – Automatic Speech Recognition

CCP – Core Curriculum Programme

CG - Caregiver

CLI – Cross-linguistic Influence

DLD – Developmental Language Disorder

EFL – English as a Foreign Language

IoToys – Internet of Toys

L1 – First Language

L2 – Second Language

LD – Language Disorder

SALTT – Speech and Language Therapeutic Toy

SES – Socioeconomic Status

SLP – Speech and Language Pathologist

SLT – Speech and Language Therapy

SLA – Second Language Acquisition

SV – Subject-Verb (word order)

SVO – Subject-Verb-Object (word order)

VS – Verb-Subject (word order)

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NewsPoint. (2024, August 5). *UM researchers designing board game for use by children with Developmental Language Disorder within the bilingual context*. University of Malta. <https://www.um.edu.mt/newspoint/news/2024/08/board-game-DLD>

Times of Malta. (2024a, February 2). *Breaking barriers in speech and language therapy - Times²*. Times². <https://x2.timesofmalta.com/20240119/child/breaking-barriersdesign-innovations-for-speech-and-language-therapy-in-early-childhood/>

Times of Malta. (2024, July 31). *Innovative intervention for developmental language disorder - Times²*. Times². <https://x2.timesofmalta.com/20240731/child/innovativeintervention-for-developmental-language-disorder/>

Stellini, D., Gatt, D., Grech, H., Abela, E., & Farrugia, P. (2024) Designing Gamified Connected Tools for Bilingual Language Therapy and Education. *Frontiers in Education - Digital Learning Innovations*. [Under Review]

Chapter 1: Introduction

1.1 Introduction

This study aimed to investigate the process of developing and evaluating a connected speech and language therapeutic toy (SALTT) that targets multiple facets of language intervention for five-to-eight-year-old bilingual Maltese English speaking children. The target population for this toy included both typically developing children and those diagnosed with language difficulties or developmental language disorder (DLD).

This introductory chapter outlines the basis of language difficulties and the diagnosis of DLD while focusing on the theoretical underpinnings of intervention delivery for this clinical population. The chapter then discusses the overall importance of play and games in children's lives, along with the inclusion of these in speech and language practice. Additionally, the chapter explains the innovation of connected technologies. Finally, the significance and objectives of the study are presented.

1.2 Background to Language Difficulties and Disorders:

Children with language difficulties experience challenges in receptive and/or expressive language development. Some of these children eventually catch up, while others continue to struggle, leading to a diagnosis of DLD if the difficulties persist beyond the age of five (Perry et al., 2023). It is crucial to rule out other potential causes before diagnosing a child with language difficulties, as developmental language problems are purely linguistic and may not be linked to either comorbid or biomedical conditions (Reilly et al., 2014). Common features for diagnosing language difficulties, as outlined by Marrus and Hall (2017), include difficulty understanding complex language, following instructions, expressing oneself clearly, limited

vocabulary, difficulty with grammar and syntax, and challenges with reading, writing, and overall literacy.

While intervention and natural maturation can aid in improvement, these difficulties often persist into adulthood, leading to social, emotional, intellectual, and long-term economic challenges for affected individuals (Leonard, 2014). Low language abilities with a lower nonverbal IQ when compared to typically developing peers, a positive family history of language difficulties and a low socioeconomic level are only a few of the risk factors that longitudinal research has linked to a higher risk of long-term developmental language disorder. Accelerated speech and language therapy (SLT) assessment may be necessary if there is a cumulative risk from several variables, especially when combined with presenting inadequate language abilities (Ebbels et al., 2019). Given the bilingual nature of the Maltese context, sociolinguistic complexities often arise when assessing and intervening in language development. Maltese English bilinguals navigate linguistic environments shaped by diglossia, code-switching, and lexical borrowing (Camilleri Grima, 2016). These features complicate both the diagnosis and treatment of DLD, as language behaviours that may seem disordered could reflect typical bilingual patterns. Following the results of the assessment, adequate and individualised intervention practices need to be put into place.

1.3 Intervention Practices within the Field of Developmental Language Disorder:

Paediatric speech and language pathology requires the careful tailoring of intervention plans that consider the strengths and weaknesses of each client while working collaboratively with families and education staff to provide advice and raise awareness to support their language development (Ebbels et.al., 2019). Informed by this sociolinguistic backdrop, the present study considers how the local bilingual environment intersects with therapeutic practices. Particular attention was paid to how bilingualism shapes both the needs of the population and

the design principles of intervention tools. By integrating this awareness into the development of SALTT-CITY, the study aims to foster inclusive and realistic therapy experiences for Maltese English-speaking children.

A pioneering method of service delivery in the field of language intervention involves providing a tiered model of service, especially in the school environment. Tiered service delivery aims to take an inclusive perspective in providing language intervention.

Universally, three tiers of intervention are delivered when this approach is employed. Tier one offers intervention practices to all present children in a sample population (e.g., liaising with educators to provide a whole class support system), whereas tier two is more targeted in its service provision by offering intervention services to children who are more at risk of being later diagnosed with difficulties. Conclusively, tier three delivers individual services to address the expressive and receptive language goals of children diagnosed with language difficulties and developmental language disorders (Terreberry et.al., 2021). Tiered service models aim to provide a better outcome for a greater number of children while making use of limited speech and language resources.

Therefore, the creation of tools that would be suitable across all three tiers of service delivery would be effective in fostering further inclusivity in speech and language intervention. Such tools would need to incorporate elements that can target both implicit and explicit learning. The theories of learning processes in children diagnosed with DLD have been influenced by the controversy over the root causes of the actual DLD (Calder et.al., 2018). The aforementioned controversy debates whether DLD stems from difficulties in cognitive processing, linguistic difficulties, or broader neurodevelopmental factors (Tomas and Vissers, 2019). Therefore, both approaches are commonly adopted in a case-by-case tailored approach (Calder et.al., 2018).

Implicit approaches seek to increase the frequency of exposure to target word forms and their output, theoretically increasing the likelihood of children acquiring them (Calder et.al., 2018). Empirically tested implicit techniques, including imitation, modelling, and focused stimulation with conversational recasting lead to gains in expressive morphosyntactic development in younger children, although Calder et.al. (2018) elaborate on the lack of effectiveness that such intervention strategies have on receptive morphosyntax. Explicit approaches, on the other hand, focus on improving children's learning through explicit metacognitive teaching and visual supports, allowing children the space to actively reflect on their language targets (Ebbels, 2014). Typical means of explicit language intervention include increased exposure to new words, slowed presentation rates, and overt instruction of word meanings provided to children (Wright et.al., 2018).

In a comparison study of 34 English-speaking five-year-olds diagnosed with DLD, Smith Lock et.al. (2013) assigned participants to two different sample groups, in which one experimental group received a combination of both implicit and explicit instruction, along with a control group that received general language stimulation. Through their findings, Smith-Lock et.al. (2013) deduced that the experimental group made far more significant gains in terms of targeted expressive morphemes, including past tense '-ed', possessives, and nominative-case pronouns when compared to the control group. Baron and Arbel (2022) recommend integrating a "hybrid" approach by targeting specific language goals through a naturalistic, play-based environment while also including structured, clinician-directed input.

1.4 Play and the Importance of Toys:

Playing has a vital role in children's lives, serving as a tool to facilitate interactions necessary for their communicative, cognitive, motor, emotional, linguistic, and psychosocial development. Adults play a crucial role in supporting children's play. Notably, adults should provide children with a selection of safe and age-appropriate games, taking into account the

child's skill level rather than solely relying on the specified age range (Dag et.al., 2021). Developmentally delayed children may benefit from toys tailored to their abilities, and introducing developmentally advanced toys, supplemented with caregiver scaffolding, can encourage the acquisition of new skills. Certain toys can evolve with the child as they explore various skill sets, fostering imagination and interactive opportunities (Healey et.al., 2019). Ferjencik (2019) emphasises the value of traditional toys that encourage children's creativity, stating, "The less a toy does, the more the child can do with it."

In recent years, many traditional toys have undergone electronic adaptation, incorporating sensory-stimulating elements and virtual interactions, ultimately blurring the lines between physical and virtual toys (Healey et.al., 2019). Modern electronic toys and games, while engaging visually, sometimes substitute human interaction, posing challenges for caregivers. Electronic toys have been shown to maintain children's attention better; however, research by Healey et.al. (2019) and Hassinger-Das et.al. (2021) indicates that play with electronic toys often involves less responsive caregivers, who provide limited encouragement and use less varied language input compared to play with traditional toys. Sosa's (2016) study echoed these findings, concluding that play with electronic toys diminishes communicative interaction between caregiver-child dyads, suggesting that play with traditional toys and books fosters language development more effectively.

Despite these challenges, technology has become an integral part of children's lives, thus influencing their social interactions. Striking a balance between traditional play and technology is essential for holistic development (Istenič et.al., 2023). Integrated connected technologies offer a promising solution, seamlessly blending traditional toys with modern engagement methods, such as virtual interactions and sensory-stimulating elements. These toys bridge the gap between traditional play and the demands of modern society, creating a harmonious fusion of old and new experiences.

1.5 Connected Technologies.

Toys have become smarter in our rapidly changing, tech-savvy, and hyperconnected culture, much like many other goods and services. According to Llorente and Cuenca (2017), the Internet of Toys (IoToys) is a newly emerging and expanding category of phygital devices that combine physical objects with digital interfaces and content. These new toys are becoming increasingly common in the already highly mediatised households of modern families. Today's youngsters dubbed the "touch-screen generation" (Brito et.al., 2019), are the first generation to be exposed to digital media from birth and have been utilising them from a very young age, without reference to predigital times. Parents play a crucial role as mediators when it comes to young children (under the age of 8) and digital media. At these ages, parents tend to determine or monitor not only access to gadgets but also the digital practices of children who frequently emulate or seek assistance from their parents in their discoveries and learning (Connell, Lauricella, & Wartella, 2015). It is usually parents who introduce digital technology to their children, children look up to them as examples and role models, mimicking their practices and preferences.

Electronics capable of digital responses are becoming increasingly pervasive, with smart toys displaying a growing range of processing and reasoning capabilities. Hall et.al., (2022) define smart toys as objects that can directly and purposefully interact back with a person. Sylla et.al., (2022) go beyond that definition and characterise the agreed-upon general properties that make up a smart toy. Sylla et.al., (2022) outline four main properties for a toy to be classified as smart:

1. The toy must be interactive and equipped with the ability to respond to individual input.
2. It needs to possess the ability to communicate with other toys or online platforms via Wi-Fi, Bluetooth, or similar connections.

3. The toy needs to be ‘pervasive’ with the ability to assist children in everyday tasks.
4. Ultimately, the toy needs to be ‘social’ in a way that encourages the creation and sharing of ideas and expression among players.

Internet-connected toys and games offer a variety of potential benefits to children.

Personalisation of interactive media, which analyses and responds to individual input from children, provides significant educational benefits such as tailored learning experiences and enhanced engagement. Individualisation is at the heart of dramatic changes in learning technologies, employing software that adapts to an individual child's needs and progress, giving students choice in the pace, place, and mode of their learning. These enhancements result in a flexible learning environment for children in which the lines between formal and informal learning are blurred (Holloway & Green, 2016).

In summary, the rise of smart toys, forming the Internet of Toys (IoToys), is reshaping childhood experiences in our tech-driven era. Children of the "touch-screen generation" are growing up surrounded by interactive digital media from birth, with parents serving as key influencers in their digital interactions. Smart toys, defined by their interactivity, connectivity, pervasiveness, and social engagement, offer personalised and flexible learning experiences tailored to individual learning styles and preferences. Therefore, it is sensible to integrate such technologies into the world of paediatric speech and language pathology, given the multitude of toys used by speech and language pathologists and the reshaped ideas of play that children foster nowadays.

1.6 Speech and Language Therapeutic Toys (SALLTs):

Toys, games, and play serve as crucial intervention tools in early childhood therapy.

Mainstream toys intended for children are often modified by specialists such as SLPs to meet therapeutic goals. In contrast, therapeutic toys are specifically designed to address the needs

of clinicians as well as the specific objectives of individual children. Effective therapy extends beyond clinical settings and requires daily participation facilitated by parents and caregivers (Balzan et.al., 2021).

Children today seamlessly incorporate digital technologies into their daily acts of play, understanding their purposes even if they cannot fully utilise them. These technologies enhance communication by enabling children to actively participate through various modes such as visual symbols, photos, videos, and written texts. Social networks expand beyond immediate communities, enabling proactive participation and shaping a child's understanding of communication dynamics and networks (McPake et.al., 2012).

Internet toys have emerged as valuable companions for children with communication disorders. These toys possess continuous learning features that facilitate meaningful communication by processing information quickly (Biffi et.al., 2015). Mobile technology, particularly applications or "apps," has transformed communication and learning for children with disabilities, including speech and language disorders, given that such technologies are accessible, affordable, and engaging forms of healthcare delivery. Factors which inherently encourage the continued targeting of therapeutic goals at home (Jadi, 2019). In summary, early childhood therapy benefits from a wide variety of toys and digital technologies. This underscores the importance of engagement, interaction, and proactive communication within therapeutic settings and larger social contexts.

1.7 Aims and Objectives of this Study:

This research study focused on contributing to the development and evaluation of the SALTT CITY bilingual language intervention board game and its companion app, integrating multiuser experiences into its design.

The specific objectives of this study included the investigation of how fitting the SALTT-CITY tool would be in the delivery of language therapy for Maltese-English-speaking children aged five to eight. Along with that, the iterative development of the tool explored how user-centred design can be incorporated into the creation of SALTTs. As a bilingual Maltese English speaker and speech and language pathologist, the researcher’s positionality shaped the design, analysis, and interpretation of this study. Reflexive practices, including continuous design journaling, were used throughout to mitigate personal bias and maintain transparency.

The above mentioned approach aimed to overcome the limitations of currently available local games and provide a unique IoToys solution that is presently unavailable in Malta. All of this was divided among the following aims and objectives.

<i>Aims</i>	<i>Objectives</i>
1. To explore the subjective opinions and perspectives of speech and language pathologists (SLPs) regarding the SALTT CITY board game/Companion App concept and their current views on using similar materials in clinical practice.	2. To investigate the SLPs' current views on utilising board games and tablet applications in clinical practice. 3. To identify the benefits and limitations of using board games and tablet applications as therapeutic tools according to SLPs. 4. To examine the SLPs' opinions and perspectives on the concept of the SALTT CITY board game and accompanying application.
2. To develop comprehensive design guidelines for the content and accompanying application of the SALTT CITY board game based on the emergent themes from the SLPs' feedback.	1. To analyse and categorise the SLPs' feedback to identify common themes and recommendations. 2. To create design guidelines for the content and game mechanics of the SALTT CITY board game that align with SLPs' feedback.

<p>3. To investigate the potential assistance provided to children with language difficulties in language therapy sessions through the content elements of the SALTT CITY Board Game and Companion App.</p>	<ol style="list-style-type: none"> 1. To outline and explain the activities included in the SALTT CITY Board Game and Companion App, designed for intervention delivery for children with language difficulties. 2. To analyse the theoretical underpinnings and evidence-based concepts behind the inclusion of each activity in the board game and app. 3. To evaluate the correspondence between the board game activities and the specific therapy goals of children with language difficulties. 4. To gather subjective feedback from SLPs regarding their experiences using the SALTT CITY board game and application in therapy sessions. 5. To investigate the perspectives of parents regarding their experiences using the SALTT CITY board game and application with their children. 6. To explore the subjective experiences of children with/and without language difficulties while engaging with the SALTT CITY board game and application. 7. To identify strengths, weaknesses, and potential improvements based on the experiences and feedback of different user groups.
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<p>4. To investigate the perceived advantages and challenges associated with the integration of connected technologies into Speech and Language Therapy Tools (SALTTs) from the perspectives of SLPs and active participants in therapy, using questionnaire analysis.</p>	<ol style="list-style-type: none"> 1. To explore the perceived advantages of integrating connected technologies into SALTTs as reported by SLPs. 2. To identify the challenges and barriers associated with the integration of connected technologies into SALTTs, as perceived by SLPs. 3. To gather insights from active participants of speech and language therapy (such as parents and children) regarding the potential benefits of using connected technologies in therapy sessions. 4. To investigate the concerns and challenges expressed by active participants in utilising connected technologies during speech and language therapy.
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Each research aim was directly linked to a corresponding methodological phase to ensure alignment between the study's objectives and its design. For more detailed information about the methodological phases, please refer to Chapter 3 of this study. Below is a brief outline of how each aim was investigated:

- Aim 1 was explored through qualitative dyadic interviews and questionnaires with Speech-Language Pathologists (SLPs) during Phase 1 of data collection.
- Aim 2 guided the thematic synthesis and prototype development across Phases 2, and 3.
- Aim 3 informed observations and surveys involving both typically developing children and those diagnosed with Developmental Language Disorder (DLD) in Phases 2 and 4.
- Lastly, Aim 4 was examined through triangulated feedback from SLPs, caregivers, and children across Phases 2, 3, and 4.

This chapter aimed to provide an overview of the current research study, its theoretical foundation, and its goals and objectives. A review of the research literature relevant to this subject is provided in the upcoming chapter.

Chapter 2: Literature Review

2.1 Chapter Overview

This chapter aims to critically appraise and highlight literature to theoretically discuss the various aspects of this study. The initial sections of this chapter seek to address the development of various cognitive, lexical-semantic, and unique morpho-syntactic processes that occur during language acquisition and use, before delving into an overview of bilingual language use. These are followed by a section detailing atypical language development, which expands on childhood language disorders and the consequent diagnosis of developmental language disorder. Subsequently, the assessment processes taken up in speech and language therapy for these clinical populations are probed into with reference to bilingual contexts. The need for specialised resources for bilingual populations is then highlighted and light is shed on the currently available materials locally. Ultimately, the focus of the study is backed up by an appraisal of relevant literature in relation to the development of gamified connected technologies for intervention in SLT.

2.2 Components of Language

Language can be categorised into four key domains: phonology, grammar, semantics, and pragmatics. Phonology is concerned with the sounds that make up a language. To explain grammar, it needs to be further subdivided into morphology and syntax. Morphology outlines the rules that govern the use of morphemes (the smallest meaningful units of language). At the same time, syntax focuses on the systems of how words can be combined to form proper sentences in a language. On the other hand, semantics focuses on the meaning and content of language, and pragmatics deals with its practical use (Bloom & Lahey, 1978). These domains,

as outlined by Bloom and Lahey in 1978, encompass the typical expectations placed on language production and comprehension within society.

Developmental researchers much like Mueller and Fleming (2001), include the stages of prelinguistic communication as another component of language. Thus, placing an emphasis on the precursors of receptive and expressive language. However, despite variations in emphasis, a consensus emerges from the significant overlap between diverse theories regarding the constituents of language, as all the aforementioned domains are generally acknowledged (Redstone, 2014). This interconnected web of linguistic elements highlights the complexity and richness of the human capacity for communication.

Given that the present research study takes place in a recognised bilingual context, fundamentally, the dynamic realm of bilingual language use is critically addressed below. In such contexts, individuals are required to navigate the intricacies of two linguistic systems, thus, adding another layer of depth to the components that make up their language.

2.3 Bilingualism and Bilingual Language Use

People acquire proficiency in multiple languages for various reasons. The surge in globalisation has resulted in increased immigration, prompting individuals to learn the language of their new country (Dixon, Wu, et al., 2012). In certain areas, there is a wide variety of ethnic groups, leading to a growing trend of bilingualism as a means to enhance social engagement and participation within these communities. Moreover, the global prominence of English in business and science has led to a widespread command of English among educated individuals worldwide. (Kay-Raining Bird, Lamond, & Holden, 2012).

Bilingualism varies in degrees. Balanced bilinguals are summed up as individuals who can equally communicate in two languages (Hsu, 2014). However, true balanced bilinguals are rare, as individuals often have a preferred or dominant language. Additionally, those

acquiring a second language after early childhood seldom achieve native speaker proficiency, making their first language the dominant one (Meisel, 2019).

Bilingual speakers, in contrast to monolingual individuals, exhibit a unique linguistic flexibility that manifests in various ways. One prominent phenomenon is code-switching, where bilinguals seamlessly transition between two languages within a single conversation or sentence (Dykes, 2018). This dynamic linguistic behaviour allows them to express ideas with precision, drawing on each language's nuanced vocabulary and cultural connotations. Overall, bilingual speakers showcase a remarkable ability to navigate and integrate multiple linguistic systems in their language use, demonstrating cognitive agility that distinguishes them from their monolingual counterparts (Bialystok, 2017).

While the linguistic flexibility and cognitive advantages associated with bilingualism are generally positive, there can be challenges or perceived negatives in certain contexts. For instance, some individuals might argue that code-switching could lead to potential misunderstandings, particularly if interlocutors are not familiar with both languages. In formal settings, such as academic or professional environments, there might be expectations for monolingual language use, and excessive code-switching could be perceived as unprofessional (Moradi and Chen, 2022). Additionally, bilingual speakers might face linguistic interference, where elements from one language unintentionally influence their expression in the other. This could result in syntactic errors or the inappropriate use of vocabulary, potentially impacting communication clarity (Sirbu, 2015). It should be noted that languages such as Maltese, have integrated borrowings from simple Italian and English as bona fide lexical items in the native language. Native speakers typically have clear intentions in use when it comes to these borrowings and consequently adapt their pronunciation to fit Maltese phonology. Thus, these would not be instances of code-switching (Tucker, 2013). Despite the challenges mentioned previously, it is important to note that

syntactic confusion is a natural part of the language-learning process for bilinguals, and it often diminishes with increased proficiency and exposure to both languages (Kroll et.al., 2012).

Cross-linguistic influence (CLI) has a significant impact on second language acquisition (SLA), with its effects varying from positive to negative depending on multiple factors. CLI occurs when a learner's first language (L1) affects their learning of a second language (L2). While negative consequences, such as interference due to differences between L1 and L2, are often highlighted, it is important to note that language contact does not necessarily lead to adverse outcomes. Positive transfer can occur when there are similarities between the two languages, facilitating easier learning and better comprehension. Additionally, the context and extent of contact with L2, such as immersion in a native-speaking environment, can promote more effective acquisition and reduce negative transfer, making CLI a complex yet integral aspect of language learning that can yield beneficial results under the right conditions (Chen, 2022).

Moreover, such negative impacts can be mitigated through targeted language instruction, awareness-raising, and a supportive linguistic environment (Peña et.al., 2023). The diverse abilities necessary for successful language acquisition and utilisation must be addressed in strategic language instruction. A variety of conceptual abilities that underlie language development will be covered in the next part, along with an array of word classes that one must learn to facilitate proper morphological and syntactic word usage.

2.4 Conceptual skills in language acquisition

Perceptual and conceptual skills are essential components of language acquisition, playing a crucial role in the development of linguistic understanding. Perceptual skills involve the processing of sensory input received from both visual and auditory stimuli, which are both

crucial for apt understanding and production of language (Seitz, 2017). Conceptual skills, on the other hand, encompass the ability to categorise, reason, and form relationships between ideas, contributing to an understanding of the meaning and structure of language (Kroll & De Groot, 2014).

In the context of social language use, perceptual and conceptual skills are interconnected, working together to facilitate communication exchanges. Perceptual skills help individuals perceive and recognise the sounds, words, and phrases that makeup spoken language, while conceptual skills enable them to understand the meaning and relationships between these elements (Ströbel, 2017). Given that this interplay of perceptual and conceptual skills is essential for the successful conveying of complex ideas and emotions, it can be said that both children and adults rely on both skill sets to process and produce language effectively within social contexts. (Henningsen-Schomers et.al., 2023).

Effective cognitive processing in the realm of language acquisition is intricately linked to specific conceptual skills such as categorisation of nouns according to semantic features, verbal reasoning and the ability to establish semantic relationships (tasks that relate two different objects together), each of these skills plays a crucial role in the understanding and manipulation of language (Committee on the Science of Children Birth to Age 8, 2015). Bilingual children living with language disorders (LD), similar to monolingual children diagnosed with LD, exhibit challenges in semantic representations and word meanings (Marinellie & Johnson, 2002; McGregor et al., 2002). Sheng et.al., (2012) observed that bilingual children with such difficulties often use vague vocabulary, offer limited elaborations, and struggle to explain multiple or colloquial word meanings. Another study by Sheng et al. (2012) found that Spanish-English bilingual children living with language disorders face specific difficulties in providing category labels and describing functions of object nouns during word definition tasks. In the realm of speech-language therapy, linguistic

skills such as convergent and divergent naming are utilised to enhance this area of language proficiency.

Convergent naming involves identifying the category to which a set of items belongs, aiding in the organisation and recall of words, while divergent naming entails specifying items within a designated category, fostering the generation of new words and ideas. Therapists employ diverse exercises like categorisation, comparison, contrast, and matching to enhance language abilities, facilitating the organisation, recall, and generation of words (MüllerWienbergen et.al., 2011).

Categorisation, an intrinsic cognitive process, plays a pivotal role in organising mental representation for language acquisition and use. This process involves the systematic grouping of linguistic elements based on shared characteristics, providing a foundational framework for word associations and thematic connections. In the process of language acquisition, the act of categorisation not only organises the lexicon but also cultivates a heightened ability to discern relationships between lexical units (Macwhinney, 1988). This, in turn, fosters a profound understanding of language, setting the stage for more advanced linguistic skills to develop later on in life such as verbal reasoning, which enhances pattern recognition and logical thinking. Verbal reasoning contributes to the nuanced development of semantic understanding and word relationships, allowing learners to unravel meanings and establish connections between words with increased acuity (Ferguson and Waxman, 2017). Verbal reasoning sharpens learners' ability to navigate inherent subtleties in language. This heightened sensitivity lays the groundwork for a more sophisticated grasp of semantic nuances and the intricacies of word relationships. These advanced skills deepen verbal comprehension by emphasising relationships between abstract concepts (Maier and Abdel Rahman, 2019).

In conclusion, perceptual and conceptual skills are essential components of language acquisition, playing a crucial role in the development of linguistic understanding and effective communication. Despite the importance of spoken language in acquiring cognitive skills, it is not a necessary requirement to master such skills (Chater and Christiansen, 2018). However, another array of components is required for morphologically and syntactically apt language output to be comprehended and produced. The following section transitions into the discussion of word classes that are pertinent to the majority of languages across the globe.

2.5 Word-Classes

In linguistics, word classes are categories that group words based on their properties recognised interchangeably as parts of speech or lexical categories. Word classes categorise words based on shared morphological, syntactic, and semantic attributes. These classes serve as a foundation for understanding how words function within sentences and convey meaning. The understanding of word classes is of utmost importance in language acquisition and use, making it a fundamental aspect of linguistic development. In most languages, the fundamental word classes encompass nouns, verbs, adjectives, adverbs, prepositions, determiners, pronouns, and conjunctions (Matras et.al., 2023). The following classes were all included as targets in the SALTT-CITY tool's prototypes.

2.5a Nouns

Nouns, fundamental elements of language, serve as essential tools for conveying meaning and referencing objects, concepts, or places. Several key aspects, including frequency, concreteness, and socio-cultural influences, highlight the fundamental nature of nouns (Maillart and Parisse, 2019).

During childhood language acquisition, nouns are used in more abundance than verbs. This pattern is observed across various languages and is linked to the initial vocabulary

development of children (Chai et.al., 2017). Nouns dominate early vocabularies because they represent concrete and tangible objects, making them easier to distinguish and learn than abstract concepts such as adverbs. This tangibility aids in language comprehension and retention, facilitating language acquisition. The frequency of noun usage among children at an early age reflects their significance in establishing a foundation for language development (McDonough et.al., 2011).

In the early stages of language acquisition, learners prioritise nouns over other word types. Nouns hold significance in categorising the world, which helps children comprehend and make sense of their surroundings. This preference for nouns aligns with the Cognitive Grammar perspective, emphasising the role of nouns in categorising the world (Hollmann, 2013). Socio-cultural factors also play a role in shaping vocabulary development. For example, Chai et.al, (2017) investigated bilingual infants and toddlers in Malaysia and found that the relative distribution of verbs and nouns varied between different language groups (Malay-English and Mandarin-English speaking children). This variation suggests that cultural context influences the way we learn and use language, and it highlights the interplay between language development and culture.

Therefore, nouns hold immense significance in communication. Nouns, being fundamental, provide the foundation for language acquisition from the very beginning. The frequency of noun usage and their tangible nature contribute to our understanding of the world. Moreover, nouns embody socio-cultural influences, shaping our perception of reality. Therefore, mastering nouns empowers us to engage in effective communication and continually enhance our comprehension of the world.

2.5b Verbs

Transitioning to verbs, it is apparent that the word class of verbs brings a dynamic essence to sentence construction. They express actions, happenings, or states of being and change according to tense (to show when an action took place), aspect (how an action extends over time), mood (to show the inflection of an action), and voice (indicating whether the subject of the sentence is performing an action) to convey nuanced meanings (Leech, 2014). Verbs play a fundamental role in shaping the meaning of a sentence through various linguistic functions. Firstly, they serve to convey actions, states of being, or transformative changes within a sentence, thereby encapsulating the primary idea or purpose and facilitating the communication of meaning (Chou, 2020). Moreover, verbs extend beyond the realm of concrete actions and possess the capacity to articulate emotions, relationships, and abstract concepts. Noteworthy examples include verbs such as "love," "hate," and "need," which convey emotional states, while verbs like "be" or "have" express relationships or possession (Hollmann, 2013).

In addition to their semantic functions, verbs contribute significantly to the structural organisation of sentences. Occupying specific positions, relating to either the subject or object, verbs play a pivotal role in delineating the sentence's structure, thereby enhancing readability and comprehension for the reader or listener. Furthermore, verbs foster semantic coherence within a sentence by establishing connections between related words and ideas. Through their ability to link subjects with objects, verbs create a sense of continuity and meaning in sentences, fostering a cohesive expression of thoughts (Gentner, 1981). In Maltese, verbs typically follow the Semitic fashion of subject agreement morphology with circumfixal agreement (Tucker, 2013). Borg & Fabri (2016), highlight the relatively free constituent order that the Maltese language possesses when it comes to sentence structure—

stating that as a language it allows for both SV (Subject + Verb) and VS (Verb + Subject) structures for intransitive sentences and also SVO (Subject + Verb + Object), SOV, OSV and OVS for transitive sentences.

Apart from providing structure to sentences, verbs are indispensable in conveying polarity (positive or negative, to mark the function of a word) and tense (present, past, future), crucial elements for indicating the time and nature of an action or state. This nuanced expression enhances the overall meaning of a sentence (Benamara et.al., 2017).

In summation, verbs are vital in constructing sentences, giving them meaning and structure. Their semantic and structural roles help us communicate, understand, and express our thoughts.

2.5c Adjectives

In contrast to nouns and verbs, adjectives fulfil the role of refining and detailing nouns to create vivid descriptions. They can convey information about the qualities of nouns by utilising inflection for comparison. This ability to communicate information about nouns' qualities enhances language's descriptive capability, leading to a more expressive and nuanced communication of ideas (Matthews, 2014).

Adjectives are important for individuals acquiring language because they help develop critical thinking skills and language comprehension. When learners are exposed to adjectives, they must analyse and interpret language more carefully, which helps them understand the specific characteristics of nouns. Teaching adjectives using conceptual metaphors can further improve critical thinking skills and metaphorical competence. This is because conceptual metaphors are a way of understanding language that is based on our everyday experiences. By using conceptual metaphors, learners can make connections between abstract concepts and their concrete experiences, which helps them understand language better (Barković,

2012).

Moreover, adjectives contribute to grammatical awareness in children's language and literacy development. In languages like Hebrew, where adjectives align with noun number and gender, understanding this agreement is essential for children's grasp of syntax and morphology in decoding both spoken and written language (Ravid and Schiff, 2021).

According to Amaira (2014), adjectives in Maltese also reflect this behaviour as they are inflected according to their accompanying noun's number and gender. However, Amaira (2014) further expands on the fact that Maltese possesses other forms of adjectives which cannot be inflected and remain fixed. With that being said, Fabri (2009) highlights the different compositions that exist in Maltese phrases due to the syntactic flexibility of the language (i.e, Noun +Adjective (eg: kaxxa infernali), A+N (eg: šhun banju), Adjective +Verb (eg: šhun jagħli) u A+A (eg: għajjen mejjet) A+A (eg: għajjen mejjet) and A+N (eg: šhun banju).

2.5d Adverbs

Adverbs are versatile modifiers that add depth to communication by providing extra details about time, place, manner, or degree. They enhance the context and nuance of sentences by describing the circumstances surrounding events (Sastra, 2014). Muscat (2021), highlights the fact that Maltese adverbs can provide the aforementioned extra details in a sentence, however, they also can change an entire sentence through the use of suffixes such as ‘-ment’ (e.g. fortunament). Sastra (2014) further details how adverbs can modify verbs, adjectives, or other adverbs, providing critical information about when, where, how, and to what extent. They play essential roles in exposing meaning, amplifying emotions, offering context, refining clarity, and improving overall communication effectiveness (Sastra, 2014). Adverbs significantly contribute to sentence structure, enhancing sentences to be more informative,

engaging, and efficacious in conveying their intended messages. Given that they clarify meaning by furnishing additional context or details, they enable a nuanced understanding of actions and the accuracy of statements. Adverbs enrich emotional expression by emphasising feelings and/or opinions, allowing speakers to communicate with heightened efficacy. This flexibility enables adverbs to modulate the tone of a statement, adapting it to the contextual requirements, as an example: whether a statement demands politeness or assertiveness.

Furthermore, adverbs excel in providing temporal context within spoken discourse. They act as linguistic signposts, guiding listeners through the chronological aspects of a message, whether it relates to the past, present, or future, or takes the form of a question, statement, or command (Choi, 2023).

The role of adverbs in enhancing clarity is crucial. By furnishing additional information, they disambiguate sentences, ensuring a clear distinction between different meanings or interpretations. Complex sentences particularly benefit from adverbs, specifying focal points that require emphasis or modification, thereby streamlining comprehension (Hernández, 2006).

2.5e Pronouns

Pronouns also play a crucial role in conveying meaning and maintaining sentence structure. Depending on the language at hand, pronouns are typically broadly categorised into two main types: personal pronouns and possessive pronouns.

Personal pronouns, such as "I," "you," "he," "she," "it," and "they," refer to the speaker, the listener, or a third person, and they act as subjects, objects, or complements in sentences (Evans, 1980). Possessive pronouns, on the other hand, such as "my," "your," "his," "her," "its," and "their," signify ownership or possession of something. These pronouns play a crucial role in indicating relationships between individuals and the objects, ideas, or qualities

they possess or are associated with. Possessive pronouns are vital components of language, as they are the main means of expressing ownership in effective communication (Aikhenvald, 2013).

Further aspects underline the significance of pronouns in spoken language. Firstly, pronouns perform various syntactic functions, including acting as subjects, objects, or complements in sentences. This syntactic role helps maintain sentence structure and meaning, facilitating the listener's comprehension of the message (Singerman, 2021).

Secondly, pronouns provide a means of reference to previously mentioned or implied entities. This referencing function aids in clarifying the meaning of sentences, contributing to smoother communication. Additionally, some languages, such as American Sign Language (ASL), utilise exclusive pronouns to exclude certain discourse participants, offering context-dependent information not present in spoken languages (Cormier, 2005).

Lastly, the comprehension and use of pronouns are crucial for language development in children. Difficulties in this area can indicate atypical language development, highlighting the fundamental role pronouns play in linguistic growth (Wessel, 2015).

2.5f Prepositions

Prepositions, crucial in establishing relationships between sentence components, conventionally precede noun phrases, exposing connections among them (Atiega, 2021). This category of words proves indispensable for furnishing specific details related to spatial and relational aspects, thereby facilitating the expression of temporal, locative, and directional relationships within literary constructs.

Prepositions, exemplified by terms like "on" and "under," are indispensable linguistic elements, particularly in highlighting spatial relations. Functioning as linguistic connectors, prepositions articulate the spatial orientation of objects or entities (nouns). For instance, in a

sentence such as "the book is on the table," the preposition "on" precisely conveys the book's location in relation to the table. Despite their relatively lower semantic weight, prepositions are fundamental in organising sentence structure and maintaining coherence (Thi, et.al., 2022).

While content words like nouns and verbs contribute substantially to a sentence's meaning, function words like prepositions are indispensable for syntactic support. Serving as structural components, they aid in the overall organisation of sentences. The choice between prepositions, such as "on" versus "under," introduces subtle yet meaningful variations in interpretation. This exemplifies the substantial influence of these linguistic elements on the communicative intent of sentences (Schumacher, 2018).

Furthermore, the strategic use of prepositions, particularly those indicating spatial relationships, significantly contributes to communication clarity. By accurately conveying the spatial connections between elements, prepositions facilitate a clearer understanding of the intended message (Flor Fabregat, 2022). Thus, prepositions not only convey meaning but also elevate the effectiveness of exchanges.

2.5g Conjunctions

Conjunctions, act as connective tissues in speech, empowering the creation of intricate and compound sentences. Their role is that of articulating relationships between ideas and fostering the construction of more sophisticated sentences in discourse. Conjunctions, to put it simply, are indispensable components of speech, as they are intricately woven between words, phrases, and clauses to contribute to a sentence's coherence and flow. Their multifaceted purposes can be succinctly categorised into the following functions (Darweesh and Kadhim, 2016).

Firstly, conjunctions play a pivotal role in expressing addition by joining two or more elements, conveying the idea that they should be considered collectively. The conjunction "and" presents as one of the most abundantly used linguistic adhesives, emphasising the joint significance of the components it connects (Mauri, 2017). Secondly, conjunctions are instrumental in expressing contrast, offering a toolset with words like "but" and "or" that highlight differences and underscore the diversity within a narrative. These linguistic signposts aid in navigating differences in expressed ideas. Moreover, conjunctions contribute to the establishment of cause-and-effect relationships within sentences. "Because" and "for" shed light on the rationale behind actions or events, while "so" and "since" illuminate the ensuing consequences. This use of conjunctions enhances the clarity of communication by guiding the audience through an intricate web of causation (Unubi, 2016). Additionally, conjunctions act as bridges that provide smooth transitions within discourse. Words like "however," "moreover," and "in addition" serve as gateways to new ideas or shifts in direction, fostering a dynamic and sophisticated conversational landscape. For instance, the use of "however" injects a contrasting note, whereas "and" underscores parity, emphasising equal importance between ideas (Tukhatsinova, 2023).

Therefore, conjunctions wield a transformative influence on sentence meaning, orchestrating connections among different elements and enabling speakers to convey ideas with precision and coherence.

2.5h Determiners

Finally, determiners, are responsible for furnishing precise information about nouns as they assume a pivotal role in the definition of ownership, quantity, and definiteness. Their careful selection contributes to the shaping of contextual parameters, refining the specificity of nouns.

Determiners are made up of articles, demonstratives, quantifiers, and possessives, which play a pivotal role in spoken language by providing essential information about the nouns they modify. Definite determiners, like "the", point to known nouns, while indefinite determiners, such as "a" or "an," introduce non-specific ones, facilitating clarity in communication (Puyo, 2016). According to Kim (2009), in Korean speech, definite articles go beyond identifying nouns; they suggest the speaker's perspective and highlight the importance of that topic in the discussion. Conversely, indefinite articles maintain referent persistence, indicating a new or non-specific noun, and ensuring a smooth flow of conversation (Cardinaletti and Giusti, 2016).

In conclusion, determiners have an indispensable role in enriching communication with subtle layers of information and perspective.

2.6 Language Disorders

The early stages of language development mark critical milestones for children because they allow them to express themselves and interact socially. However, speech and language difficulties in toddlers and preschoolers are particularly common. While these difficulties are often temporary, certain individuals may face ongoing speech and language difficulties throughout their entire lifespan (Jansen et.al., 2013).

Childhood language disorders encompass a range of difficulties in the development of language skills in children. These can include problems with language comprehension, expression, and literacy. These disorders can manifest themselves as difficulties with vocabulary acquisition, proper sentence structure, and inappropriate discourse, and can significantly impact academic achievement and social interaction (Rosenbaum, 2016).

According to Caplan (2002), the main manifestations can be summed up into three areas, as follows:

1. **Lack of Language Input:** Insufficient exposure to language can impede language development. This may occur due to sensory deficits, such as hearing loss or visual impairment, which limit the individual's ability to perceive and access linguistic input (Bishop, 2014). Unfavourable environmental factors, such as a lack of toys and books that support language learning at home, can also contribute to a deficit of language input (Roulstone et al., 2015). Limited opportunities for interaction, such as excessive television time or a lack of language- and literacy-related activities, along with parental stress, can further hinder language development (Romeo et.al., 2018).
2. **Difficulties with Language Processing:** Language processing difficulties can occur in association with biomedical conditions. For example, individuals diagnosed with autism spectrum disorder (ASD), Intellectual Disability, genetic syndromes, or sensorineural hearing loss may experience challenges in processing language (Azunre, 2021). Developmental Language Disorder (DLD), on the other hand, refers to language processing difficulties that arise in the absence of another biomedical condition (Bishop et al., 2017). DLD affects an individual's ability to access, comprehend and express language appropriately, however, this specific disorder will be discussed in more depth in the upcoming section of this chapter.
3. **Difficulties with Language Output:** Problems with language output can stem from neuromuscular impairments that affect the control and coordination of articulators. Conditions like verbal dyspraxia and dysarthria can hinder the individual's ability to produce clear and intelligible speech (Turner et.al., 2019). Orofacial structural abnormalities, such as cleft lip and/or palate, can also impact speech production by affecting the physical structures involved in articulation (Hardin Jones et al., 2020). While physical limitations may be present in some cases of language disorders, the primary focus lies on the intricate cognitive processes underlying language

production. It is often observed that children diagnosed with language disorders typically have smaller vocabularies compared to their peers who are developing typically. This limitation in vocabulary can lead to restricted options for expression. Additionally, these children may also face challenges in understanding social cues and conversational conventions, which can result in poor pragmatic skills. As a result, their ability to effectively interact verbally may be impacted (Laasonen et al., 2018).

It is important to note that one or more of these areas can contribute to speech and/or language difficulties. Understanding the specific factors underlying an individual's language disorder is crucial for effective intervention, this is where speech and language pathologists involve themselves seeing as they play a key role in the assessment and treatment of these disorders, using various therapeutic techniques to help children outline their strengths and weaknesses in terms of language skills.

2.7 Developmental Language Disorder

Developmental language disorder (DLD) is defined by Bishop et.al. (2017) as a disorder occurring in the absence of comorbid biomedical conditions (e.g., Autism Spectrum Disorder, Intellectual Disability, Sensorineural Hearing Loss etc.) in which language difficulties are only one part of a more complex system of weaknesses) spanning beyond the age of five. It is estimated that 7.6% of children aged five to eight in the United Kingdom are diagnosed with Developmental Language Disorder (as reported by the population-based study by Norbury et.al., 2016), with male gender, later birth order, positive family histories, lower socioeconomic status (SES), lower parental education levels, and perinatal factors being reported as salient risk factors (Wu et.al., 2023). Ultimately, the presence of DLD typically results in a negative prognosis, namely in terms of academic, social, and emotional functioning, given that its implications commonly persist well into adulthood (Nudel et.al.,

2023). Noteworthy, DLD presents itself in a heterogenous format, with difficulties manifesting themselves across multiple linguistic (i.e., grammar, phonology, and semantic realms) and non-linguistic aspects (working memory, attention, problem-solving etc.). Therefore, speech and language pathologists need to be able to identify all the affected areas of difficulty through a battery of assessments which would consequently lead to tailor-made treatment plans (Thomas et.al., 2019).

2.7a Areas of Deficit and clinical markers in the diagnosis of Developmental Language Disorder

Children who are candidates for the diagnosis of Developmental Language Disorder often exhibit specific areas of deficit that affect their ability to effectively communicate and process language. Certain clinical markers can be useful as a screen in the full picture context of the child's needs when administering the comprehensive battery of assessments which is required for the diagnosis of DLD (Bishop et.al., 2016).

Verbal memory deficits emerge as a common strand in the makeup of DLD. Children with DLD often encounter difficulties in tasks involving new word retention, sentence recall, and comprehension of verbal instructions, reflecting the broader impact that the disorder has on short-term memory and information processing (Archibald & Joanisse, 2009). These deficits may not be limited to verbal material, as difficulties with retaining information in the short term can extend beyond language-related content (Bishop, 2014).

Verbal memory tasks in DLD can be differentiated based on whether they involve brief retention only or also require information processing. Tasks that involve brief retention only, such as phonological digit recall or visuospatial recall of dots on a grid, tap into short-term memory. On the other hand, tasks that require information processing in addition to retention, such as judging the veracity of a sentence and repeating the final word, engage working memory, a multifaceted system involved in complex task performance (Riches, 2012). Two

distinct clinical markers for DLD are non-word repetition and sentence repetition, both of which involve verbal memory and are often impaired in children diagnosed with DLD (Archibald & Joanisse, 2009).

Non-word repetition tasks, which require the repetition of nonsense words with increasing syllables, assess phonological processing and phonological memory, revealing difficulties in discriminating and identifying word phonology and storing phonological information (Gathercole, 2006). However, non-word repetition alone is not sufficient to identify DLD (Archibald & Joanisse, 2009). Sentence repetition tasks tap into the interaction between phonological short-term memory, working memory, and language knowledge. They assess the ability to preserve the structure of a sentence through phonological short-term memory, coordinate different sources of information during recall in working memory, and rely on existing language knowledge in long-term memory to support sentence recall (Riches, 2012). Sentence repetition has been found to correlate with measures of phonological short-term memory, and language abilities such as vocabulary and grammar, and highlights limited short-term memory capacity, poor working memory, and impoverished linguistic representations in long-term memory in children with DLD (Archibald & Joanisse, 2009). Children with DLD may face a double disadvantage in sentence repetition tasks due to impaired verbal memory and reduced language knowledge. Despite errors in recalling sentences, the overall meaning is generally preserved (Archibald & Joanisse, 2009). Verbal memory deficits, assessed through non-word repetition and sentence repetition tasks, contribute to our understanding of the challenges faced by individuals with DLD in retaining and recalling verbal information, thus guiding the SLP towards the decision on whether the individual would require further assessment or the start of intervention protocols. Nair et.al., (2023) examined 14 different studies to tabulate the most common intervention drills in speech and language therapy, when confronted with cases of DLD. From the reviewed

studies, Nair et.al., (2023) deduced that vocabulary was the most frequently targeted area (typically in combination with other areas such as morphosyntax). Despite being targeted, intervention on phonological skills, pre-literacy and literacy abilities, narrative instruction, and pragmatic skills were not as commonly examined as vocabulary skills in children living with DLD (Nair et.al., 2023). On the other hand, Stanford et.al., (2019) surveyed several studies which explored non-linguistic cognitive skills such as speed of processing, working memory, and selective attention. Ultimately, the results yielded by Stanford et.al., (2019) indicate that direct vocabulary intervention is more often paired with tasks from these cognitive areas as opposed to further linguistic skills.

2.7b Intervention Practices regarding DLD

Intervention strategies for children with DLD are carefully tailored to the severity and nature of each child's language difficulties. As highlighted by Montgomery and Gillam (2024), DLD frequently results in persistent language and academic difficulties, outlining the need for evidence-based and tailored interventions. Ebbels et.al., (2019), describe the commonly employed tiered intervention framework, which ranges from universal support to intensive, individual therapy. Children with severe difficulties would require direct intervention by an SLP. Children with milder difficulties could benefit from monitoring by the SLP and indirectly delivering intervention through their caregivers.

Consequently, Neumann et.al., (2024) recommend the use of parent training programs as they have shown efficacy in improving expressive language skills, underscoring their importance in DLD intervention. In Malta, the field of SLT has greatly evolved since its inception in the late 1970s. The population's bilingual context is reflected in SLT training, where theoretical coursework is conducted mainly in English, whereas clinical placement uses both Maltese and English (Grech & Galdes, 2018). Despite the evolutions in the system, Grech and Galdes

(2018) note that there is no national screening or surveillance program for DLD. Regardless, interventions such as “Colourful Semantics”, adapted for use with Maltese children by Grima (2019), employ explicit techniques to support sentence construction through colour-coded cues. Grima's (2019) study outlined significant improvements in participating children in morpho-syntactic abilities, enriched Mean Length of Utterance (MLU), and word order, highlighting the program’s suitability for the linguistic features of Maltese.

Notably, effective intervention techniques for children with language disorders often combine explicit teaching of linguistic rules with implicit exposure to enriched language output (Forsythe et.al., 2021), Hence, through this dual approach, children are encouraged to discover new language forms and comprehensively develop their linguistic skills (Montgomery & Gillam, 2024).

2.8 The need for specialised materials in SLT intervention (with a focus placed on speech and language therapeutic toys).

Speech and language therapeutic toys (SALTTs) serve as tools for supporting children with speech and language difficulties, creating an environment conducive to their development (Balzan et.al., 2023). These toys play a pivotal role in fostering communication skills by targeting areas such as articulation, vocabulary, and social communication during play.

Integrating play and interaction, not only encourages communication in a fun setting but also contributes significantly to enhancing language skills. (Besio, 2010).

Throughout the area of paediatric speech and language pathology, play is used across multiple contexts. It is used in history taking, icebreaking, intervention and even assessment.

However, overall, it is also deemed as a skill that needs to be optimised so that developmental milestones can be achieved (O’Connor & Stagnitti, 2011). Children slowly discover their surrounding world through play. As children develop, they start to gain an understanding of

how to communicate and socialise within the context of play. Therefore, facilitating their cognitive, emotional, and social development through various types of play (Whitebread et.al., 2012). Throughout speech and language intervention, play is described according to its role and the level of child control that is allowed during the session. Therefore, play can either be a component of a clinical session (an aspect of free play or structured gameplay is incorporated into the session, taking place in a clinical environment), or a context for intervention (e.g., targeting social communication in a context that stimulates play such as the playground). Ultimately, however, it is most commonly used as a key mechanism during intervention to stimulate skill development and change (Gibson et.al., 2021). Speech and language therapeutic toys play a crucial role in educative and therapeutic interventions when they are integrated into broader strategies aimed at enhancing the communication skills of children. Moreover, the incorporation of new robotic technologies in play and therapy sessions offers innovative opportunities to further improve communication skills and develop novel devices, expanding the therapeutic landscape (Georgieva-Tsaneva et.al., 2023). Speech and language therapeutic toys stand out from traditional toys in their specific focus on addressing communication challenges in children. Unlike traditional toys, they are intentionally chosen to target and improve specific communication areas such as articulation, vocabulary, and social communication. Professionals often recommend and integrate these specialised toys into educational and therapy sessions, ensuring targeted support for the development of such skills (Jadi, 2019)

These therapeutic toys cater for various age groups, employing targeted strategies to address specific communication skills and create supportive and engaging environments for development. For younger children, the emphasis is on foundational pre-verbal skills. As children progress in age and developmental level, available toys become more sophisticated, targeting language skills such as grammar, narrative abilities, and abstract thinking (Jenkins,

2017). Examples include story-telling kits, board games with language prompts, and toys promoting creative and imaginative play. The key to their effectiveness lies in adapting these toys to the unique needs and abilities of each child, offering tailored support for their communication and language skills.

Overall, speech and language therapeutic toys play an integral role in supporting children with speech and language difficulties, fostering their communication development, and contributing to their overall well-being (Healey et.al., 2019).

While the field of speech and language therapeutic toy manufacturing holds promise for innovative interventions, the current body of research supporting this area is still relatively limited. Therefore, while there is potential for speech and language toys to contribute to SLT, there is a need for more research to establish their efficacy.

2.8a Speech and Language Therapeutic Toys in the Maltese Context with a focus on the SPEECHIE project.

Olly Speaks was developed through the collaborative efforts of engineers, SLPs, and game developers in the SPEECHIE project, which concentrated on the development of a multimodal device (refer to Figure 1), Olly Speaks underwent usability studies with 155 bilingual Maltese English-speaking children, receiving positive feedback and generating emotions of delight during use. The device not only supports SLPs in therapy sessions but also appeals to parents as an educational toy for home use or as a platform for delivering assessment and therapy in various contexts (Frendo Wirth, 2020).

In the realm of speech and language therapy in Malta, Olly Speaks emerged as a trailblazer for Speech and Language Therapeutic Toys, uniquely tailored to meet the needs of bilingual children diagnosed with DLD within the Maltese context (Cassar, 2019). Notably, Olly Speaks is rooted in the foundational work discussed by Buttigieg (2019), who evaluated its

effectiveness as a speech assessment tool, by integrating Automatic Speech Recognition (ASR) technology with the Maltese English Speech Assessment (MESA). Through Buttigieg's (2019) study the tool's ability to streamline speech assessment by reducing analysis time while retaining the manual method's reliability was highlighted. The MESA, once integrated into Olly Speaks, was evaluated with speech from typically developing children and those with speech sound disorders, with findings demonstrating its adaptability potential when it comes to diverse therapeutic needs, however, further refinement of the ASR component was required.

As far as the literature extends, Olly Speaks is the sole speech and language therapeutic toy designed for this specific demographic (Maltese children), marking a significant advancement in addressing the challenges associated with bilingual speech and language development.

Taking the form of a toy penguin (see Figure 1), Olly Speaks serves as a smart assessment and therapeutic companion, engaging children in customised therapeutic activities developed by SLPs. The primary goal of it is to make therapy more rewarding and motivating, ultimately enhancing the effectiveness of interventions (Balzan, 2018).

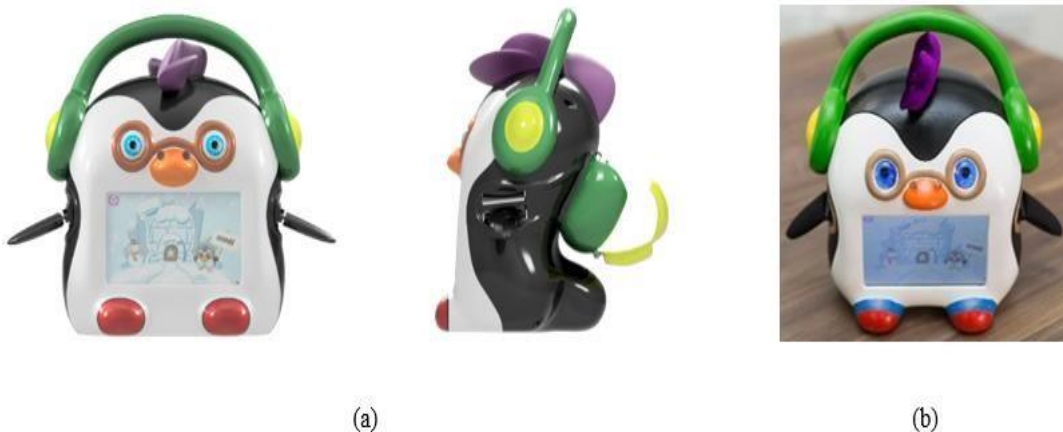


Figure 1 Olly Speaks from the SPEECHIE Project

The device integrates seamlessly into the local bilingual environment, supporting both the Maltese and English language. Through a touchscreen interface, children can partake in assessments of conceptual skills, lexical skills, phonological awareness and speech sound production (Buttigieg, 2019). Consequently, the device also provided targeted speech and language activities. Olly Speaks incorporates interactive features such as mechanically moving wings and LED eyes, providing a sensory-rich experience for the child. These features act as rewards, activating in response to the child's performance, for instance, flapping wings and blinking eyes upon task completion. With its kinaesthetic learning approach through moving parts, Olly Speaks contributes to improved speech and language skills in a unique way (Balzan, 2018).

To complement the physical toy, Olly Speaks includes a dedicated app, the SLP/Parent app, which can be installed on smartphones and tablets. This app is a control hub, allowing SLPs or parents to customise game settings based on the child's therapy goals. From adjusting game accessibility to monitoring progress, the app provides a comprehensive tool for enhancing the learning experience. The SLP app allows SLPs to control the device during therapy sessions, whether in a clinic or remotely at the child's home (Frendo Wirth, 2020). If Olly Speaks was sold as a stand-alone smart toy it had the potential for international market impact and economic growth as it opened up revenue streams with its dedicated SLP app and its ability to provide speech and language assessment and therapy as a remote service.

Intending to bring Olly Speaks to the market, the SPEECHIE team sought to secure additional funding to further develop games targeting speech intervention along with the available language games and expand the language pairs provided to cater for diverse bilingual contexts (Farrugia, 2023).

Ultimately it can be said that Olly Speaks is a pioneering prototype in the local field of speech and language pathology as it redefined therapeutic support for bilingual children

diagnosed with DLD in the Maltese context. However, the product itself also came with its downfalls which will be further delved into in the following section.

2.8b The SALTT-CITY Project and its proposed solutions to the downfalls of the SPEECHIE project.

The SALTT-CITY consortium is currently¹ engaged in a project dedicated to the conceptualisation and implementation of a therapeutic board game tailored for speech and language therapy within the context of a smart city environment. The focal point of this initiative is to address the challenges associated with the treatment of developmental language disorder (DLD) in children aged 5-8 years.

Developmental Language Disorder, as previously discussed (Section 2.5b) is characterised by language difficulties and necessitates early diagnosis to facilitate successful intervention during early childhood. However, the consortium observed limitations in conventional toys adapted for therapy within the local context (i.e. the lack of bilingual Maltese English readily available supplies), which thus prompts speech and language pathologists (SLPs) to leverage diverse resources that they have on hand to accommodate the varied needs of their clientele (SALTT-CITY Consortium, 2023).

As previously stated, specialised therapeutic toys are specifically designed products that facilitate connections with young children and encourage therapeutic efforts during intervention sessions and are typically employed by clinicians. Building upon the groundwork laid by the preceding SPEECHIE project, the current project intends to enhance the design of Olly Speaks based on qualitative and quantitative user experience (UX) data obtained from stakeholders, including children with developmental language disorder, SLPs, and caregivers (Balzan et.al., 2022).

However, upon analysing critical areas of improvement in-depth during the second phase of

¹ The SALTT-CITY project will still be an ongoing research project at the time of this dissertation's submission.

SALTT-CITY, it was determined that to retain the original functionalities of Olly Speaks, the manufacturing costs would remain on the high side. This rendered the device economically uncompetitive, with an estimated selling price ranging in the hundreds of euros. Following extensive deliberations in consortium meetings and a dedicated one-day workshop with SLPs, a strategic shift towards the development of a therapeutic board game dedicated to speech and language therapy was decided upon. This board game is specifically aimed at bilingual Maltese English-speaking children and with this research study, it aims to be prototyped within the Maltese cultural context (Farrugia, 2023).

This strategic decision was grounded in the objective of achieving a reasonable price point for the product, ensuring robust distribution prospects both locally and potentially in international markets. It is noteworthy that board games, falling under the subcategory of toys, involve goal-oriented play with predefined rules. The consortium aims to produce the board game at a lesser price of under a hundred euros, positioning it as a more accessible alternative to the Olly Speaks device. In addition to cost considerations, other factors substantiated by scientific evidence were taken into account by the team in opting for board game development (SALTT-CITY Consortium, 2023).

Current research, as exemplified by the work of Ibrahim and Leng (2021), has demonstrated the effectiveness of board games in speech and language therapy. Such games have proven to be instrumental in conducting therapy and subsequent follow-up sessions at home, ensuring a consistent and effective therapeutic approach.

2.9 Board Game Use within Speech and Language Therapeutic Practice

Board games are games that can be played on a flat surface, typically with pieces or cards that are moved or manipulated according to a set of rules. They can be played by two or more players and often involve strategy, luck, and social interaction. Board games have a long history, dating back to ancient civilisations, and have evolved to include a wide variety of themes and mechanics (Wood, 2018). In recent years, there has been a resurgence of interest in board games, with many new games being developed and honing a growing community of enthusiasts. Board games can serve as a form of entertainment, a way to socialise with others, and even as a tool for education and personal development (Antunes, 2023).

Board games have emerged as a valuable and engaging tool in speech and language therapy, particularly for children facing difficulties with their language development. The benefits that board games offer within language therapy are multifaceted given that they may be used as a channel for the therapist to provide language instruction while fostering cognitive skills, and overall social communication abilities in children living with language disorders (Juhasz, 2021).

One particular intervention approach for this clinical population involves the use of visual cues to prompt language production. Integrating board games into language therapy sessions offers a significant advantage through the strategic use of visual stimuli. In this context, board games can be designed to compel players to generate language based on visual prompts, such as pictures or symbols (Arslan et.al., 2020). For children diagnosed with Developmental Language Disorder (DLD), this technique proves invaluable in fostering associations between words and images, thereby enhancing both vocabulary and semantic skills. Another effective strategy is the combination of visual and auditory stimuli within board games, creating a multisensory experience. By incorporating both modalities, these games provide a comprehensive sensory encounter. This approach aids children living with DLD in processing

and retaining information more effectively (Brylka and Cygan, 2023). As indicated by Brylka and Cygan (2023) research supports the efficacy of audiovisual stimuli in enhancing phonemic memory, indicating its specific benefits for children with Developmental Language Disorder.

Extending beyond their visual stimuli, board games offer a structured and predictable environment which is ideal for supporting children living with language disorders. This setting instils comfort, thus creating an atmosphere which is conducive to engagement and learning. Predictability reduces anxiety, allowing children to focus more on language during therapy sessions (Bouzid et.al., 2016). With the reduction of therapeutic anxiety, social interaction becomes vital once such board games are incorporated into therapy sessions to promote the progression of gameplay during the session. Therefore, with the use of such games, therapists provide children with ample opportunities to practice essential social skills such as turn-taking, idea-sharing, and engaging in conversations inherent to these activities. Thus, as children navigate these social interactions, they not only enhance language skills but also develop broader social competencies, contributing to well-rounded communication (Lakatos et.al., 2023).

Furthermore, engaging in board game play can significantly contribute to the development of specific cognitive skills in children both with and without language disorders. One key area is attention, as board games demand players to concentrate on the game and adhere to its rules, thereby enhancing their attention skills. Additionally, memory skills are fostered through various board games that involve remembering the board layout, game rules, and the moves of fellow players. Problem-solving abilities are also honed, as these games often necessitate strategic thinking and decision-making based on both the game's rules and the current ingame situation. Furthermore, board games play a crucial role in improving executive functions, including planning, organisation, and inhibition, which are fundamental for overall language

development in children. Through these engaging activities, board games provide a multifaceted approach to enhancing cognitive skills in children (Pozzi et.al., 2023). Board games can be modified to match the needs of individual children, making them more interesting and educational. This can involve adjusting the rules, materials, and content of the game. One approach is to adjust the rules to make the game more challenging or easier, depending on the child's abilities. For example, the number of cards drawn or the victory conditions can be modified. Another way to customise a game is to use materials that match the child's interests or learning goals. For example, picture cards related to the child's experiences or preferences can be used to improve vocabulary development. (Bouzid et.al., 2016). Furthermore, therapists can target specific language skills during gameplay, such as conversational turn-taking, following instructions, or practising word classes. Additionally, supportive prompts and cues can be integrated into the game to aid the child in overcoming challenges and reinforcing their strengths in communication and language development. As previously stated, the playful nature of board games encourages active participation, making the therapeutic process more enjoyable for children, which can in turn enhance motivation and contribute to creating a more relaxed and open environment for language development (Langley, 2021). Group play therapy using board games has been shown to have a positive effect on children's sociability, and semi-structured therapy using board games has demonstrated promising results in improving verbal comprehension and processing speed in children with language disorders associated with autism spectrum disorder (Elbeltagi et.al., 2023).

Integrating interactive and engaging strategies into collaborative efforts between educators and parents can also significantly contribute to children's language development. Effective collaboration between educators and parents has proven to be advantageous for the language development of children. A study by Poll and Hoffman (2023) investigated this synergy and

revealed that not only do preprofessional teachers exhibit positive attitudes toward classroom-delivered intervention, but speech-language pathologists (SLPs) also share a similar perspective. The study employed a convergent mixed-methods, two-group design, tasking participants with an assignment that necessitated interprofessional collaboration. The results from the study mentioned above indicate that to enhance the inclusivity of such collaborations, there is a need for professional preparation programs to emphasise the development of skills essential for respectfully managing differences in the contributions of each professional involved (Poll and Hoffman, 2023). The use of board games can also facilitate interdisciplinary collaboration by providing a platform for individuals from different disciplines to engage in a shared activity. This innovative approach opens avenues for crossdisciplinary cooperation, fostering a richer learning environment (Fedewa et.al., 2023). In conclusion, incorporating dynamic elements, such as board games, into collaborative endeavours can not only enhance interdisciplinary cooperation but also promote a holistic approach to children's development.

Integrating board games into language therapy, particularly with children, brings a mix of engagement and interactivity, but it also requires careful consideration of drawbacks. One significant concern is the potential limitation of language focus within board games, as the allure of the game may divert children from targeted language practice (Lopez Sanchez, 2018).

Of notable challenge are also the intricate rules and instructions of some board games, which can be especially problematic for children with language difficulties. This complexity poses a hurdle, potentially diverting attention from the primary language goals of therapy sessions and hindering effective skill development (York, 2019). The competitive nature of certain board games also introduces social and emotional challenges, like frustration or

disappointment, which may not align with the supportive atmosphere crucial for therapeutic interventions (Eriksson et.al., 2021).

In group settings, the risk of unequal participation is present, with some children dominating the game and limiting opportunities for their peers to engage meaningfully in language practice (Jordaan, 2018). Despite these challenges, board games remain a valuable supplement to language therapy. Thus, therapists must navigate these issues thoughtfully, ensuring that selected games align seamlessly with specific language goals for therapy sessions.

Therefore, incorporating board games into language intervention programs can be a valuable approach to enhance learners' language proficiency and overall cognitive development if the speech and language pathologist can take proper considerations before implementing it throughout intervention sessions. While recognising the benefits, it's essential to acknowledge and address potential challenges, such as limited language focus, complex rules, and emotional dynamics, to ensure a well-balanced and effective therapeutic environment. Notably, the therapeutic environment is constantly changing with new advancements, particularly in the realm of technological practices being introduced to meet the needs and inclinations of the upcoming generations.

2.10 Technology Use within Speech and Language Therapeutic Practice

Smartphone and tablet applications, also known as mobile apps, are software programs designed to run on mobile devices such as smartphones and tablets. These apps can offer a wide range of functions, including entertainment, productivity, communication, and information retrieval. They are typically downloaded and installed from app stores or other platforms (Ventola, 2014). The use of mobile apps has become pervasive in various domains, including social media, live video streaming, and even healthcare.

Mobile apps have emerged as powerful tools in supporting speech and language pathologists in a variety of therapy sessions, offering innovative approaches to engage clients and reinforce therapeutic concepts. However, alongside their potential benefits, it is crucial to acknowledge and address potential drawbacks. Apps specifically designed for speech and language therapy do exist on the global market and they play a pivotal role in diversifying therapeutic approaches, however, not many present themselves with an ample body of evidence-based research and therefore need to be utilised with caution. Despite that, these applications provide a dynamic and interactive platform, offering therapists the ability to tailor activities and exercises with minimal effort and aiding in addressing diverse speech and language disorders.

Speech-language pathology apps offer therapists a versatile set of tools to enhance their practices and promote consistent skill development in various ways. These apps grant access to a diverse range of resources, including drill exercises, games, and carry-over activities, which can be customised to meet the specific needs of each patient, thereby enhancing the effectiveness and engagement of therapy. Additionally, most apps provide real-time feedback and progress tracking, enabling therapists to adapt treatment plans as necessary for ongoing, consistent patient progress (Heyman, 2020). Thus, also aiding the therapist in terms of administration work and digital data collection reference points. Furthermore, by aiding in the creation of personalised treatment plans, these apps contribute to therapy that is tailored to individual needs and goals. Their ease of use and accessibility on various devices further promote consistency in therapy, allowing patients to practice regularly, even outside of inperson sessions (Olszewski et.al., 2022). Noteworthy, these apps also serve as collaboration and communication tools, fostering effective interaction among therapists, patients, and other healthcare professionals to ensure coordinated efforts and optimal patient outcomes (Frey and Kerkemeyer, 2022).

Furthermore, as Lang (2021) highlights, the incorporation of STEAM (Science, Technology, Engineering, Arts, and Mathematics) principles into toy design promotes toys that foster language acquisition, cognitive growth, and parent-child interaction. However, Lang's (2021) study is conceptual and lacks empirical validation, raising concerns about the practical implementation of such toys and their scalability. Continually, Arabiat et.al., (2022) highlight the importance of rigorous experimental research to establish the causal relationship between technology use and developmental outcomes. Similarly, Bourha et.al., (2023), suggest that the integration of technology into intervention should be considerate of diverse family situations, ensuring equitable access and effective outcomes to all users. Collectively Arabiat et.al., (2022) and Bourha et.al., (2023), emphasise the importance of using a balanced approach when integrating technology into early childhood development, advocating for designs and software which prioritise active engagement, verbal interaction, and the ability to tailor the technology to meet various needs.

Another dynamic and tech-savvy way through which therapy may be provided is that of teletherapy. Teletherapy is typically set up through the use of videoconferencing apps and software. Videoconferencing apps facilitate remote therapy sessions by allowing therapists and clients to communicate in real-time through audio and video. This enables therapy sessions to take place remotely, eliminating the need for clients to travel to a physical location. Videoconferencing apps can be used on various devices, such as smartphones, tablets, and computers, making it easier for clients to access therapy from the comfort of their own homes. Additionally, incorporating physical objects and games displayed on tablets during telehealth interventions can enhance interaction and engagement during remote therapy sessions (Ekberg et.al., 2019).

Despite the potential benefits of introducing technology in practice, several drawbacks warrant careful consideration. Firstly, technical limitations, especially in telehealth settings,

may pose challenges related to connectivity issues, potentially impacting the quality of therapy sessions. Therapists need to be prepared to troubleshoot technical problems to maintain a seamless and effective therapeutic experience. Consequently, therapists incorporating such applications into their sessions should be mindful of specific considerations related to the seamless integration of technology within their practice (Watermeyer et.al., 2023). Secondly, the limited evidence base surrounding the effectiveness of specific applications in speech and language therapy raises concerns. The integration of these apps into therapy sessions is still in its infancy, relying predominantly on expert opinions rather than robust empirical evidence (Sidock, 2011). Furlong et.al., (2016), also emphasise evidence-based practice when adopting such apps in therapeutic plans, SLPs ought to critically evaluate available research and expert opinions, to integrate tablet apps with demonstrated positive outcomes that align with established therapeutic principles. In the intricate process of selecting tablet apps for language therapy sessions, speechlanguage pathologists (SLPs) shoulder a pivotal role, meticulously weighing various factors to enhance the effectiveness and appropriateness of these digital tools. SLPs need to not only consider the app's distinct factors but also need to take into account the age, cognitive ability, and treatment targets of their clients, recognising the significance of tailoring app selections to match developmental stages and individual needs, thereby optimising therapeutic impact (Olszewski et.al., 2022).

Another notable concern is the potential for excessive screen time, particularly in therapy sessions involving younger clients. Therapists have expressed apprehension about prolonged exposure to screens, emphasising the need for a balanced approach to mitigate possible adverse effects such as eye strain and attention span issues (Olszewski et.al., 2022). Mindful of the potential drawbacks associated with excessive screen time, especially for younger clients, SLPs should seek to strike a balance between the benefits of digital engagement and

mitigating concerns about extended screen exposure. Thus, ensuring that the digital portions of sessions are also accompanied by offline activities that allow the child a break from screen use (García-Ruiz and Santana-Mancilla, 2018).

Of note, the usability and human-computer interfaces of tablet apps should also be of paramount consideration, with SLPs prioritising user-friendly designs that seamlessly align with client abilities, as the effectiveness of these tools in promoting engagement and facilitating learning hinges on their design and ease of use. Usability challenges are also a consideration, particularly in the design and development of game apps. Ensuring that these apps are user-friendly and effectively support therapy goals is essential for their successful integration (García-Ruiz and Santana-Mancilla, 2018).

Therefore, mobile apps offer promising avenues for enriching language therapy sessions, providing interactive and engaging tools for both therapists and clients. However, the field requires further research to establish a more robust evidence base. In balancing the benefits with potential drawbacks, therapists must exercise caution in managing screen time, addressing usability challenges, and navigating technical limitations. By doing so, the responsible integration of tablet apps into language therapy can lead to more effective and personalised therapeutic interventions, harnessing the potential of technology to enhance the delivery of intervention.

2.11 Connected Technologies

Connected technology refers to physical objects that are connected to the internet or other digital networks, allowing them to communicate with their environment and other products. These products have built-in or embedded technology comprising sensors and processors that enable them to connect with electronic devices. Examples of connected technology include smart homes, health monitors, and connected vehicles. Connected technology is also referred

to as Smart Connected Technology and is changing lives and making work practices more efficient (Kelly, 2020). In the context of research and therapy, apps can facilitate a broad array of possibilities in speech and language pathology. For instance, apps can serve as a feedback aid for speech therapists, enable patients to practice independently, increase the intensity and frequency of therapy, and improve therapy motivation (Leinweber et.al., 2023). Despite the information available about the use of digital means in speech and language therapy, there is limited information about the use of connected technologies such as those fabricated in SALTT CITY.

Although the benefits of connected technologies in the field of speech and language pathology are evident given the uproar in digital use among clinicians who still make use of traditional means that can be interwoven with technological modernisations, current research in this area is limited. Therefore, there is a noticeable gap in the literature which exposes their potential within the field. Thus, highlighting the need for increased attention and investigation which proves the innovative nature of the SALTT-CITY project and this research study.

2.12 The clinical expectations of the SALTT CITY game's use in practice

Recent scholarship has highlighted the unique opportunities presented by combining traditional play with digital technologies, particularly in therapeutic settings. The emerging field of Internet of Toys (IoToys) exemplifies how physical-digital hybrids can sustain children's engagement while supporting educational and therapeutic goals (OECD, 2024). In language intervention, such tools are capable of reinforcing both implicit and explicit learning targets within naturalistic, play-based contexts. They also provide flexibility in feedback and personalisation, which can support generalisation of language skills across settings (Kakembo, 2024).

The research discussed in this section highlights the benefits of employing play-based approaches and technological influences in language intervention, thus underscoring the potential impact connected technologies could have in this field. However, at present, the literature reveals a notable gap concerning the availability of connected technologies specifically tailored for speech and language therapy, as well as their potential applications within this domain. It is regrettable that despite the widespread adoption of technology and connected technologies in healthcare, there is a notable scarcity of research focusing on the integration of connected technologies within the realm of speech and language therapy. Particularly in paediatric speech and language therapy, where technology has been increasingly embraced. While existing digital interventions show promise, a critical examination of their effectiveness reveals several limitations. As outlined in the previous sections, studies report small sample sizes and lack diverse bilingual representation, raising concerns about generalisability. Furthermore, outcome measures as described above are often inconsistent, making it difficult to compare across studies or replicate findings. Additionally, many tools lack cultural adaptation, which is crucial in bilingual contexts like Malta. These limitations underscore the importance of developing and evaluating tools like SALTT-CITY within a user-centred and locally grounded framework. In light of this the potential benefits of exploring custom-connected technologies, which seamlessly merge traditional therapy tools with smart technology, are immense and warrant further investigation.

Further investigation into connected technologies for speech and language intervention must be evidence-based, with any developments made being firmly rooted in research. Given the increasing multilingualism worldwide, the development of bilingual materials would also be immensely beneficial. Presently, in Malta, there are no monolingual or bilingual-connected technology materials available for speech and language pathologists (SLPs) to utilise. These

materials could significantly enhance the delivery of local language therapy, offering a more engaging alternative to traditional methods.

Moreover, the physical aspect of connected technology would enhance social interaction and tactile input, aspects that are harder to achieve solely through mobile apps. Insights from SLPs who can compare available resources with this innovative concept would also be important.

These materials also hold the potential to improve carry-over practices at home, although this would require input from caregivers to be confirmed. Additionally, it's crucial to gather feedback from children undergoing therapy to ascertain their interest in this innovative approach compared to the conventional methods they have grown used to.

In summary, while the potential benefits of connected technologies in speech and language therapy are promising, further research, evidence, and stakeholder input are essential for their effective development and implementation.

2.13 Research Questions

In light of the gaps identified in the research, the present investigation delves into the potential utility of the SALTT CITY game in language intervention. This study seeks to address the following overarching research question:

- Does the SALTT CITY game present itself as a viable clinical tool in language intervention for bilingual children diagnosed with developmental language disorder in Malta?

For the overarching research question to be answered, the following sub-questions needed to be tackled as well:

- What is the opinion and perspective of SLPs on the concept of the SALTT-CITY Board Game and Companion App, and how can their feedback be converted into

thorough design guidelines for the SALTT-CITY Board game's mechanics and accompanying application's design?

- How do the specific activities within the SALTT-CITY Board Game and Companion App contribute to speech and language therapy intervention, based on the subjective experiences of different user groups (e.g., SLPs, parents, children) with the game and application?
- What are the potential advantages and challenges associated with integrating connected technologies into SALTTs, as perceived by SLPs and active speech and language therapy participants?

2.14 Conclusion

In summary, this chapter explored the complexities of bilingual language acquisition, areas of potential difficulty for children with DLD and the intervention strategies commonly employed, highlighting key gaps in the availability of user-centred, connected and gamified bilingual therapeutic resources. With these insights underpinning the need for innovative, contextually relevant approaches similar to those proposed in this study. The next chapter will outline the methodology adopted to address these gaps and guide the iterative development of the SALTT-CITY tool.

Chapter 3: Methodology

3.1 Introduction:

This chapter presents the systematic approach employed to comprehensively address the study's research questions and investigate the research problem. It outlines the research design, data collection methods, and analytical techniques utilised to generate the study's findings. It describes the reliability and validity measures chosen to ensure that the research process is not only rigorous but also transparent, providing a solid foundation for the ensuing analysis and discussion of the results. Additionally, it outlines the data protection and ethical considerations taken throughout the study to ensure compliance with ethical guidelines and the safeguarding of participant welfare.

Additionally, it details the data protection and ethical considerations adhered to throughout the study, ensuring compliance with relevant guidelines and safeguarding participant welfare.

3.2 Research Design and Approach

This study used a mixed methods approach, integrating qualitative and quantitative data to explore the effectiveness and usability of the SALTT-CITY Board Game and Companion App. Guided by User-Centered Design (UCD) principles, the research prioritised iterative feedback to identify patterns and relationships that informed tool refinement.

It should be noted that this study used an explanatory sequential approach, with qualitative insights guiding quantitative input. Seeing as the study's focus was on descriptively assessing user experiences rather than testing hypotheses (Guest et al., 2015). Hence, hypotheses were not explicitly generated at the start of this study.

3.2a User-Centred Research Design

User-centred design (UCD) served as a critical framework in this research methodology, enabling the development of tools that aligned with the specific needs of end-users, such as children, caregivers, and speech and language pathologists (SLPs). The iterative and participatory nature of UCD ensured that tools were user-friendly, engaging, and effective in real-world therapeutic contexts. Building on the findings of Gačnik et al. (2017) and Philippone (2022), this approach prioritised collaboration among stakeholders throughout the design process, ensuring that tools address key challenges in speech and language therapy, including limited resources, low motivation, and the need for home-based practice. By incorporating user feedback into multiple design iterations, UCD facilitated the development of gamified features and adaptive configurations that promote long-term engagement and adherence to therapy plans (Gačnik et al., 2017; Philippone, 2022).

Additionally, UCD ensured that the tools were accessible to diverse populations and adaptable across therapeutic and educational contexts. For example, gamified elements such as progress tracking and rewards, as highlighted by Gačnik et al. (2017), are shown to sustain motivation during repetitive tasks. Furthermore, Philippone (2022) emphasises the importance of designing tools that address emotional and psychological safety, ensuring a positive and inclusive user experience. Therefore, this iterative methodology, centred on realworld needs, supports the creation of solutions that meet functional requirements and deliver meaningful and engaging experiences, making it an ideal approach for the current research.

3.2b The Different Research Approaches Available

The first kind of research approach is quantitative research, which is a formal, objective, and systematic process often used to describe variables, test hypotheses about their relationships,

and determine their associations. Quantitative research generates impartial numerical data, seeking to test hypotheses by drawing on a representative sample from a known population, measuring variables of interest, and testing their relationships using statistical analyses.

Inferences and generalisations may then be applied to the population of interest based on the elicited data (Bloomfield and Fisher, 2019). Critiques of this approach highlight its potential reductionism and its inclination to neglect the complexity of human experiences by concentrating exclusively on measurable variables. However, its strengths are evident in its ability to yield generalisable and replicable findings, provided that the research designs are robust and demonstrate both internal and external validity (Mitchell and Jolley, 2010).

On the other hand, qualitative research focuses on an inquiry-based approach to gathering data about complex issues, such as human behaviour and feelings. Its primary goal is to understand social phenomena by noting the views and experiences of participants in a sample population, often through methods such as interviews, focus groups, or observational studies. With questions typically exploring the “what,” “how,” or “why” of a research phenomenon (Isaacs, 2014). Qualitative research empowers participants by actively engaging them in expressing their subjective experiences. However, it often faces criticism for its lack of generalisability and the potential for researcher bias. Despite these critiques, its strengths lie in its capacity to capture depth and complexity, resulting in rich, holistic narratives through the analysis of words and personal perspectives (Cresswell and Poth, 2016). Furthermore, analysing recorded interviews is a common practice in qualitative research, providing a means to revisit nuanced details in participants' responses and ensuring accuracy in data interpretation. Overall, qualitative research can be summed up as an approach that values experiences while providing insights into the benefits and harms of the research topic (Pathak et al., 2013). The third and final approach is the mixed-methods approach, which employs elements of both quantitative and qualitative methods within the same study. This research

approach is gaining recognition for its capacity to unite the strengths and address the weaknesses of both methodologies. For example, while quantitative methods offer breadth and generalisability, qualitative methods contribute depth and context. Mixed-methods research is especially acknowledged in the development, implementation, and evaluation of healthcare intervention techniques (Henly, 2015). Hence, at first glance, it appeared to be the most suitable option for this study.

3.2c A focus on the Mixed Methods Approach and Rationale for the choices made for this study.

As Bressan et.al., (2017) highlight, three distinct types of mixed-methods research may be considered when planning a research study. Firstly, there are exploratory mixed methods, in which qualitative elements precede and help develop the quantitative tools that follow.

Opposingly, explanatory mixed methods are formulated with quantitative data driving the qualitative investigation. The last option is that of mixed methods in which the qualitative and quantitative data are collected and analysed during a similar timeframe (Fetters et.al., 2013).

An exploratory sequential mixed methods approach was selected as the research approach for this investigation. An explanatory sequential approach involves collecting one dataset, followed by a second dataset intended to clarify or expand on the initial dataset. This approach highlights the complementary strengths of qualitative and quantitative methods.

While quantitative studies often identify relationships between variables without explaining the underlying reasons, qualitative research provides rich, contextual insights but lacks generalisability. By combining these approaches, explanatory sequential approaches bridge these gaps, offering a deeper and more comprehensive understanding of research questions (Guest et al., 2015).

As is common with mixed methods designs, the data in this study was obtained through a combination of surveys and observations, which were then analysed and interpreted using both quantitative and qualitative procedures (Robson, 2011; Suleman & Hopper, 2014).

Likert scales were utilised across multiple questionnaires for the collection of quantitative data, while observation forms were used for the annotation of observed findings.

Additionally, open-ended sections of questionnaires/transcribed discussions were subjected to qualitative approaches. (Braun & Clarke, 2006).

The main reasoning behind this approach being chosen for this study was that neither single technique could address the entire range of research aims; whereas mixed approaches, could inherently target all the research aims while increasing the validity of results by correlating both qualitative and quantitative data (Robson, 2011; Suleman & Hopper 2014).

3.3 The Phases of Data Collection

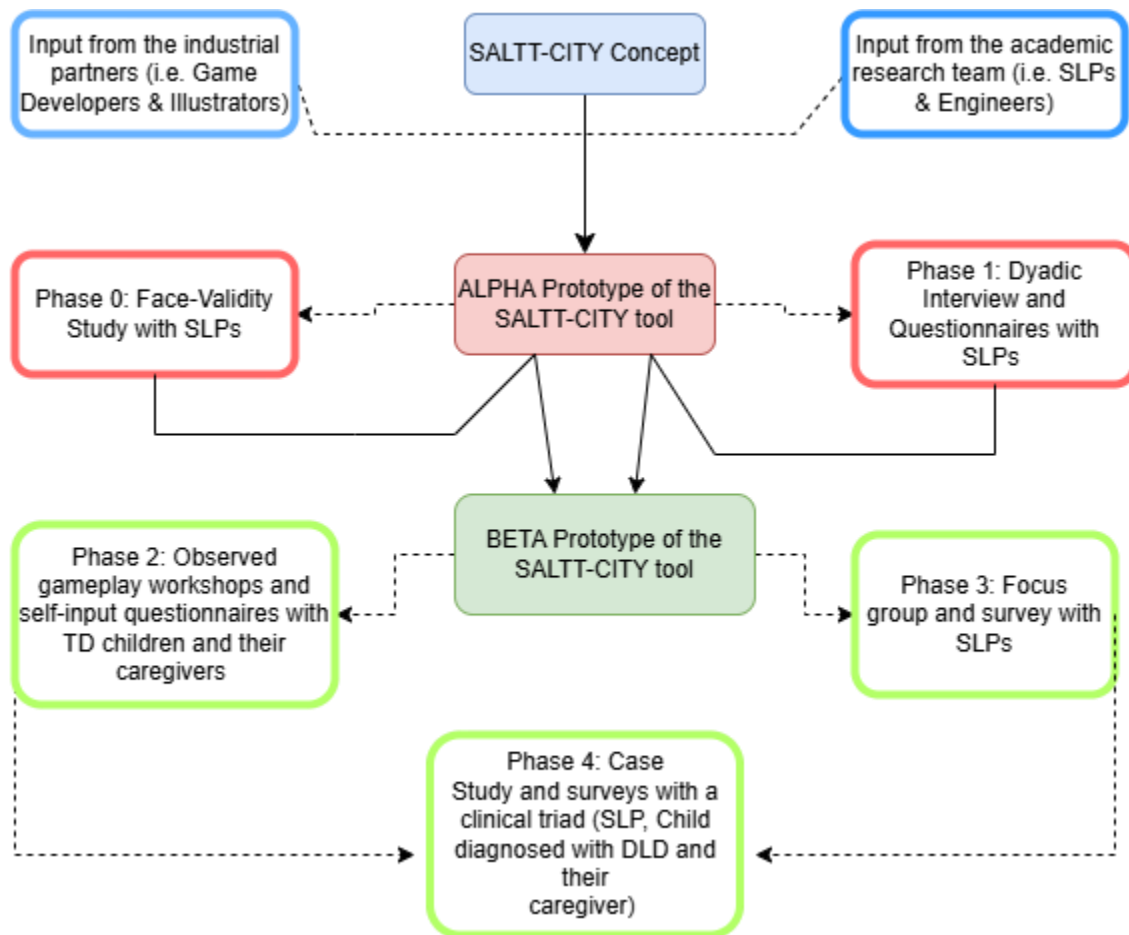


Figure 2: Flow Chart Detailing the Phases of Data Collection

3.3a Introduction to the Phases

The data collection process for this study was organised into multiple iterative phases, each designed to gather targeted feedback from diverse participant groups, including children, caregivers, and speech and language pathologists (SLPs). These phases systematically informed the development and evaluation of SALTT-CITY, ensuring a user-centred approach. By building on insights gained in each stage, the study aimed to refine the game’s design, functionality, and educational impact, ultimately creating a tool tailored to its users' needs. The following table (Table 1) outlines the different phases of data collection carried out in this study.

<u>Phase of Data Collection</u>	<u>Types of Participants Recruited</u>	<u>The version of SALT-CITY used</u>
Phase 1: Dyadic Interview and Questionnaires with SLPs about the ALPHA Prototype	SLPs	ALPHA Prototype
Phase 2: Observed gameplay workshops and self-input questionnaires with TD children and their caregivers	TD children aged 5 to 8, caregivers and research assistants	BETA Prototype
Phase 3: Focus group and survey with SLPs about the BETA prototype	SLPs	BETA Prototype
Phase 4: Case Study and surveys with a clinical triad (SLP, Child diagnosed with DLD and their caregiver) using the BETA Prototype	SLP, Child diagnosed with DLD and Caregiver.	BETA Prototype

Table 1: Different Phases of Data collection carried out.

3.3b Phase 1: Dyadic Interview and Questionnaires with SLPs about the ALPHA Prototype.

3.3bi Phase 1's Design:

The scope of the research at hand centres around the creation of the intervention tool described above. For the initial design to be developed, expert opinions were required to gauge the potential benefits of having such a tool in clinical settings. Clinicians' opinions on the activities presented and the designs being used were crucial to ground the tool not only in evidence-based practice and theoretical underpinnings but also in practice-based evidence. To elicit this feedback, at the start of the data collection process a group of four speech and language pathologists was meant to be gathered online for a focus group discussion about the ALPHA prototype of the tool.

According to Moser and Korstjens (2018), focus group discussions are methods in which a small group of people can discuss a presented topic through the guidance of a moderator who presents open-ended questions. By attending the aforementioned meeting, the participating SLPs were able to engage in a stimulating discussion

when presented with the ALPHA prototype of SALTT-CITY. The researcher was then able to guide the discussion to target all the focuses that were required for apt design guidelines to be compiled for the rest of the research team to be able to consolidate their efforts and produce the BETA Prototype of the tool.

With that being said, given that SLPs are the experts in the field of language disorders they were expected to be able to produce new ideas regarding what was missing from the presented prototype. Thus, enriching the tool with practice-based opinions before the BETA prototypes were produced and tested with the intended population.

3.3bii Phase 1's Participant Recruitment:

Participant Recruitment for Phase 1 of data collection took place during January 2024. A recruitment email with an adhered information letter, consent form and registration form was sent out to all members of the SLP governmental workforce via the Maltese professional lead of SLPs. The same email with the same documents was also sent out to all members of the Association of Speech and Language Pathologists in Malta (ASLP) through the second intermediary (the Association's secretary).

Potential participants were provided with multiple time slots during registration to accommodate scheduling differences. Consequently, the discussion was held virtually through Zoom Video Conferencing Software to boost attendance possibilities. Given that, as Rupert et.al., (2017) state focus groups conducted virtually can be more economical and productive, as they do not require travel and can provide results quicker. They also ease participants' logistical responsibilities, which boosts attendance and expedites recruiting.

Therefore, given this evidence, it seemed logical to hold such data collection virtually.

3.3biii Phase 1's Participants:

Cortini et.al., (2019) argue, that a focus group should not exceed 7 individuals as this would take away from the natural course of discourse and make it difficult for participants' opinions to be voiced. With the efforts mentioned, four SLPs were recruited to join the focus group to discuss the design of the ALPHA prototype of the SALT CITY board game. As Morgan and Hoffman (2018) state, for a focus group to produce salient and naturalistic discussions, a minimum of four participants is ideal. Thus, the focus group was scheduled with those four participants in mind.

Unfortunately, on the day of the focus group, two SLPs pulled out of the study due to unforeseen circumstances. Given the short notice, the discussion was not rescheduled, instead, additional open-ended questions were posed to the two participants and a dyadic interview was conducted (Morgan et.al., 2013). Kvalsvik and Øgaard (2021), highlight the fact that dyadic interviews are advantageous in allowing participants more time to process the questions posed and articulately formulate their responses. However, according to the same researchers, dyadic interviews are typically conducted with individuals who share a preexisting relationship. Given that recruitment was done independently and not on an invitation basis, there was no way of knowing if the individuals present shared a pre-existing relationship. According to Kenny et.al., (2020), strangers who share common experiences can still yield data of similar if not equal quality to dyads with pre-existing relationships. Therefore, since both individuals present share the same profession and given the limitations in recruitment, the choice to move forward with a dyadic interview in place of a focus group was still considered to be sound.

3.3biv Tools used in Phase 1:

In Phase 1 of the data collection process for this study, a diverse range of questionnaires and a virtual prototype of the ALPHA version of the SALTT-CITY Game (Figure 2) were used.

As Alves et.al., (2014) and Wiltgen (2022) explain, the assessment of prototypes across different phases of development and with a diverse range of individuals aids in advancing the product's maturity and shortens the path towards publishing and production. In this phase of data collection, a virtual version of the ALPHA Prototype was presented to the attending participants, to consolidate their understanding of the tool's concept and gather their opinions on the place-holder design.



Figure 3 ALPHA-Prototype of the SALTT-CITY Tool.

The design was presented to the participants during the interview portion of phase 1, however, before this, a pre-interview questionnaire was disseminated to all the participants.

This was done to explore the participants' experiences, ideologies and beliefs about the research topic. The pre-interview questionnaire was not only geared towards eliciting participant backgrounds for data collection purposes; it also enhanced participant reflexivity by explaining the research topic. Thus, promoting more thoughtful responses during the interview (Haukås and Tishakov, 2024).

Following the interview, another questionnaire was presented to the participants.

Harris and Brown (2019) discuss the common nature of questionnaires and interviews being used in a parallel manner throughout mixed-method studies. Thus, highlighting how questionnaires can provide evidence of patterns among sample populations, whereas qualitative interviews gather in-depth outlooks on participants' thoughts and feelings.

Therefore, with the combination of tools used in this phase of data collection, a holistic profile of the opinions and perspectives of SLPs regarding the ALPHA prototype was compiled. With the data gathered, design recommendations could be formulated for the design engineers, app developers and illustrators involved in the overarching project. This was done so that the BETA Prototype of the tool could be produced.

As Kilpeläinen (2020) defines it, a beta prototype is an advanced product version tested with a limited audience to identify usability, functionality, and reliability issues. In the case of SALTT-CITY, input was collected from various users, including SLPs, caregivers, and children, ensuring a well-rounded assessment of the game's therapeutic value, usability, and engagement. Each participant group offered unique perspectives that helped inform iterative changes to the game's mechanics, design elements, and companion app functionality ultimately leading to the development of the final version of SALTT-CITY.

3.3bv Data Collection Procedure in Phase 1:

Initially, the pre-interview questionnaires were disseminated as a Google Forms document after recruitment and confirmation of the interview's date.

Consequently, on the day of the interview, a 45-minute-long Zoom videoconference call was held with the participants. As Archibald et.al., (2019) discuss, the option to hold the interview using virtual means was welcomed by the participating clinicians as it was a more convenient and flexible option compared to in-person gatherings.

During the videoconference call, the ALPHA prototype of the SALTT-CITY Tool was presented to the participants using a virtual model of the tool. Furthermore, the diverse range of activities included in the tool was discussed with the clinicians to gain their practice-based opinions regarding the content of the activities and their presentation in the app. Throughout this videoconference call, the researcher acted as a moderator with the present participants, guiding them through discussion topics using open-ended questions to probe their opinions and perspectives.

Ultimately, the post-interview questionnaire was disseminated, as another Google Forms document. This questionnaire served as a channel through which the participants could express themselves individually about the discussion that they had during the interview.

Thus, the researcher was able to gain the full picture of these clinicians's background perspectives on the use of boardgames, tablet applications and connected technologies in the clinic. As well as their opinions about the innovative concept being brought forth by the SALTT-CITY project.

3.3c Phase 2 of Data Collection: Observed gameplay workshops and self-input questionnaires with TD children and their caregivers

3.3ci Phase 2's Design:

Throughout phase 2 of data collection, observations with typically developing children and their caregivers were tackled. Observer-reported measures were chosen as the means of data collection since the child participants could have been unable to reliably answer the presented questions. Therefore, direct observers (the caregivers) answered in proxy according to the behaviours they witnessed (without any interpretation or interference). Thus, providing the study with useful data from the caregiver's perspective (Lopez et.al., 2023).

To achieve triangulation of data, observations from the researcher's trained perspective were also undertaken in this study, to form a better understanding of the presented situations. Overall, throughout this research project, given the novelty of the intervention tool, the researcher's interference was required for it to be used during evaluations. According to Cotton et.al., (2010), such ethnographic elements allowed the researcher to participate in events and still take notes as a neutral observer.

To enhance the collected data the researcher filled in observation forms based on the interactions that took place during the gameplay sessions. This provided the researcher with the advantage of annotating events as they occurred in real-time, following a natural route, as opposed to the more artificial context of a questionnaire or interview. Seeing as these methods (questionnaires and interviews) typically require participants to respond to predetermined questions or prompts, which might not fully capture their authentic, spontaneous reactions or behaviours

(Taherdoost, 2021). This made observation a more effective method for capturing genuine interactions, providing richer natural insights into the gameplay experience

3.3cii Phase 2's Participants:

The participants recruited in this phase of data collection formed part of two distinct sample populations. The first group of participants was comprised of typically developing children aged five to 8 years old. The second group on the other hand was made up of the respective caregivers of the aforementioned children.

These two overarching groups of participants were further divided into five subdivisions of participant pools. The child participants were categorized into three subtypes, whereas the adult participants were categorized into two.

The child participants were classed as either active viable child participants, active non-viable child participants or spectating child participants. On the other hand, the adult participants were categorized as either active adult participants or spectating adult participants. The following list outlines the defining criteria for participant categorization.

1. **Active Viable Child Participants:** Active Viable Child Participants were those child participants who interacted with the tool's prototype while fitting into the proposed chronological age range and possessing reported typical development.
2. **Active Non-Viable Child Participants:** Active Non-Viable Child Participants were the child participants who interacted with the tool's prototype, however, they either did not fit into the proposed chronological age range or had reported atypical development.

3. **Spectating Child Participants:** Spectating Child Participants were those children who attended the gameplay sessions with active child participants but did not interact with the tool.
4. **Active Adult Participants:** Active Adult Participants were the adult participants who interacted with the tool's prototype. These participants attended the gameplay sessions to accompany the child participants as their caregivers.
5. **Spectating Adult Participants:** Spectating Adult Participants were those adults who attended the gameplay sessions but did not interact with the tool's prototype.

The following table (Table 2) highlights the number of participants per category and the different types of groups who interacted with the tool's prototype.

Type of Participants	Total Number
Active Viable Child Player	53
Active Non-Viable Child Player	9
Spectating Child Participant	3
Active Adult Player	36
Spectating Adult Participant	14
Overall Total Number of Individuals who interacted with the SALTT CITY BETA prototype: 115	

Table 2: Participant Categorisation of the Phase 2 Evaluation

3.3ciii Phase 2's Participant Recruitment:

A number of participants were recruited through social media advertising, and they were then asked to attend gameplay workshops at a central venue of their choice out of three locations (for accessibility purposes). As Darko et.al., (2022) state, accessibility to participants from a wide range of demographics and geographic

locations is facilitated by using social media to promote research opportunities and recruit subjects. Social media Recruitment took place between February and March 2023. The criteria for participation were presented in the social media advert and its corresponding information letter and consent form.

Information letters and consent forms were disseminated to this group via online form-filling software (i.e., Google Forms). No child participant was allowed to interact with the tool's prototype without consent from their caregiver. As Coyne (2010) states, strict ethical guidelines and procedures are to be followed when accessing children for research purposes to safeguard them from potential harm. For any research to be carried out with children, researchers are required to obtain both consent from the child's caregiver and the child's assent.

Through this, voluntary response sampling was conducted for a portion of this data collection phase. In voluntary response sampling, the researcher waits for responses as participants volunteer to take part in the study (Purna Singh et.al., 2023). Despite the extended dates, the three different venues used for data collection and the month-long recruitment process. Only 25 total adults registered their interest in participating in the research study. Therefore, the initial voluntary response sampling method was boosted with convenience sampling employed on the days of data collection. By using convenience sampling, participants were not selected from a larger population rather they were recruited from a convenient subset of individuals who were available on the days of data collection. Unfortunately, this approach towards participant recruitment did not ensure the selection of a truly representative sample of the chosen population (Baxter et.al., 2015).

Overall, participation in the study was voluntary, including those recruited through convenience sampling. In line with the study's ethical considerations, information

letters and consent forms were made readily available to all participants on the days of data collection.

3.3civ Recruitment of Research Assistants

With the decision being taken to proceed with convenience sampling and the prime locations secured for data collection, it was estimated that a fairly large sample of participants would be recruited. Therefore, due to the substantial size of the estimated sample population, it was necessary to enlist additional assistance to ensure that the researcher would be able to effectively carry out all the required observations.

The researcher sought additional assistance from second and third-year undergraduate students enrolled in a four-year Bachelor's degree program in speech and language pathology at the University of Malta. Initially, permission to recruit students from the different cohorts was requested from the Head of the Department of Human Communication Sciences and Disorders at the university. Additionally, the Head of the Department was invited to act as an intermediary in the recruitment process, facilitating the dissemination of a recruitment email outlining the students' participation in the study.

Following these efforts, two students reached out and volunteered their time to act as research assistants in the study. After their recruitment, these students were invited to attend a brief one-hour-long workshop during which they were introduced to the SALTT-CITY tool and the observation forms that they would be using while observing child-caregiver participants in data collection sessions. Consequently, following data-collection, the research coordinator for the SALTT-CITY project (Prof. Philip Farrugia) and the Department Head from the Human Communication

Sciences and Disorders (Dr Ritienne Grima) provided a certificate of attendance for these students.

3.3cv Tools used in Phase 2:

For each group (i.e. adult and child participants), once the adult participant read through the information letter and signed the adhered consent form, the participants were guided towards the physical versions of the BETA Prototype of the SALTT-CITY Tool (Figure 3). As Hess (2012) defines it a prototype is an approximation of a product along one or more of its dimensions. Therefore, the prototype would be an assimilation of the envisaged final product, but may not be functional. However, opposing what Hess (2012) stated, the SALTT-CITY BETA prototype was fully functional to prove its concept, but it simply did not look like the final tool (i.e. the images used were stock images and the design was still not finalised). Regardless of the prototype phase (i.e ALPHA, BETA and Pre-Production); the SALTT-CITY board game and companion app were designed to embed evidence-based intervention strategies commonly used in SLT for children with DLD, including modelling, scaffolding, visual prompting, and reinforcement. These strategies were integrated into gameplay in clinically relevant ways: modelling occurred through in-app character dialogues and repeated target structures; scaffolding was delivered via auditory and visual cues that adapted in complexity; visual prompting included in-app animations, and manipulable game pieces depicting nouns to support comprehension of instructions; and reinforcement involved social praise, progress indicators, and immediate in-app feedback. Although specific task scenarios cannot be disclosed due to ongoing IP licensing and commercial evaluation, this study outlines the general framework to reflect the design's therapeutic intent and

maintain transparency of how the tool was built to encourage study replicability (within proprietary constraints).



Figure 4 BETA Prototype of the SALTT CITY Tool

Throughout the participants' interactions with the prototype, the observing researcher completed an observation form of her design. The observation form was aimed at eliciting feedback about:

1. Participants' Engagement Metrics
2. Game Interaction Metrics
3. User Satisfaction Metrics
4. Participants' Feedback

This observation form encouraged the researcher and research assistants to stick to a standard protocol of observation. It thus encouraged the gathering of higher quality feedback, as opposed to the input which could have been gathered in an unstructured fashion (Beck Dallaghan et.al., 2018). Consequently, after the participants' interactions with the tool and the completion of the observation forms by the researcher, the adult participants were asked to complete a self-report questionnaire regarding each child's participation. This questionnaire aimed to elicit information about:

1. The child's background (i.e. age, linguistic background, educational background etc.)
2. Opinions about the game's features in regards to effectiveness and satisfaction of users.
3. Perspectives about the tool's gameplay and use (if it was readily available to caregivers).
4. Participants' opinions on the activities presented in the tool.
5. Opinions about the overall game's properties.
6. Participants' thoughts on the game's design
7. Game Metrics
8. Personal Feedback

Thus, these tools gathered comprehensive data about the use of the BETA Prototype of the SALTT-CITY tool with typically developing children aged five to eight and their interacting caregivers. This data will be further explored in Chapter 4.

3.3cvi Data Collection Procedure in Phase 2:

The data collection process took place during March and April 2024. Three separate data collection locations were used across a variety of dates (i.e. The Central Public Library, the Esplora Science Centre and the National Aquarium).

Each data collection session lasted between 45 to 60 minutes, according to the number of participants in attendance. The research study was explained to the caregivers and children accordingly, and questions were answered. If the participants were recruited on the day through convenience sampling methods, the necessary forms were shared and completed before the start of gameplay. Whereas, the ones recruited through voluntary response would have already gone through the necessary documents through the disseminated social media advertisement. The participating group then moved on to interacting with the tool for 30 to 45-minute instalments, during this time the observing researcher filled out an observation form for each active child participant. It should be noted that the student research assistants carried out 31% of the observations performed. Additionally, since observations were simultaneously conducted with different participants by the researcher and research assistants (observers), direct inter-observer agreement analysis was not achievable. However, all observers followed a consistent procedure using a detailed observation form and predefined coding guidelines. Observers were trained to apply the same criteria uniformly, to maximise procedural reliability (Essig et.al., 2023).

Ultimately, once the participants completed their interaction with the tool, an attending adult then proceeded to complete the caregiver questionnaire.

3.3d Phase 3: Focus group and survey with SLPs about the BETA prototype.

3.3di Phase 3's Design:

Given the overall user-centred design approach adopted in the overarching research project, the needs of all potential end-users needed to be factored into the product's developmental process. Therefore, SLP input needed to be gathered to the maximum extent possible to achieve the tool's innovation goals (Liem and Sanders, 2011).

Multiple SLPs showed an interest in trialling the prototype for Phase 4 but reported that they did not have potential child participants diagnosed with developmental language disorder (DLD) with whom to implement the trial. The main hypothesis that explains this phenomenon correlates to Nudel et al. (2023), who attribute the significant underdiagnosis of DLD in clinical settings to a lack of awareness among healthcare professionals and the absence of standardised guidelines for identification and support. Therefore, as Newington and Metcalfe (2014) state, researchers need to be realistic and gauge how accessible this vulnerable research population is before committing to a research method or number of participants for their studies. With that in mind, the input elicited from these SLPs was still considered vital for the study's progression, even if it was gathered in the absence of children with DLD.

Therefore, after consulting with the professional lead of Malta's speech and language department (SLD), a series of gameplay workshops/focus groups were scheduled to be held at the SLD's main office to gather the required SLP input. During these workshops, SLPs interacted with the BETA prototype of the game in groups of three or four clinicians and provided their input about the perceived

benefits and concerns towards using the SALTT CITY game as a clinical tool with the target clinical population.

3.3dii Phase 3's Participants:

The final goal for the SALTT-CITY tool would be to be implemented in local speech and language sessions. As Hysong et.al., (2013) discuss, in the context of implementation, clinicians serve not only as a source of data but also as stakeholders and resources that ensure the success of any new intervention technique's implementation.

Given the increasing work demands, clinician time is increasingly becoming more valuable. For this phase of data collection, 12 SLPs were recruited to evaluate the BETA prototype of the SALTT-CITY tool, however, on the day of the workshops only 10 attended.

3.3diii Phase 3's Participant Recruitment:

Initially, before participant recruitment for phase 3 of the data collection process, a 30minute-long consultation with the professional lead of SLPs in Malta was held. During this consultation, the limitations in recruiting clinicians and clients for phase 4 were discussed. Therefore, following this consultation, recruitment emails were sent out to registered SLPs from both ASLP and Allied Health intermediaries. In this email, two different dates with 3 individual time slots were presented to the SLPs to avoid scheduling difficulties as much as possible.

3.3div Phase 3's Research Methods:

The primary research method used during this data collection phase was qualitative evaluation workshops among professionals, which were arranged as focused

discussions rather than free-form expressions. These workshops functioned as a focus group discussion, meant to elicit specific input. Furthermore, mini-surveys in the form of individual questionnaires were provided to participants to gain a better understanding of their ideas and opinions on the SALTT-CITY tool (Ørngreen and Levinsen, 2017). For the researcher, the aim was to produce data regarding clinicians' perspectives on the following:

1. Game Features
2. Gameplay and Use
3. Activities presented
4. Game Design
5. Personal Opinions

On the other hand, attending clinicians had the opportunity to contribute to the innovative tool's user-centred design. Seeing as, the input received from these 10 SLPs would serve as further design recommendations for the SALTT-CITY tool's final version.

3.3dv Tools and Data Collection Procedure used in Phase 3:

In this phase of data collection, the BETA prototype was presented to the 10 attending clinicians along with an information letter detailing their involvement in the study, and a consent form to confirm their agreement to this involvement.

During the clinicians' workshops, an additional feature of the questionnaires was included in the evaluation of the tool. Three different fictitious case studies were randomly allocated to each group of clinicians.

Case studies are intensive analyses of an individual element (Denzin and Lincoln, 2011). For this study, three case studies were chosen from Kuiack and Archibald's (2023) study and adapted to suit the local bilingual Maltese-English speaking context. Each case study was divided into three different roles (i.e. the child diagnosed with DLD and his/her distinct profile, the child's caregiver and the child's SLP). The participants were randomly allocated a role and asked to discuss this among their group, while also coming up with two to three goals they would target if the child from their case study were assigned to their caseload.

Inherently, these case studies were presented to the SLPs to replicate the missing clinical element from the workshop. As Shivakumar (2012) states, case studies presented to groups provide descriptive situations which stimulate decision-making. Shivakumar (2012) further discusses that this case method encourages participants to apply their knowledge while developing new ideas. Thus, placing the focus on the approach that they use as opposed to finding a solution to a problem.

Ultimately, a questionnaire that probed into the target perspectives mentioned in section 3.4div was provided to the clinicians to elicit further feedback that was not brought forward during the discussions.

3.3e Phase 4: Case Study and surveys with a clinical triad (SLP, Child diagnosed with DLD and their caregiver) using the BETA Prototype.

3.3ei Phase 4's Design:

Similar to Phase 2's research design, caregiver-report questionnaires along with observations were taken on in Phase 4. However, Phase 4 employed a smaller scale of participants when compared to Phase 2.

Given the limitations in recruitment, only one child diagnosed with DLD could trial the tool in therapy. Thus, a case study-based approach was adopted in this phase's

design. As Huby et.al., (2011) describe it, the case-study approach is beneficial when a study requires an indepth analysis of a phenomenon of interest as it occurs in its natural, real-life context. Furthermore, Stake's (1995) work is particularly influential when defining the case-study approach, characterising three main types of case studies: intrinsic, instrumental and collective. In this study's case, an intrinsic case study was undertaken, as the researcher attempted to learn about a unique phenomenon. The distinguishing factor of this case lies in the fact that the child, diagnosed with DLD, utilized the SALTT-CITY Tool in therapy.

Documentation of language performance as elicited using the SALTT-City tool was unprecedented, as no other child with a similar developmental profile had ever used this tool before.

In addition to the minute sample size of children diagnosed with DLD who could participate in the study, the case-study approach was also chosen to explore the implementation of the SALTT-CITY tool in the clinical setting in depth. Thus, as Crowe et.al., (2011) highlight, in contrast to experimental designs, which aim to test a specific hypothesis by deliberately manipulating the environment, the case study approach is well-suited for exploring explanatory questions like "how," "what," and "why." For example, it can address questions such as, "How is the intervention being implemented and received by the client?"

In the following section, the aforementioned clients (i.e. the child and his mother) along with the participating clinician are described.

3.3eii Phase 4's Participants:

Three participants were recruited in this phase of data collection. The data collection session took place during May 2024.

The first participant, from this point on will be referred to as Mason. Mason was a boy aged five years and 7 months old, diagnosed with DLD who had a bilingual Maltese-English linguistic background but predominantly expressed himself in English. Mason had been attending speech and language therapy since March 2022. Throughout this time he had mainly been receiving language therapy, however, in October of 2023 the child started to exhibit speech errors. Consequently, he started to receive intervention to improve his speech intelligibility. From October of 2023 up until February of 2024, Mason's goals in therapy revolved around the following:

- To target word-finding difficulties,
- To increase Mean Length of Utterance,
- To target the expression of prepositions,
- To encourage better syntax through the use of Colourful Semantics;
- To target speech intelligibility using a core vocabulary approach.

In March 2024, Mason was handed over to a new clinician who chose to participate in this study and has been pseudonymized as Jane for this write-up. The same goals were retained by this clinician, seeing as the child still required intervention on these targets. However, verbal reasoning skills were being targeted with Mason as of March 2024.

The remaining participant in this phase was Mason's mother, who will henceforth be referred to as Veronica, who attended the observed session with Mason. She reported herself as a learning support educator who was also enrolled in an Inclusive Education post-graduate degree at the time of the session. This information was taken into consideration throughout the evaluation of the caregiver questionnaire which she completed.

3.3eiii Phase 4's Participant Recruitment:

Participant recruitment for Phase 4 followed a similar pattern to Phase 3.

Recruitment emails containing information letters and consent forms were sent out to clinicians through both intermediaries to recruit SLPs as both participants and intermediaries in the study. Therefore, participating SLPs were tasked with identifying clients who fit the research criteria, with whom they would then trial the BETA-Prototype of the SALTT-CITY tool in their respective clinics. Recruitment for this phase of data collection spanned between January and May 2024.

Consequently, following the recruitment and acceptance of participation from the childcaregiver dyads, the researcher would observe the triadic clinical interaction between the child, caregiver and clinician.

Unfortunately, the recruitment only yielded one triad (i.e. Mason, Veronica and Jane). Therefore, the observation was done in more depth than originally planned and turned into a case study about the triad's overall experience once the SALTT-CITY tool was implemented into the clinical setting.

3.3eiv Phase 4's Research Methods and Tools used:

As previously mentioned, the main research method employed in this phase of data collection was that of case studies. As Creswell and Cresswell (2017) highlight, the qualitative design of case studies allows researchers to explore individual phenomena in-depth using a variety of data collection methods.

Priya (2021) agrees with this statement and further states that case studies provide researchers with a leeway to use any methods of data collection that suit their purpose (if they are feasible and ethical). The aforementioned study encourages the use of questionnaires, participant observations, document review and natural

conversations as a means of enhancing a study's case study in an unbiased fashion. Conforming with this, in phase 4 of data collection, various research methods were utilized, including self-report questionnaires, smile-o-meters, analysis of audio recording transcriptions and naturalistic observations.

To once again achieve data triangulation and maintain a standard operation protocol regarding observations, notes by the researcher were taken using an observation form purposefully designed for this study. To further ensure the reliability of results, the participating clinician was also tasked with completing the same observation form as the researcher.

Continually, feedback from both the SLP and the caregiver was required given the study's user-centred-based design. Therefore, post-experience questionnaires were handed out to both of these participants.

Given that the child's literacy skills were still in the process of developing, he could not be presented with a questionnaire such as the ones disseminated to the adult participants. In light of this, a smile-o-meter (Figure 4) was presented to Mason after each activity. A smile-ometer is a pictorial Likert scale often used to express judgment in quantitative research when young participants are not yet fluent readers (Hall et.al., 2016).

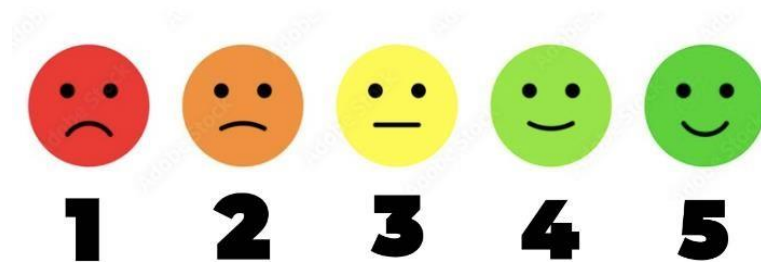


Figure 5 5 Point Smile-o-meter used in Phase 5 of Data Collection

3.3ev Data Collection Procedure in Phase 4

Initially, the SLP was recruited to take part in the study. Consequently, she acted as an intermediary to recruit Veronica and Mason. This was done by disseminating an information letter, consent, and assent form. Once the caregiver returned her signed consent form to the SLP, the date for data collection was then scheduled.

On the data collection day, the participant triad was introduced to the BETA-Prototype of the SALTT-CITY Tool. They were then allowed to freely interact with the prototype for approximately 45 minutes, during which audio recording took place. During this time, the researcher and clinician were tasked with completing an observation form regarding the child's behaviour and performance with the tool.

Following the completion of each activity from the tool, Mason was asked to rank his enjoyment of the activity on a pictorial Likert scale (smile-o-meter).

Ultimately, a post-experience self-report questionnaire was provided to the mother and clinician respectfully, through this they provided individual feedback on the tool for further improvements to be made as the research team strove to produce the tool's final design.

3.4 Data Coding

In the study, both quantitative and qualitative methods of investigation were employed. The quantitative data was further expanded on in the subsequent statistical analysis chapter, and the qualitative data was analysed in the thematic/content analysis chapters. Before analysis can be undertaken, the qualitative data needs to undergo the process of coding, during which it is broken down according to its intended analytical processes (Elliott, 2018).

Three methods of data coding were proposed for this study. These methods are theoretically explained hereunder considering their corresponding data sets.

- **Inductive Coding:** Inductive analysis requires careful examination of the data to find emergent codes, categories, patterns and themes. Therefore, the codes are not predetermined but instead are identified and named as the researcher examines the data. A common practice in inductive coding is the use of initial coding and constant comparative analysis before finalising the identified codes. Therefore, the researcher would identify and name initial concepts in the data set (initial coding) and then compare that data to other data and the codes with other codes. To finally condense these codes into categories, the categories into themes and the themes into findings (constant comparative analysis) (Bingham, 2023). This method of data coding shall be used with the data gathered from the analysis of Phases 1-3.
- **Deductive Coding:** Deductive coding involves the creation of codes before data analysis and then their application to the data. The collected data can then be organised into predetermined categories elicited from literature or ones created based on the research purpose/questions. Through deductive codes, propositions are formed, and the nature of these deductive propositional statements allows researchers to accurately describe what they believe will emerge from their data set (Bingham & Witkowsky, 2021). This means of coding will be employed with the analysis of the transcribed audio recording and caregiver questionnaires from Phase 4 of data collection. Due to the preliminary answers that were elicited from the previous phases of data collection (i.e. the positively received prototypes of the tool and the components which still required further work).

- **Thematic Analysis:** Thematic analysis is a systematic process that involves creating codes and themes from qualitative data. Codes represent the most important elements of data related to the research question, and these codes are then grouped into themes, which are patterns of meaning containing a shared core concept. These themes provide a framework for the researcher to organise and report their observations. Hence, thematic analysis goes beyond simply summarising data; it also involves identifying and interpreting key features in the data, guided by the research question (Clarke & Braun, 2017). As previously mentioned, this process will be particularly employed for the analysis of the data collected across Phases 1-3.

The qualitative data collected across Phases 1-3 were analysed using a manual approach. This process began with repeated readings of interview transcripts, observation notes, and questionnaire responses to ensure familiarisation with the data. Initial codes were generated by identifying recurring patterns, similarities, and contrasts across stakeholder feedback. These codes were then grouped into broader thematic categories through iterative comparison, visual mapping, and colour-coded highlighting. No qualitative software was employed; instead, organisation was maintained manually using thematic charts.

Themes were confirmed through constant comparison, where initial categories were tested against new data and refined or merged accordingly. This ensured that the final themes represented consistent and saturated insights from across the dataset, rather than isolated observations. Throughout the analysis, care was taken to preserve participant voice, especially where feedback diverged across sample pools.

3.5 Ethical Procedures

The main role of participants in research studies is to act as sources of information. Thus, researchers must ensure the protection of health, dignity, integrity and confidentiality regarding the personal information of research participants (World Medical Association, 2013). According to the Belmont Report (1974) which was a result of the National Research Act of 1979, research studies may be ethically evaluated according to their adherence to the following three principles:

- Respecting the autonomy of individuals and protecting those with diminished independence,
- Being magnanimous and maximising the potential benefits received from the study while minimising potential harms;
- Upholding individual and societal justice.

As Yip et.al., (2016) discuss, the mistreatment of research participants through a lack of ethical measures in the research design would result in ethical misconduct and ultimately lead to unacceptable research practices. Therefore, in this study, the following ethical measures were implemented:

- i. **Permissions were obtained from the entities involved in the study:** Before participant recruitment, permissions were obtained from the relevant authorities, such as the Data Protection Officer for Primary Healthcare, the Professional Lead of speech and language pathologists, the Head of Department of Communication Therapy at the University of Malta and the respective individuals in charge of the various data collection venues used (i.e. the Central Public Library, Esplora Interactive Science Centre and the Malta National Aquarium).

- ii. **Ethical Approval was sought:** This research study (FHS-2023-00601) was granted. Ethical approval by the Faculty of Health Science Research Ethics Committee (FREC) and the University Research Ethics Committee (UREC) on December 4th, 2023¹.

- iii. **Written and Verbal Information Dissemination:** All participants (i.e. clinicians and caregivers of child participants), received written information letters about the nature of the research study. These letters also detailed their involvement in it. Participants were verbally encouraged to ask for further clarification if anything from the written letter was unclear.

- iv. **Data Protection and the right to withdraw from the study:** Participants were guaranteed that all the collected data would be retained confidentially and used solely for the described research purposes. Participants' names and identities were safeguarded and removed from results, when needed the use of pseudonyms was employed. Any recordings and identifying data will be destroyed after 18 months from the final data collection date (i.e. September 2025). It was also highlighted that participants could withdraw from the study at any point without any consequences following this action.

- v. **Written consent:** All adult participants were provided with a consent form, in the case of caregivers their consent form requested consent for both their and their child's participation. The consent forms detailed each participant's involvement and agreement according to the phase of data collection in which they were recruited.

1 Kindly refer to Appendix A: Ethical Approval

- vi. **Assent:** Given that child participants were recruited in the study, verbal assent was elicited from them through their parents who were tasked with explaining the project. In addition, the researcher also obtained verbal assent from the participating children before their interaction with the tool and smile-o-meter.

3.6 Validity, Reliability and Replicability

Reliability refers to the consistency of the findings, while validity pertains to the accuracy of the findings. These concepts are crucial to establish a strong foundation in research. Together, they enhance transparency and minimize the risk of researcher bias in research (Mohajan, 2017). In the study at hand, the following steps were taken as a measure to ensure both the validity and reliability of the collected data.

3.6a Phase 0 of Data Collection: Face-Validity Study with SLPs:

3.6ai Phase 0's Design:

When utilising self-administered questionnaires in research, face validity is often employed to assess whether the questions posed to a population align with their intended measurement objectives. It is a subjective evaluation to determine if the questions aptly convey the intended meaning and purpose. Typically, the assessment of the materials being used is conducted by experts in the relevant field or individuals from the research's targeted demographic, this assessment ensures the relevance and clarity of the questionnaire items. Incorporating face validity into questionnaire development significantly contributes to bolstering the overall credibility and trustworthiness of the subsequent results (Leon et.al., 2022). In Phase 0 of data collection, the insights were gained by 5 SLPs regarding the tools designed for the study at hand. The feedback from the face-validity study was essential for refining their effectiveness and presentation.

3.6aii Phase 0's Participant Recruitment:

Participants were recruited anonymously through a recruitment email disseminated with the University of Malta's Bachelor of Science (Hons) in Communication Therapy graduating class of 2019. The email was sent to the class' collective email address and explained the purpose of face validity in the research study as they were invited to fill in a Google Form document (this will be further described in section 3.3e). This recruitment took place in December 2023 and recruitment lasted for approximately one week.

3.6aiii Phase 0's Research Methods:

The validity of assessment tools is crucial in research, however, given that the tools used in this study were original in their design their validity needed to be established. The chosen research method for this data collection phase took the form of a mixed-methods response process validity measure. Response process validity aims to measure the thought processes of users about the clarity of instructions and language used in assessment tools. This process contributes to the overall validity of an assessment tool and aids in the systematic quantification of this validity based on quantifiable evidence (Yusoff, 2019).

3.6aiv Tools used in Phase 0:

To facilitate the process of face validation a response process validation form should be provided to ensure that the raters, who are also the intended respondents, have a clear understanding of the task and the researcher's expectations in terms of the feedback they need to provide (Patel & Desai, 2020).

For this to be achieved, the SLPs recruited in this phase of data collection were given the option to access a transfer link to download the set of research tools created for this study. Consequently, a validation form was provided to them via Google Forms software.

The validation form presented two types of questions which guided the SLPs in providing their feedback about the attached documents. The initial question presented the respondents with a quantitative choice to outline their opinion about the clarity of the tools, the language used and the structure presented. The second question was presented qualitatively and allowed the participants to express any remarks that they had in regards to the tools which were not covered in the quantitative portion of the validation form.

Personally identifying information (i.e. names and email addresses) was not collected through these tools, as it was irrelevant to the necessary data.

Following the receipt of the forms, their responses were checked and taken note of. The tools at hand were then amended accordingly through the use of these notes. This was done before the utilisation of the tools in the consequent research phases, to ensure that the data collected throughout the study was collected using valid tools.

3.6b Inter-rater Reliability

Inter-rater reliability measures the level of agreement between two or more raters (or observers, coders, or examiners). High inter-rater reliability indicates a strong consensus between the examiners, whereas low inter-rater reliability signifies a lack of agreement (Lange, 2011). As McHugh (2012) highlights, 80% is the minimum acceptable interrater agreement.

In the evaluation phases of this study (Phases 2 and 4), the researcher completed observation forms detailing each child participant's performance with the SALT-CITY tool. In phase 2, certain portions of the observation form were repeated in the caregiver questionnaire. By comparing the scores given by both raters, inter-rater reliability could be calculated.

Additionally, in Phase 4 of data collection, the participating SLP was provided with a copy of the researcher's observation form regarding the child's performance. Inter-rater reliability

was determined by counting the number of test items the raters agreed on, dividing this number by the total number of test items, and converting the result into a percentage (for both phases). Overall, the mean percentage of inter-rater reliability in Phase 2 was: 80.9% (the researcher/research assistants and caregivers agreed on 356/440 points), and in Phase 4 it was: 85.5% (the researcher and observer agreed on 47/55 points).

3.6c Replicability

While the tool itself is not explicitly explained in this study due to legal discussions ongoing at the time of writing, the procedural details, data collection phases, and analytic steps have been documented thoroughly to support future replication and adaptation in similar contexts. Clear documentation of materials and coding methods allows for methodological transparency and reproducibility.

3.7 Limitations and Difficulties Encountered

3.7a Limitations

Limitations in studies represent weaknesses within the research design which may influence the outcomes and conclusions of the research. It is a researcher's responsibility to present complete and honest limitations in their study to the academic community, to support future investigations in the same areas of study (Ross & Bibler Zaidi, 2019). The following six main limitations prevailed in this study:

- i. **Sample Sizes:** As Faber and Fonseca (2014) state samples should be neither too big nor too small since both ends of the spectrum could compromise the conclusions drawn from the study. Too small of a sample would prevent the findings from being extrapolated and generalised, whereas a sample that is too large would amplify irrelevant statistical differences. In this study's case, the sample sizes across

phases 1, 3 and 4 of data collection were smaller than the expected number. Thus, limiting the study's generalisability.

ii. **Sampling Method:** During Phase 2 of data collection, convenience sampling was used to recruit participants. This involved including individuals who were easily accessible to the researcher. However, studies conducted with convenience samples may have limited external validity. This is because the findings drawn from these samples may not easily be generalised to populations with differing characteristics from the accessible population from which the sample was drawn (Andrade, 2011). Thus, due to the sampling method used this study's conclusions may have limited generalisability to the broader population.

iii. **Research Assistants:** The sample size in phase 2 was significant and could not be effectively observed by the singular researcher in charge of this study. Therefore, two undergraduate students were recruited to aid in these observations. Unfortunately, despite receiving training (to improve construct-based reliability) and their enthusiasm regarding the study, these two students were still inexperienced in the field of data collection. Thus, as Narendorf et.al., (2016) outline, inexperienced research assistants can lead to errors in data collection due to a lack of attention to detail and consistency as well as an incomplete understanding of research methodologies. Therefore, to mitigate such difficulties, the aforementioned research states that close supervision should be provided to such assistants. This measure was indeed taken during phase 2 of data collection; thus, despite being present, this limitation was reduced as much as possible.

iv. **Observer Bias:** Throughout Phases 2, 3 and 4 of data collection; adult participants were tasked with completing self-report questionnaires. However, the

researcher was present in the room as these adults were completing their questionnaires. Due to this, observer bias (Hawthorne effect) may have been present. The Hawthorne effect refers to the fact that people tend to behave differently when they know that they are being observed (Sedgwick & Greenwood, 2015). McCambridge et.al., (2014) discuss how a certain degree of observer bias occurs in all user research since participants tend to answer questions to appear as the better version of themselves. Thus, they inflate the number of positive traits and minimize the negative ones in their survey responses. Therefore, the answers reported in the questionnaires could be slightly skewed due to the possible presence of observer bias.

v. **Inter-Rater Reliability (IRR) Approach:** The study utilised a consistency-based approach to IRR, which was appropriate given the nature of the user-centred design and the reliance on relative rankings rather than absolute agreement. While this approach provided a practical solution, it was not consistently achieved across all phases of data collection. Specifically, during Phase 2, IRR was calculated between the observing researcher (or research assistant) and the caregiver, but there was no direct IRR established between the observing researcher and the research assistant. Although construct agreement was present, the absence of IRR between these two parties introduces a potential source of variability in the data. In Phase 4, IRR was limited to being calculated between the researcher and the participating SLP due to the small sample size. Calculating IRR with only two individuals reduces the robustness of the reliability estimate and limits the generalizability of the findings (Hallgren, 2012).

vi. **Observation Tools and Time Constraints:** Phase 4 of the study was initially intended to be a series of clinical observations aimed at examining the use of the tool in practice. However, as the study progressed, a shift toward a case study approach

was adopted. This change required a more in-depth and contextually bound exploration of the phenomena. Given the time constraints, it was not feasible to completely redesign and validate new observation tools to align with the case study methodology. Instead, predesigned and validated questionnaires and observation forms were revised for use. This approach allowed for data collection to proceed within the available timeframe but also introduced certain limitations. The reliance on modified tools, rather than newly developed and fully validated instruments, may have affected the comprehensiveness and precision of the observational data collected Kekeya (2021).

3.7b Difficulties Encountered

The main difficulties encountered in this research study related to participant recruitment. In the following section, these difficulties and the solutions attempted by the researcher will be highlighted.

Initially, difficulties were encountered in recruiting SLPs for the pre-design focus group (Phase 1). The first solution proposed for this was to offer different time slots to accommodate scheduling difficulties and host the focus group virtually instead of in person.

As Englund et.al., (2022) highlight conducting online focus groups is cost-effective, timesaving and increases accessibility to participants. This did not yield any effect in terms of recruitment. Therefore, a new intermediary other than the SLPs' professional lead was sought. The new intermediary (secretary of ASLP) forwarded the recruitment email and traction was gained in terms of interested SLPs who emailed for further information. If the study had to be redone, the second intermediary would have been recruited from the starting point of data collection. This would have given the researcher further outreach among the professional community, thus enhancing the likelihood of participant recruitment.

Further difficulties were encountered while recruiting child-caregiver dyads from speech and language therapy caseloads, to participate in the clinical phase of data collection (Phase 4).

Recruitment emails were sent out from organisational intermediaries to recruit SLPs as intermediaries in recruiting child participants and their caregivers. A number of SLPs reached out wishing to participate, however, this proved fruitless as they were unable to recruit participants from their caseload.

Hence, recruitment for child and caregiver dyads who attend speech and language therapy had to remain indefinitely open from the start of recruitment until it was feasible due to the time constraints placed on the study. The initial plan for phase 4 was to have a minimum of 25 observations undertaken in clinical settings, in these observations, the triadic interaction between clinicians and clients would have been taken note of using a short observation form which would have then been boosted by caregiver and clinician self-report questionnaires. However, even after exhausting the different recruitment possibilities and time allowances, only one triad was successfully recruited. Therefore, to elicit as much information as possible, the initial observation method was changed to a descriptive case study. The initial observation form was supplemented with further details along with the caregiver and clinician questionnaires. The session was also audio-recorded, to allow for transcription and analysis of the various interactions that took place.

In retrospect, the researcher could have avoided the need to adapt tools and deviate from the initial research design by conducting a preliminary review of how many children diagnosed with DLD attended speech and language intervention in Malta at the time of data collection.

During the participant recruitment for phase 4 of data collection, several clinicians showed interest in evaluating the tool. However, most of them mentioned that they couldn't find suitable clients for the data collection. As a result, they would not have been able to evaluate

the prototype if we had followed the initial data collection plan. With a slight change to the plan, these clinicians were also included in the evaluation process during the clinician workshops (Phase 3). If this approach had been taken from the beginning, more clinicians could have been reached and promoted the scheduling of clinical observations. This would have allowed clinicians to get familiar with the tool and spread the word about its use to their colleagues who might have missed the recruitment emails.

3.8 Reflexive Practices

Throughout the study, the researcher engaged in ongoing reflexive practice to consider how their background, values, and professional identity shaped the research process. As both a researcher and a speech-language pathologist, their clinical insights influenced the development of the SALTT-CITY tool, particularly the prioritisation of user needs and the practical relevance of therapeutic features.

The researcher's identity as a bilingual Maltese-English speaker provided cultural and linguistic familiarity that enhanced sensitivity to local sociolinguistic norms, especially concerning code-switching, lexical borrowing, and bilingual language use in children. While their clinical training was central to identifying and interpreting language behaviours as typical or atypical, the researcher remained aware that this familiarity could influence how certain findings were framed or prioritised. For example, features considered intuitive or commonplace by the researcher might be interpreted differently by individuals less embedded in the Maltese-English linguistic context.

Additionally, as a relatively young clinician, the researcher naturally gravitated toward therapy approaches that combine technology and play. These preferences informed both the enthusiasm brought to the project and the direction of the tool's design. While this alignment strengthened the ecological validity of the intervention in contemporary practice, the

researcher remained mindful of the potential for personal preferences to shape engagement with stakeholder feedback and interpretation of user responses.

To maintain transparency and reduce bias, the researcher kept a reflective design log throughout the project and maintained a detailed audit trail of key design decisions.

Triangulation of data sources and peer debriefing were used to ensure that the findings remained grounded in the perspectives of participants and were not overly influenced by the researcher's clinical or contextual lens.

3.9 Conclusion

This chapter has detailed the research design, methodology, and tools used to gather data relevant to the objectives and research questions indicated earlier on.. The next chapter will present the results of this study and provide an analysis of the data.

Chapter 4: Analysis of the Qualitative Input collected across Phases 1-4 of Data Collection.

4.1 Introduction

This chapter aims to analyse the majority of the qualitative data gathered for this study. It includes an explanation of the coding process, along with the synthesis of emergent codes into themes is provided, based on the data gathered from the use of the following tools in the study

- Background Questionnaire for Focus Group SLPs (Phase 1)
- Transcription of the Dyadic Interview's audio recording (Phase 1)
- Post-Interview Questionnaire (Phase 1)
- Typically Developing (TD) Caregiver Questionnaire (Phase 2)
- TD Child Observation Form to be filled in by researcher/research assistant (Phase 2)
- Further Annotations taken down by the researcher during TD Observations (Phase 2)
- Survey for SLPs about the BETA Prototype of SALT-CITY (Phase 3)
- DLD Caregiver Questionnaire (Phase 4)
- SLP Questionnaire (Phase 4)

As can be noted, the observation form and transcription of the audio recording taken from Phase 4 have been omitted from the above list. This exclusion is because they will be used to analyse the case study in the upcoming chapter, which provides an in-depth look at the clinical session held in Phase 4.

4.2 Qualitative Data

Qualitative data represent information that cannot be expressed numerically. It is frequently collected through interviews and focus groups, personal diaries and other printed materials or observations. Qualitative data differs from quantitative data, which relies on numerical data (National Library of Medicine, 2022). The main purpose of qualitative data is to enhance the understanding of phenomena through the detailing of experiences from individuals who have directly experienced said phenomena. Thus, recognising the value of participants' unique points of view that can realistically only be fully understood within the context of their experience and worldview (Morgan, 2018). Qualitative data can be analysed in several ways. One common way is data coding, which is the act of converting raw data into a collection of clear categories that define the data's key concepts (Zhang & Wildemuth, 2009).

4.2a Data Coding

To better understand the data, 'descriptive coding' was employed in this analysis. As Linneberg and Korsgaard (2019) state, this approach involves the systematic process of examining data and assigning labels, or 'codes,' to specific segments that capture the essence of their meaning within the broader research context. These codes are typically applied to smaller units of data, such as sentences or coherent groups of statements.

Notably, the data collected using the tools mentioned in section 4.1 was merged during the coding process, which then led to an expansive thematic analysis. This step was taken based on Sanders and Stappers' (2008) findings, which state that the merging of data across iterative cycles in user-centred designs facilitates a comprehensive understanding of user needs and experiences by identifying recurring themes and patterns across diverse data sources and time points during the design process.

4.2b Data Coding Visuals

This section presents Diagrams 1-8, which outline the codes gathered during each of the four phases of data collection. Diagrams 1, 3, 5 and 7 illustrate the primary data collection method used in each phase, along with the corresponding instruments that helped identify the codes. Overall, these diagrams visually demonstrate how each phase contributed unique insights to the overall analysis of the study. They also highlight the interconnected nature of the iterative development of codes throughout the research process, as each phase provided different information about similar points of interest. Diagrams 2, 4, 6, and 8 illustrate the arrangement of the elicited codes into their corresponding subthemes and themes. These subthemes and themes are further elaborated in Section 4.3 of this chapter.

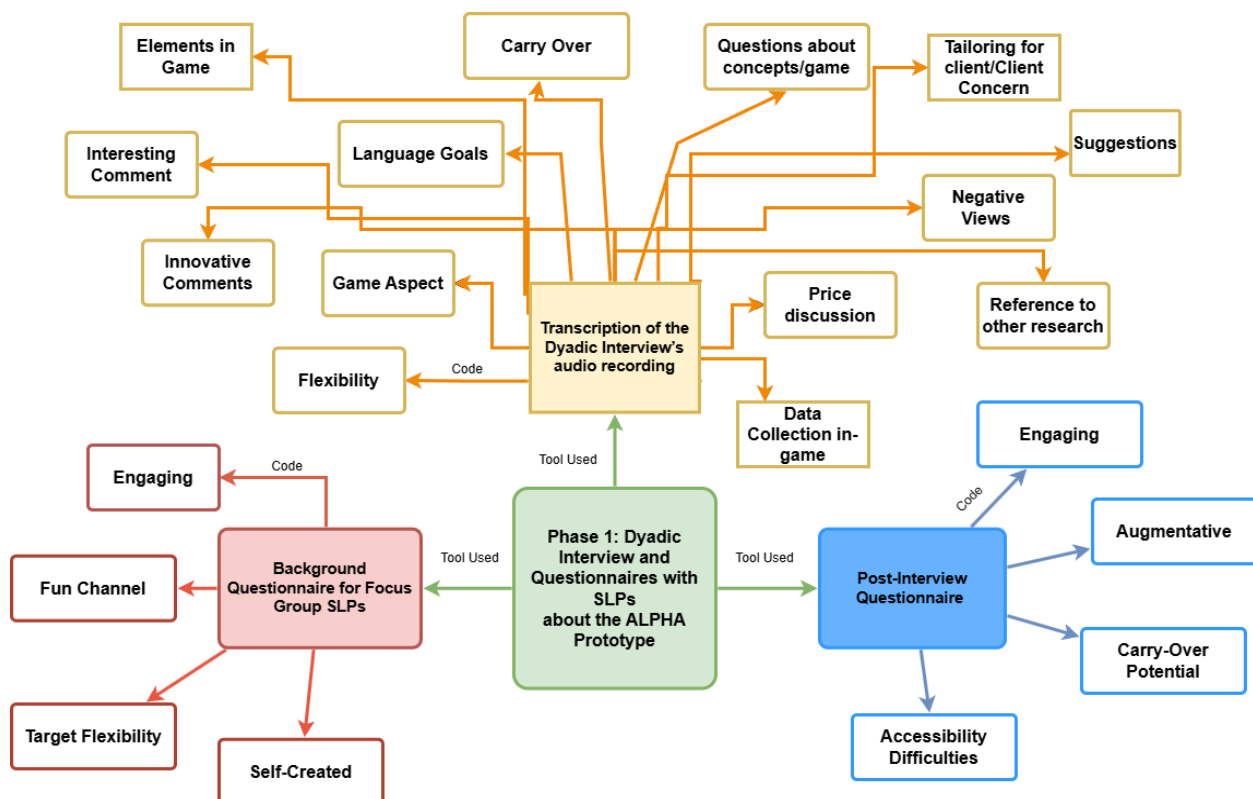


Figure 6: Codes Elicited from Phase 1's Data Collection

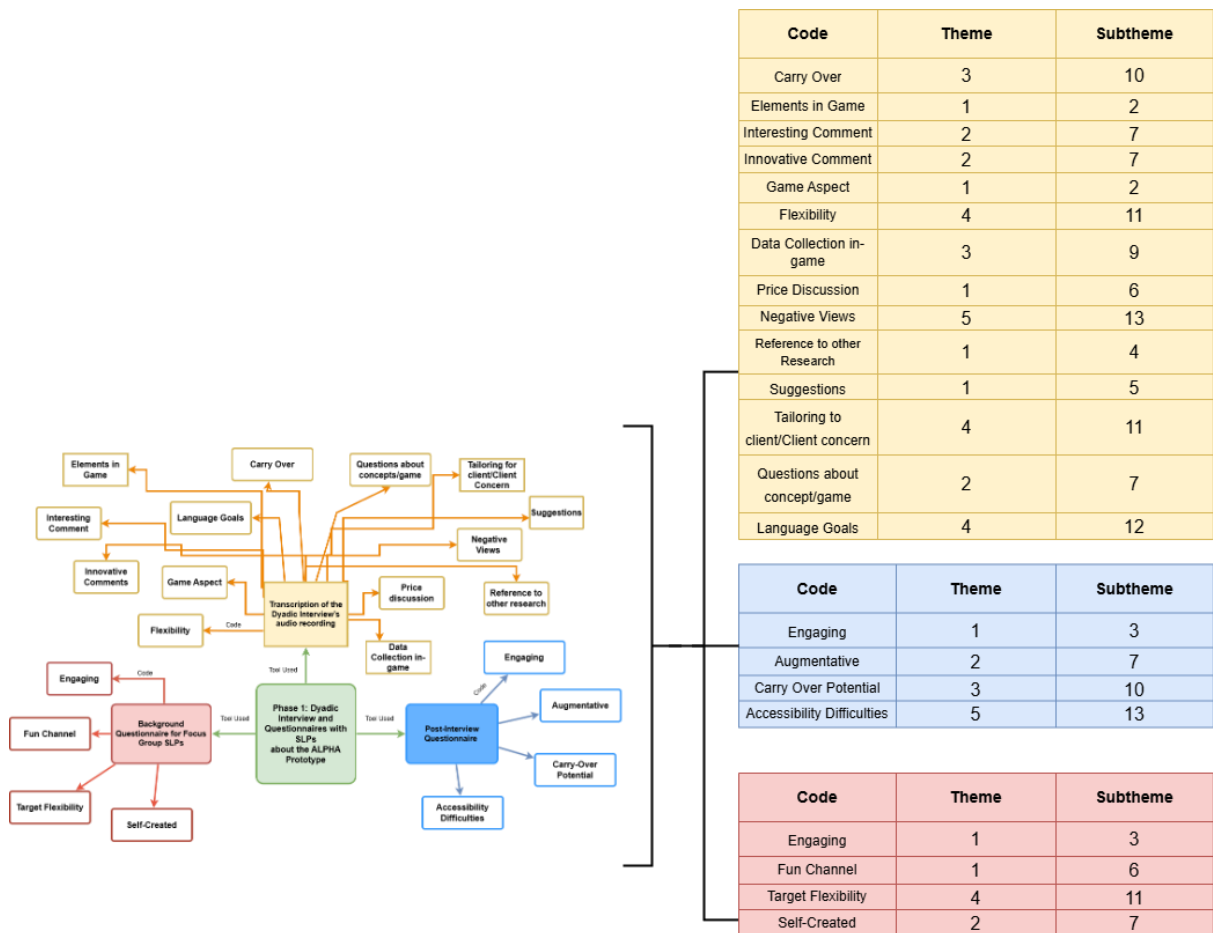


Figure 7: Data Coding Scheme for Phase 1's Codes

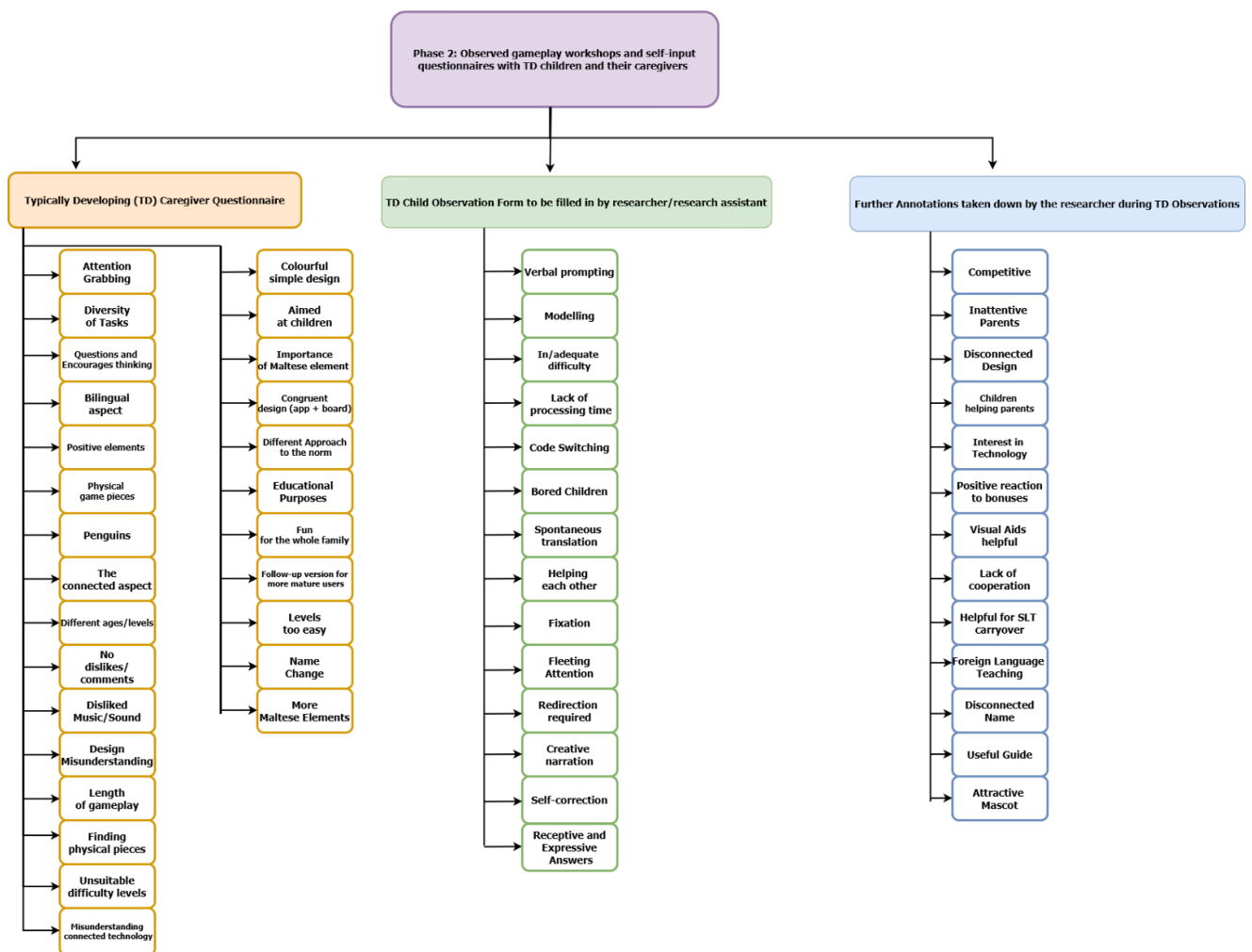


Figure 8: Codes Elicited from Phase 2's Data Collection

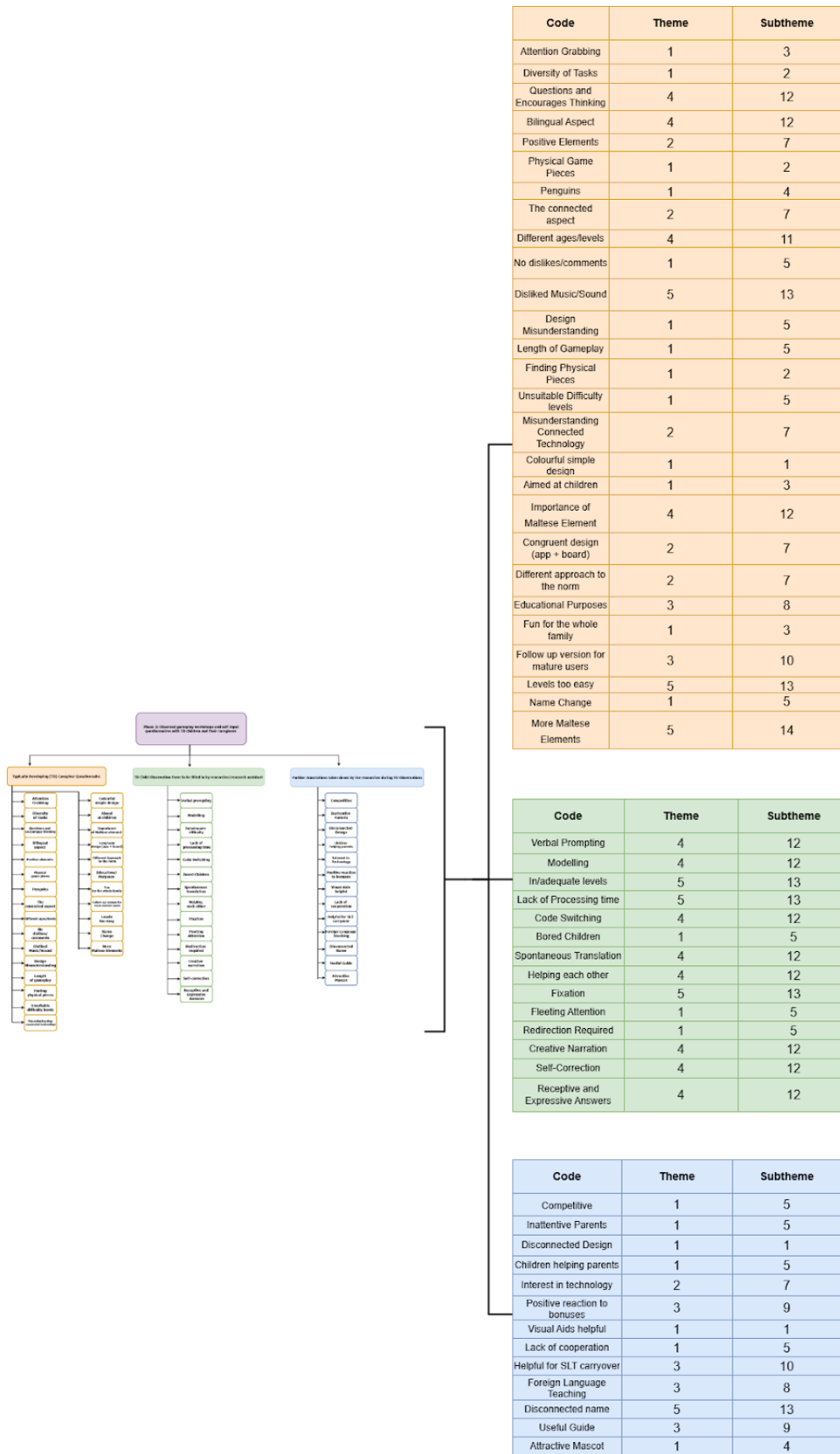


Figure 9: Data Coding Scheme for Phase 2's Codes

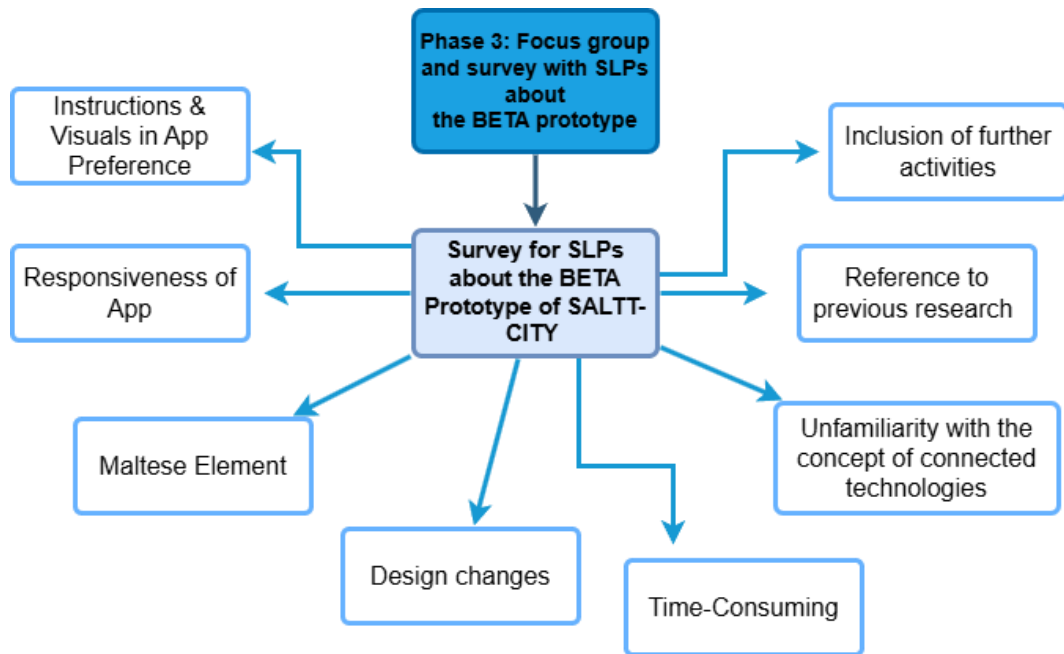


Figure 10: Codes Elicited from Phase 3's Data Collection

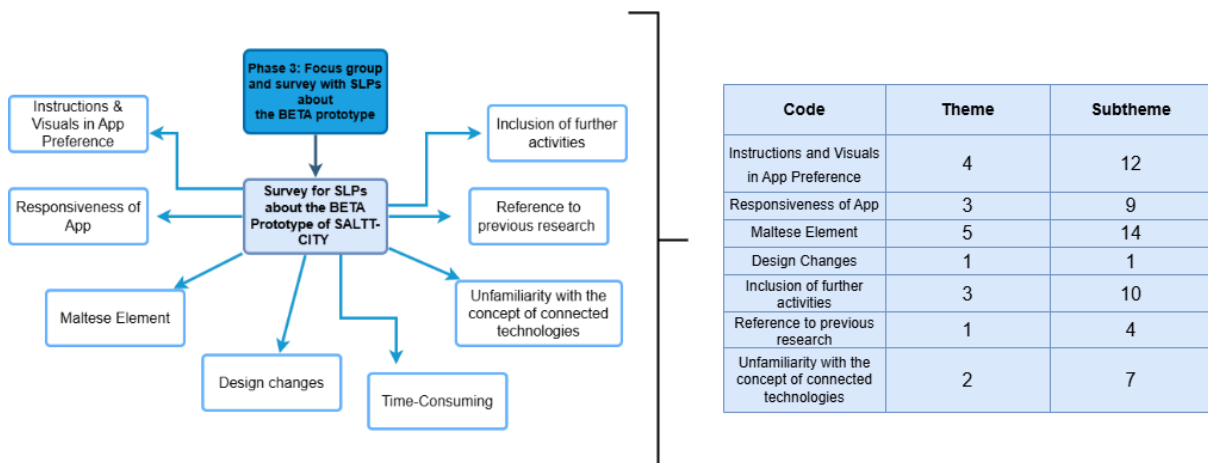


Figure 11: Data Coding Scheme for Phase 3's Codes

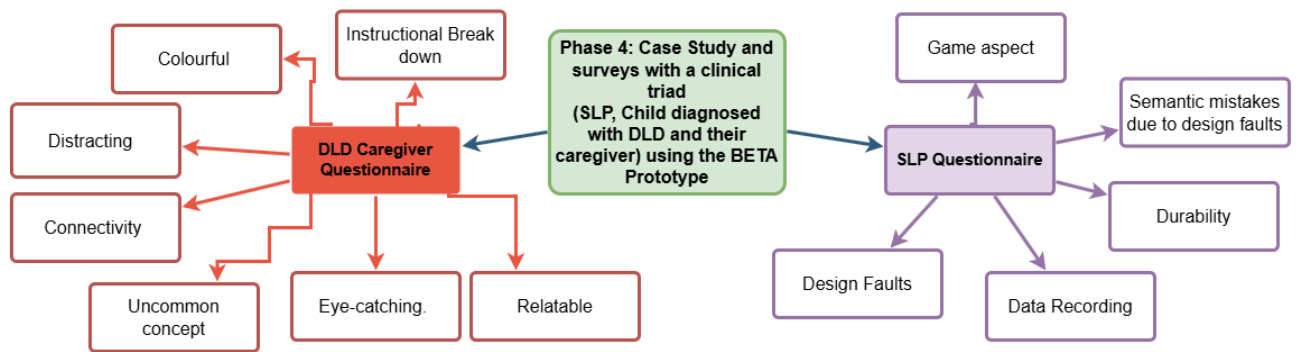


Figure 12: Codes Elicited from Phase 4's Data Collection

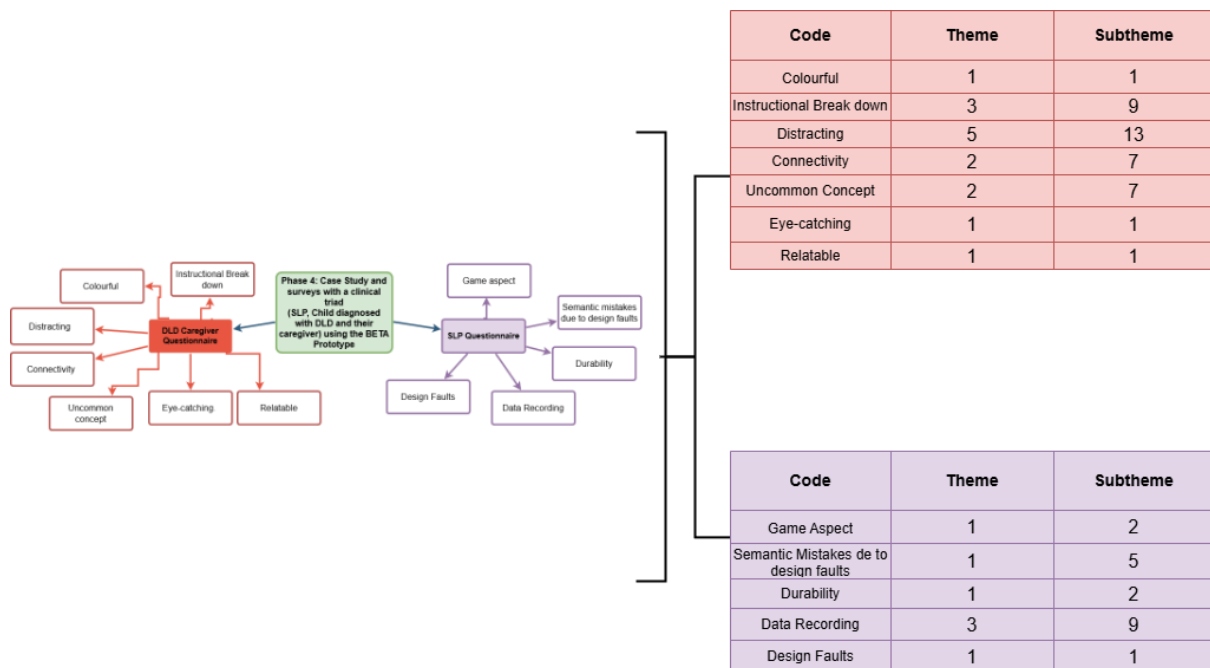


Figure 13: Data Coding Scheme for Phase 4's Codes

4.3 Emergent Themes and Thematic Analysis

Thematic analysis is a widely recognised qualitative research method for identifying, analysing, and interpreting patterns of meaning within data. It provides a systematic framework for grouping codes into broader themes that represent the underlying structure of the dataset Braun et al. (2012). As described by de Farias et al. (2021), the grouping and classification of content into themes and sub-themes establishes causal relationships between

codes and forms the foundation for robust qualitative analysis. Seeing as, themes capture the data's subjective and culturally contextual meanings, offering a lens for understanding complex phenomena (Maguire & Delahunt, 2017). As Vaismoradi and Snelgrove (2019) observe, developing themes is an iterative and time-intensive process which requires careful consideration of the relationships between codes.

This study employed a hybrid approach to the coding and thematic analysis, combining inductive and deductive reasoning to achieve a balanced analysis. The inductive approach captured participants' unique perspectives and context-specific codes, while the deductive approach integrated broader theoretical insights into the analysis. This dual approach allowed for an analysis that was both deeply grounded in the research context and situated within the existing literature (Azungah, 2018).

Guided by these principles, thematic analysis was applied to the synthesised data gathered across all four phases of the study. Each phase generated extensive qualitative data, revealing a variety of interconnected themes and sub-themes. Rather than analysing each phase's findings in isolation, an integrative approach was undertaken to ensure that the phenomenon at hand was understood comprehensively (Sanders & Stappers, 2008). This process reflects the study's iterative user-centred design, where insights from one phase informed and enriched the subsequent phases, allowing for findings to be placed within a broader context.

By synthesising data from all phases, this systematic approach highlighted the complexity and interrelationships among themes, which might have remained fragmented if examined separately. Guided by the thematic synthesis principles of Thomas and Harden (2008), diverse data sources were integrated to create overarching themes with nuanced interpretations. Nicholson et al. (2016) highlights the importance of such syntheses in generating actionable messages, enhancing the relevance and applicability of findings across

various end-users. For this study, this process enabled the identification of a diverse range of opinions about the tool, which culminated in the generation of guidelines for the intended amelioration of the SALTT-CITY tool.

Through this unified analysis, the data was amplified, ensuring that the findings resonated with the diverse users at hand. Consequently, the codes were then unified according to their shared reference points and their degree of transferability into complementary themes (Vaismoradi & Snelgrove, 2019). Ultimately, five main themes were elicited, with 14 subthemes providing deeper insights, as seen in the thematic map outlined in Diagram 9 below.



Figure 14: Thematic Map of the Main Themes and Emerging Sub-Themes

These five main themes are outlined in this section, while the sub-themes are explored further in the upcoming chapter (Chapter 5).

4.3a Main Themes Elicited from the Collected Data:

Through the application of thematic analysis, the collected data was systematically examined to identify recurring patterns and significant insights. This involved an iterative process of coding the data, grouping similar codes, and refining these groupings to uncover overarching themes. By carefully analysing the data and considering the context of each code, the following five main themes emerged, each representing a critical aspect of the study at hand:

i. **Theme 1: Elevating Play**

The concept of "Elevating Play" emphasises the crucial role that engaging and thoughtful design plays in attracting and retaining children's interest in educational tools. By combining captivating visual aesthetics with sound gameplay mechanics, these tools can provide immersive and enjoyable learning experiences tailored to their target audience. Integrating appealing characters and thematic elements further enhances engagement, making learning both fun and effective. Additionally, prioritising user experience through continuous feedback ensures that the tool remains responsive to the needs and preferences of its users. Effective pricing and strategic marketing also contribute to the accessibility and widespread adoption of the tool, ultimately maximising its educational impact.

ii. **Theme 2: Navigating the Unfamiliar**

The theme of "Navigating the Unfamiliar" examines the unique challenges and opportunities associated with introducing an innovative tool in the local context where such designs and the use of gamification in therapy are relatively unfamiliar. Given the tool's incorporation of connected technologies, it stands to elicit varied responses from local therapists, ranging from enthusiasm and openness to scepticism and a lack of understanding. This section explores why this is a novel approach and the implications of bringing it to light, emphasising the

tool's potential to transform therapeutic practices while also addressing the importance of providing education and support to facilitate its successful adoption.

iii. **Theme 3: Revealing Future Possibilities**

The theme of "Revealing Future Possibilities" delves into the expansive potential of the tool, highlighting its versatility beyond its initial therapeutic purpose. While the tool is primarily designed for language therapy, it also shows promise as an educational resource within mainstream classrooms. This theme draws connections to previous research that informed the current development, emphasising the tool's data-handling capabilities that enable it to be effectively utilised in diverse settings. Furthermore, the discussion highlights the tool's ability to facilitate therapeutic carry-over and follow-up in home environments, providing a seamless and effective means of ensuring ongoing progress outside of structured clinical sessions.

iv. **Theme 4: Language Learning**

The theme of "Language Learning" focuses on the tool's capacity to adapt to the specific needs of individual clients, making it a valuable asset in the delivery of personalised language therapy. This theme underscores the unique features of the tool that actively promotes language acquisition, catering to diverse learning styles and abilities. Additionally, the discussion highlights the tool's bilingual functionality, allowing it to be used in both Maltese and English, either independently or simultaneously. The varied interaction and instruction techniques elicited during gameplay evaluations further demonstrate the tool's effectiveness in fostering language development dynamically and engagingly.

v. **Theme 5: Addressing the Negative views towards Gamification**

The theme of "Addressing the Negative Views Towards Gamification" explores the concerns and criticisms associated with the use of connected technologies and gamified therapy materials. This section outlines the scepticism some individuals expressed towards integrating gamification in therapeutic contexts, particularly regarding its effectiveness and appropriateness. Additionally, the discussion highlights issues encountered during the prototype evaluation, such as inadequate difficulty levels for certain children, which underscored the need for further refinement. The theme also addresses the importance of incorporating cultural elements into the tool, a component notably lacking in the BETA prototype, to ensure greater relevance and acceptance within diverse user communities.

4.4 Conclusion

Overall, these themes encapsulate the key findings and provide a structured framework for understanding the data in greater depth. The following chapter will highlight the division of the above-mentioned five themes into their corresponding 14 sub-themes.

Chapter 5: Discussion of the Qualitative Input collected across Phases 1-4 of Data Collection

5.1 Introduction

In this chapter, the sub-themes elicited from the primary themes discussed in Chapter 4 will be explored in detail. As described by Vaismoradi et al. (2016), each of these sub-themes focuses on a distinct element within the central organising themes.

These sub-themes highlight particular elements of interest within each theme, illustrating the multifaceted nature of the data and situating it within the broader context of existing literature. To provide further depth, relevant quotes from participants across all four phases of data collection have been integrated into the discussion. These excerpts not only exemplify the findings but also reinforce the analysis, bringing a richer perspective to the narrative.

5.2 Subthemes Emerging from the elicited Themes

5.2a Subtheme 1: Design and Visual Appeal

Aesthetics play a crucial role in the effectiveness of pedagogical tools, as highlighted by Page and Thorsteinsson (2017), who explore the dual need for toy designs to appeal to both children and caregivers. They conclude that toys need to catch the child's eye for them to be used, but they also need to claim certain educational benefits to persuade adults to purchase them. This balance was evident during the beta prototype's evaluation, where participants consistently praised its visual appeal. For example, one caregiver remarked, "*The strategic use of colours, shapes, and interactive elements made it very inviting and engaging.*"

Heljakka (2019) advocates incorporating "wow factors" to enhance toys' long-term play value and establish emotional connections with users. This was supported by a caregiver who described the prototype as "*very stimulating and fun,*" while another SLP noted, "*It's very attractive in terms of the design and all of that, it's very appealing.*" Similarly, Feng (2024)

underscores the importance of incorporating innovative play modes and materials that align with societal norms to foster healthier development and encourage real-world interaction. As highlighted by one SLP's statement "*It's something different to the norm*".

From the gathered data, the prototype was deemed highly attractive and effective. One caregiver highlighted its relatable design, stating, "*The board game is very colourful, and children can relate to the background of the game as it shows places they would normally visit*". Some participants provided feedback about the design's complexity, suggesting minor changes to simplify the game and reduce playtime by decreasing the number of paths. This is further discussed in Subtheme 5: User Experience and Feedback.

5.2b Subtheme 2: Gameplay and Mechanics

Effective gameplay and well-designed mechanics are crucial to the developmental value of toys for children, as noted during the evaluation sessions of the BETA prototype for the SALTT-CITY tool. Participants provided valuable feedback regarding the tool's ease of use and interactional mechanics, helping to shape the final design. The proposed age range for the tool corresponds to a crucial period of cognitive, physical, and emotional development. As Qiu (2024) explains, tools designed for young children must do more than just entertain; they should actively engage the senses and encourage exploration. One SLP emphasised, "*It's not just about fun, it's about development*," reflecting the importance of both enjoyment and educational value in the design.

The incorporation of perceptual engineering into toy mechanics, considering how children interact with and perceive toys, enhances intellectual stimulation. Jiang et al. (2018) further highlight that understanding children's preferences, such as colour and material, makes these interactions more effective. One caregiver noted, "*The use of colour and different physical materials in the tool makes it more engaging for my child, and it keeps her interested longer*."

Inclusive design is particularly important for children with additional needs, as toys that stimulate tactile and motor responses can significantly improve their quality of life. Piculo dos Santos et al. (2019) emphasise the role of inclusive toys in fostering development for children with diverse needs. This sentiment was echoed by an SLP, who noted, “*The mechanics of this tool are accessible and would work well for children with different abilities.*”

In professional settings, such as SLT clinics, the mechanics of educational tools are equally crucial. Jesus et al. (2019) observed that user-friendly designs, such as those in the T2T app, help therapists conduct effective sessions with minimal preparation, focusing more on direct interaction with children. Similarly, Saunders and Wong (2020) emphasise that instructional materials should complement teaching and use simple, accessible mechanics to reduce cognitive load. One SLP reflected, “*Tools like SALTT-CITY would make it easier for us to interact with children and keep them engaged, using minimal planning.*”

While digital elements can enhance gameplay, Qiu (2024) cautions that their mechanics can sometimes disrupt traditional play patterns and reduce valuable parent-child interaction. One caregiver noted, “*It’s nice to have a digital aspect, but we also need the face-to-face engagement to such quality time more meaningful.*” This feedback highlights the need for a balance between traditional and digital play elements.

5.2c Subtheme 3: Audience and Engagement

Effective engagement, whether in a clinic, classroom, or home setting, requires a deep understanding of how to capture and maintain attention. Educators must tailor their approach to diverse learning styles and employ strategies to sustain focus (Arifadah et al., 2020).

Similarly, toy designers must create products that are appealing and engaging for different children. One caregiver highlighted the immediate appeal of SALTT-CITY, noting, “*The fact*

that it has an app, it grabs the child's attention immediately.” However, as with any tool, maintaining attention over time remains a challenge. As another caregiver pointed out, *“If the game takes too long, young children start losing interest.”*

Family-centred approaches emphasise the importance of involving parents in children's learning and play (Law et al., 2019). SALT-CITY fosters this inclusion by offering an interactive environment that engages both children and adults. One caregiver appreciated this aspect, stating, *“I liked that the children could play together, but also the adults.”* This is especially important with the increasing focus on family-centred approaches in health and social services, where parental involvement is recognised as crucial for a child's development (Law et al., 2019). In this environment, toys must not only engage children but also facilitate interaction with parents, reinforcing the family's role in the child's linguistic growth.

When designing board games for language therapy, a balance between complexity and simplicity is essential. Observations from the evaluation workshops highlight this need for balance: *“It should be noted that the child's attention was fleeting at times, and she had to be redirected to the game on multiple occasions.”* This emphasises the importance of designing games that are not only engaging but also adaptable to various attention spans and developmental stages. Customisable gameplay, including tiered rules and adaptable components (as found in the pre-production version of “SALT-CITY”), can cater to different skill levels and developmental needs.

5.2d Subtheme 4: Character and Theme

The current study is rooted in the previously mentioned 'SPEECHIE' project, which utilised an animatronic penguin as its therapeutic delivery channel. To maintain a consistent theme across both studies, it was decided that incorporating various animated penguins into the game and virtual application would be appropriate.

The SALTT-CITY tool therefore utilises animated penguin characters in its design to appeal to its younger potential users. Character design, particularly for younger audiences, plays a crucial role in capturing attention and enhancing learning experiences. Features like larger eyes and rounder faces can make characters more appealing (Carter et al., 2016). Feedback from caregivers and observations during the evaluation sessions support this, with one caregiver noting, *“My son really liked the penguins!”* and another observing that, *“Both girls were mostly attracted to the game because of the penguins, they’re their favourite animals.”* One caregiver also remarked, *“Love the colours and penguins.”* Thematic choices, such as using animal protagonists and prosocial themes, can significantly impact children's engagement and development (Hejazi, 2023; Larsen, Lee, & Ganea, 2018).

However, some caregivers suggested that integrating the penguin’s environment into the gameplay could further enhance engagement: *“It would be nicer to match the games to the ambient where the penguin of the respective player is.”* and *“Maybe use a different animal related to Malta”*. This feedback suggests that creating more contextually and culturally immersive environments for the characters could deepen the connection children feel with the game.

5.2e Subtheme 5: User Experience and Feedback

User feedback is crucial in designing effective and engaging toys, much like in software and game development. Since user feedback is critical for improving products by identifying needs and assessing satisfaction (Pagano & Brügge, 2013; Fotrousi et al., 2014), it plays a key role in ensuring that the final product meets both functionality and enjoyment requirements. In game development, phases like prototyping, beta testing, and postproduction focus on evaluating and refining user experience (Bernhaupt, 2015). This iterative process

can be effectively applied to toy design as well, ensuring that the final product is not only functional but also engaging for children.

Feedback from the evaluation sessions highlighted areas for improvement. For example, one SLP suggested, *“To add the points onto the app, to have one path instead of 4 in order to be less time consuming, it's a very fun game and very stimulating.”* Another SLP recommended, *“To combine the areas on the board to make it one complete path,”* aiming to streamline gameplay and reduce complexity. This feedback was incorporated into the pre-production design. Additionally, one SLP emphasised the importance of reducing playtime, stating, *“Decrease playing time. A 40-minute game is too long for most 5-8-year-olds (especially those with additional challenges).”*

The Quality of Experience (QoE) is a valuable indicator of how well a toy resonates with users. High QoE values reflect a well-designed toy that meets user needs and provides a delightful experience, while low values signal areas for improvement (Le Callet et al., 2012; Fotrousi et al., 2018). Therefore, given SALTT-CITY’s moderate QoE, continuous seeking and integration of user feedback would be essential to lead to higher satisfaction and better outcomes for the children who use the tool.

5.2f Subtheme 6: Marketing and Pricing

Effective pricing and marketing strategies are essential for the successful implementation of SALTT-CITY in healthcare clinics and classrooms. The pricing strategy must be designed to appeal to both professionals and at-home users, ensuring that the product remains accessible while maintaining its perceived value. Transparent and relevant pricing, along with strategic marketing efforts, significantly influences product acceptance (Ali & Anwar, 2021).

Additionally, an understanding of buyer behaviour and the integration of customer feedback

throughout the product development process are critical, particularly in healthcare settings where products directly impact patient outcomes (Ballanger, 1996).

The need for a balanced pricing approach was emphasised by caregivers during the evaluation. One caregiver noted, *“It requires a lot of money to be able to 'publish' this and put it on the market, so it cannot be put at a high price, but at the same time if it is very expensive people will not buy it even though it is fun to play.”* This feedback highlights the necessity of developing a pricing strategy that reflects the value of the product while considering the financial constraints of potential users.

As consumers increasingly turn to various channels for information, it is necessary for marketers to ensure that pricing strategies are not only transparent but also relevant and engaging. Positive electronic word-of-mouth can enhance product acceptance while addressing negative feedback promptly serves to mitigate potential harm to the product’s reputation (Ali & Anwar, 2021). In healthcare, incorporating customer feedback from both end-users and healthcare professionals is crucial in ensuring that the product aligns with the specific needs of the clinical environment.

5.2g Subtheme 7: Understanding and Adopting New Technologies

The integration of new technology alongside pre-existing practices in healthcare, particularly in SLT, is a complex yet crucial process that requires careful consideration of various factors. As SLPs gain access to an expanding array of technological resources, including electronic devices, software, and internet-based tools, these innovations have the potential to significantly enhance clinical practice by improving data collection, documentation, assessment, and treatment implementation (Pierrakeas et al., 2006; Garrett, 2013; Chen et al., 2016). However, while some of these technologies can transform practice, many lack empirical support and may not align with evidence-based principles, raising concerns about

their widespread adoption (Furlong et al., 2018). The success of these technologies in clinical settings is often contingent upon their perceived usefulness and ease of use, as highlighted by early technology acceptance models (TAMs) developed by Davis et al. (1989). These models suggest that the likelihood of adopting a new technology is heavily influenced by the belief that it will improve productivity and efficiency and that it will be easy to use (Albudoor & Peña, 2021).

In evaluation workshops of the SALTT-CITY tool, several SLPs expressed concerns and suggestions regarding the tool's integration. One SLP noted, "*I wish we could have the ability to use it without the app (due to potential connectivity issues in district clinics).*" This emphasises the importance of flexibility in the tool's design to address practical barriers like network reliability. Another SLP suggested simplifying the process, stating, "*I would simplify the process by removing the app and having the instructions on flashcards,*" reflecting concerns over the complexity of the design and the need for a more straightforward approach. Despite these challenges, many SLPs recognised the potential for SALTT-CITY to enhance therapy, with one SLP commenting, "*I do believe it could augment therapy in terms of variety and interest.*" The customisable features of the game, such as different levels of difficulty, were also appreciated, as one SLP remarked, "*The colours, the characters, they're really interesting and I liked that it wasn't like the normal sorting or labelling.*" This feedback highlights the importance of a technology's ability to engage users in ways that are both enjoyable and beneficial to therapy.

Furthermore, challenges to technology adoption extend beyond technical barriers to include individual factors, such as clinician familiarity and comfort with the technology, as well as system-level issues related to healthcare policies and resources. Technical barriers may include network reliability and issues with hardware or software, while individual barriers

often stem from a clinician's prior experience and training in using technological tools. The slow adoption of mobile health (mHealth) technologies in healthcare, as compared to other sectors, further emphasises the complexity of these issues and the need for thoughtful integration of technology into clinical workflows (Zakerabasali et al., 2021).

5.2h Subtheme 8: Educational Potential and Purpose

The potential for collaboration between education and SLT is a promising avenue for enhancing language support across different contexts. Both fields are committed to improving language skills, albeit with distinct focuses. While SLPs target specific language difficulties, educators aim for broader language proficiency, creating an overlap that presents opportunities for collaboration and resource sharing.

Zhang and Hasim's (2023) study on gamification highlights the potential of game-based learning in enhancing language skills in educational settings. Such approaches could be adapted for SLT, making interventions more engaging and motivating for children with Speech, Language, and Communication Needs (SLCN). Feedback from caregivers who were also educators emphasised the versatility of this approach: *“It could be introduced in literacy classes where students are practising without noticing; it could also be used in complementary classes, CCP, Prince Trust, and also as a means to assess speaking.”* Another participant noted the potential for cross-curricular use: *“It could be extended to other subject areas across the curriculum.”* These observations underscore the adaptability of game-based learning in both educational and therapeutic settings.

A key challenge, as identified by Mathers et al. (2024), is the lack of clear guidelines for collaboration between SLPs and teachers. This gap could be addressed by developing frameworks that guide the adaptation of educational materials, such as gamified resources, for therapeutic use. Such frameworks would need to account for the specific language targets

of SLT and how these can be integrated into game structures suitable for use in mainstream classrooms.

Moreover, the role of learning support educators (LSEs) in this process is vital. Mathers et al. (2024) emphasise the importance of including LSEs in collaborative efforts, as they often work closely with children and can effectively implement language-rich activities. Therefore, any framework for sharing materials should consider the role of LSEs, offering guidance on how they can effectively utilize these resources.

5.2i Subtheme 9: App Functionality and Data Handling

The companion app presents significant potential for innovative healthcare applications by providing data-driven insights. By capturing detailed information about gameplay, including accuracy and error patterns, the app can generate valuable patient-generated health data (PGHD) (Pulimamidi, 2024). This data could be instrumental in detecting difficulties across various areas of language, allowing for earlier identification of challenges and more targeted interventions.

In addition, the app's capacity to deliver personalised experiences, as highlighted by Omaghomi et al. (2024), can enhance user engagement and improve adherence to therapeutic regimens. Feedback from SLPs emphasises the importance of customisation, with one suggesting, *“including profiles for clients which can be accessed by carers at home. SLPs can set goals for the client on the app to facilitate carryover at home. Data related to performance (at home and during the session) could be stored on profiles on the app.”*

However, some concerns were raised about the potential complexity and impact on workflow. One SLP noted, *“I personally would not like that because it really takes away from the... fun of it. It becomes much more complicated. If it's integrated as something that you have to do, it's like you can't get away from it.”* These varying perspectives highlight the need to balance

functionality with usability to ensure the app remains an effective and engaging tool, rather than an added burden.

5.2j Subtheme 10: Carry-Over and Follow-Up

The board game and companion app demonstrate considerable potential for enhancing language therapy outcomes by promoting therapeutic carryover and supporting follow-up practice at home. By offering structured exercises, immediate feedback, and opportunities for consistent practice, the app can serve as a valuable supplement to in-person therapy sessions, thereby improving overall therapy efficacy. This aligns with the increasing recognition of mobile health applications as powerful tools for enhancing patient engagement and improving health outcomes (Okolo et al., 2024).

A significant challenge in language therapy is ensuring that patients maintain consistent practice outside the clinical setting. The app addresses this challenge by providing engaging, motivating activities that encourage patients to regularly practice new skills, as noted by Orehovački et al. (2017). As one SLP suggested, *“It would augment therapy, rather than solve, I think. It would make it more interesting and varied. It would also help carryover if parents purchase it too.”* Through structured exercises and real-time feedback, the app helps patients not only practice these skills but also generalise them to real-world contexts.

Additionally, the ability to access therapy-like activities at home can increase overall therapy time without requiring additional in-person sessions. One caregiver reflected, *“It used to be very difficult for me to try and get my son to sit and work on the carryover activities the SLP provided. If I had had something like this, I could have potentially instructed my child in a better way.”*

5.2k Subtheme 11: User-Centric Adaptations

Person-centred care (PCC) is a cornerstone of SLT, emphasising personalised interventions that address individual needs and preferences (DiLollo & Favreau, 2010; Forsgren et al., 2022; Bellon-Harn et al., 2017; Mahomed-Asmail et al., 2023). By fostering a collaborative partnership built on mutual respect and shared decision-making, SLPs can effectively implement PCC (Forsgren et al., 2022). Adaptable tools are essential to this approach, as they allow for the customisation of therapy to address individual strengths, weaknesses, and preferences (Bellon-Harn et al., 2017). By aligning with the client's perspective and incorporating their input, SLPs can enhance engagement, motivation, and ultimately, therapeutic outcomes (Mahomed-Asmail et al., 2023).

The tool's multiple difficulty levels and customisation options exemplify this adaptability.

This flexibility was appreciated during evaluation sessions, where a caregiver remarked, *"I liked the fact that she was able to play the same game as an older child but the questions were tailored for their ages respectively."* These features ensure that children of varying developmental abilities can meaningfully engage, enhancing inclusivity.

While the benefits of adaptable tools in promoting PCC are evident, balancing the demands of individualisation with the pressures of caseload management is a significant challenge for SLPs. Allocating sufficient time for comprehensive client assessments, developing individualised treatment plans, and monitoring progress can be demanding. Additionally, the need to stay updated on the latest evidence-based practices and adapt tools accordingly can further strain resources. As Binns et al. (2022) note, prioritising clients based on their needs, delegating tasks, and utilising technology to streamline administrative processes may help address these challenges.

Furthermore, the diverse needs of clients, particularly those from multilingual or multicultural backgrounds, may necessitate additional resources and training to ensure effective adaptation of therapeutic tools. This aligns with the findings of Mahomed-Asmail et al. (2023) regarding the challenges posed by diverse client populations. Nevertheless, the potential for improved client outcomes and satisfaction through a personalised approach makes the pursuit of adaptable tools a worthwhile endeavour.

5.21 Subtheme 12: Language and Bilingual Elements

Bilingual materials, as highlighted by Li (2023), offer significant potential in supporting the language development of bilingual children with DLD. These materials reflect the child's linguistic reality, fostering cultural identity, and providing valuable insights into strengths and weaknesses across both languages (Dam et al., 2020; Nair et al., 2023). One caregiver remarked on the utility of such tools, noting that children *“can use it in both Maltese and English and also that they will learn something from the game.”*

Given that the SALTT-CITY tool was designed with the bilingual context of Malta in mind, it offers a framework for addressing the unique challenges faced by local bilingual children with language difficulties. Bilingual materials acknowledge the child's dual-language environment, avoiding the artificial separation of languages, which can hinder development. Instead, they allow clinicians to leverage cross-language transfer, where gains in one language benefit the other, a phenomenon observed in typical bilingual children and potentially applicable to those with DLD (Dam et al., 2020; Nair et al., 2023).

Beyond linguistic benefits, bilingual materials enhance cultural relevance and engagement by incorporating familiar words, phrases, and contexts from both languages (Song et.al., 2022). This approach promotes a positive attitude towards language learning and improves motivation, ultimately fostering better therapeutic outcomes. Additionally, comparing

performance across different linguistic contexts allows clinicians to identify specific areas of need and tailor interventions accordingly.

The potential of the SALTT-CITY tool was highlighted during evaluation workshops.

Austrian children fluent in English, German, and Russian played the game in English, with one child translating instructions into German for his younger sister. Their Maltese-speaking nanny observed its applicability as a learning base for French, which the children were studying. Similarly, a Hungarian mother noted its utility in contexts where English is not widely taught. Another session demonstrated the tool's flexibility: a child began playing in Maltese to accommodate his grandmother but later switched to English, requiring the moderator to translate. This feature has since been incorporated into the pre-production version of the companion app, enabling language changes (between Maltese and English) during play without requiring spontaneous translation.

5.2m Subtheme 13: Concerns and Negative Views

While digital gamification shows significant promise in SLT, its adoption faces notable challenges, including therapist concerns, user apprehension, and broader systemic issues. One recurring issue is the potential for misuse of personal data, as highlighted by De Cremer et al. (2017). Users may feel apprehensive about sharing sensitive information, such as patterns of difficulty or personal details, with technology companies, particularly given the increasing prevalence of data breaches and privacy violations.

Another barrier is the perceived complexity and technical requirements of digital gamification tools, which can deter therapists and users alike. According to Gustafsson and Edberg (2017), technological literacy significantly impacts receptivity to such innovations. Older SLPs or individuals with additional needs may find the learning curve steep and frustrating, leading to resistance.

Concerns about accessibility and usability for diverse populations also arise. For example, one SLP commented, “*Could prove difficult to use with those with limited fine motors and clients with aggressive behaviour,*” a potential issue stemming from the smaller physical pieces included in the board game or the frustration of not winning the game. Another SLP suggested practical adaptations, such as providing advice and a communication board to navigate using partner-assisted scanning. Similarly, another professional proposed simplifying cognitive and usability demands by “*removing the app and having the instructions on flashcards and presenting fewer items at any given time.*” It should be noted that the majority of these concerns arose from older participants, who remain more confident in traditional therapy methods, as is also reflected in the rationale presented in section 5.8. Notably, these opinions may be influenced by researcher bias, and such findings should be interpreted with caution.

Continually, questions about the reliability and effectiveness of digital gamification persist. While emerging evidence suggests positive outcomes, more robust studies are needed to address scepticism about whether gamified resources can adequately address complex speech and language difficulties (Gentry et al., 2019; Melcarne et al., 2023).

5.2n Subtheme 14: Cultural Elements

The provision of culturally appropriate therapy materials is essential for effective intervention, particularly when working with culturally and linguistically diverse populations. Culturally relevant content enhances client engagement, builds rapport, and improves treatment outcomes by respecting clients' values and beliefs, which significantly influences their perceptions of therapy (McLeod et al., 2017). Ignoring these factors risks miscommunication and undermines the quality of care.

Moreover, the use of culturally appropriate materials can help to reduce power imbalances between therapists and clients. By demonstrating an understanding and respect for the client's cultural background, SLPs can build trust and create a more collaborative therapeutic relationship. This is particularly important when working with marginalised or underserved populations (Stubbe, 2020). As one SLP remarked during the evaluation, *“It would be a shame to lose the Maltese element as it is something that makes the game unique, and since it is a bilingual game that includes Maltese as one of the main languages, I think it would make it stand out.”*

Feedback from caregivers echoed this sentiment, suggesting that the tool could be *“more Maltese-centric”* or include culturally iconic features, such as *“the luzzu”* (a known Maltese icon) or activities linked to popular locations like *“Ta’ Qali National Park”* (a location in Malta). Suggestions also included replacing the penguins with *“another animal typical of Malta.”*

As Verdon et al. (2015) note, a *“one-size-fits-all”* approach is inadequate. Cultural awareness is fundamental to providing effective care, as culture significantly influences an individual’s values, beliefs, and perceptions of health and therapeutic practices. By incorporating culturally relevant materials, therapists can demonstrate their commitment to providing culturally responsive care while creating stronger connections and fostering improved outcomes.

5.3 Conclusion

This chapter delved into the qualitative input gathered across the four phases of data collection (barring the transcription of the case study session, which will be explored in

Chapter 7). Hence, shedding light on the participants' perspectives and experiences regarding the SALTT-CITY prototype tools' design, functionality, and potential in SLT. The findings revealed the tool's main strengths as its engaging design, bilingual abilities, its flexible nature in terms of presentation and adaptability across various settings. Additionally, areas for further improvement were identified, namely, the need for streamlined gameplay mechanics, inclusion of culturally relevant content, and adjustments needed for its accessible integration into the clinical workflow (i.e.inclusion of data collection abilities, facilitation of language switching in the app and use of better materials for the physical pieces). Therefore, these findings served as a basis for further inquiry into the SALTT-CITY BETA Prototype and supplied the research team's design engineers with data to inform the next iteration of the tool. Importantly, these findings do not solely serve as guidelines for this project's team, they also provide valuable insights into the expectations for developing an inclusive, user-centred gamified tool which will align with both professional and familial needs.

The next chapter will build upon this discussion by presenting detailed statistical analyses of the quantitative data gathered in parallel with the qualitative data presented beforehand, allowing for a deeper exploration of the trends that emerged from these findings. Through this dual approach, this study aims to present a holistic evaluation of the SALTT-CITY BETA prototype, thus contributing to the field's understanding of how gamified and connected technologies based on a user-centred design can support language therapy.

Chapter 6: Statistical Analysis of Phases 2 and 3 of Data Collection

6.1 Introduction to the quantitative analysis concerning this study

In mixed-methods research, quantitative analysis plays a crucial role in complementing qualitative insights by providing quantifiable evidence that strengthens the overall findings, through statistical means. While qualitative data offers rich, detailed descriptions of user experiences, the statistical analysis adds an empirical dimension, allowing for the detection of patterns, trends, and relationships that may not be immediately apparent from qualitative data alone (Guetterman et.al., 2015).

In the context of user-experience methodologies, statistical analysis enables the researcher to move beyond anecdotal or subjective perceptions by systematically comparing different user groups and their interactions with a given system or process (Law et.al., 2014). For example, comparing performance scores and other measurable aspects of user interaction, as in this study, offers an objective lens through which to assess differences between groups such as caregivers and speech-language pathologists (SLPs).

Furthermore, statistical analysis is essential for validating qualitative findings by providing a level of rigour and reproducibility that helps ensure the results are generalizable. By combining subjective and objective data points, it not only enhances the credibility of the research but also provides a more holistic understanding of user experiences (Johnson et.al., 2020). This balanced approach leads to richer, more actionable insights and supports the development of interventions that are grounded in both user perceptions and measurable outcomes.

6.2. Descriptive Statistics

Descriptive statistics provides a foundational means of summarising and organising data to facilitate its interpretation. It is an apt way to present data in a clear, manageable way, allowing for the observation of patterns and trends without making formal inferences

(Cooksey, 2020). The main descriptive analysis techniques employed in this section of the study focus on describing the key features of the dataset through distribution and central tendency summarisations.

One of the primary components of descriptive statistics is the concept of distribution, which refers to how data points are spread or arranged within a dataset. Understanding the distribution allows for the determination of the range of values in the dataset, the frequency of each value or group of values, and whether the data is skewed or follows a normal pattern. Visual tools like frequency distribution charts are often employed to help illustrate the spread of data and identify potential patterns or anomalies (Forbes et.al., 2011).

Alongside distribution, measures of central tendency play a key role in summarising data by identifying the most representative value within the dataset. The three most common measures of central tendency are the mean, median, and mode. The mean provides the arithmetic average of the dataset, the median identifies the middle value when the data is ordered, and the mode refers to the most frequently occurring value. These measures help to condense a large amount of data into a single, interpretable figure that reflects the central point around which the data clusters (Manikandan, 2011).

By examining both distribution and central tendency, a clearer understanding of the overall structure of the data can be obtained, which serves as the foundation for further analysis and interpretation. This is especially important in ensuring that subsequent analytical methods, whether parametric or non-parametric, are applied appropriately based on the underlying characteristics of the dataset.

a. Data from the Questionnaire given to the Caregivers of Typically Developing Children during BETA-Prototype Evaluations.

Table 2

Distribution of TD Children based on specific variables

Variable	n	Mean	SD	Minimum	Maximum
<i>Age</i>	48	6.57	11.16	5.01	8.11

In **Table 2**, the descriptive statistics presented, focus on the age of the typically-developing (TD) child participants from the BETA-Prototype Evaluation held during Phase 2 of data collection. The sample consists of 48 children, with a mean age of 6.57 years ($SD = 11.16$), ranging from a minimum of 5.01 years to a maximum of 8.11 years.

Table 3

Distribution of TD Children based on specific variables

Variable	Group	Frequency	Percentage
<i>Gender</i>	Female	27	56.3
	Male	21	43.8
<i>School Type</i>	Church	23	47.9
	Private	7	14.6
	Public	18	37.5
<i>Geographic Location</i>	Malta Center	24	50
	Malta North	7	14.6
	Malta South	17	35.4

<i>Language Background</i>	Both, in approximately balanced proportions	19	39.6
	Predominantly English	12	25
	Predominantly Maltese	17	35.4
<i>Language Exposure</i>	Both, in approximately balanced proportions	13	27.1
	Predominantly English	9	18.8
	Predominantly Maltese	26	54.2
<i>Game Language</i>	English	27	56.3
	Maltese	21	43.8
<i>Level of Difficulty</i>	Level 1	10	20.8
	Level 2	14	29.2
	Level 3	10	20.8
	Level 4	14	29.2

Table 3 further elaborates on the distribution of TD children across several demographic variables. In terms of gender, 56.3% of the children are female ($n = 27$), while 43.8% are male ($n = 21$). The sample is also divided by school type, with 47.9% attending church schools ($n = 23$), 14.6% in private schools ($n = 7$), and 37.5% in public schools ($n = 18$). Geographically, 50% of the children are from Malta Center ($n = 24$), while 14.6% and 35.4% come from Malta North ($n = 7$) and Malta South ($n = 17$), respectively.

Regarding language background, 39.6% of the children ($n = 19$) have an approximately balanced use of both English and Maltese, 25% ($n = 12$) predominantly speak English, and 35.4% ($n = 17$) predominantly speak Maltese. In terms of language exposure, 54.2% of the children ($n = 26$) are exposed primarily to Maltese, while 27.1% ($n = 13$) experience balanced

exposure and 18.8% (n = 9) are exposed predominantly to English. The distribution by game language reveals that 56.3% of the children (n = 27) played the game in English, and 43.8% (n = 21) played it in Maltese. Finally, the children were distributed evenly across difficulty levels, with each level being chosen by approximately 20-30% of the sample.

Table 4

Central tendency indicators of TD Children based on specific variables

Variable	n	Mean	SD	Median	Mode
<i>Effectiveness of the games in making language learning fun for your child</i>	48	4.52	.618	5	5
<i>Efficiency of the activities in gaining the children's attention when playing the game</i>	48	5	.512	5	5

Table 4 provides central tendency measures for two variables, scored according to the opinions of the TD children's caregivers. The mean score for the *effectiveness of games in making language learning enjoyable* is $M = 4.52$ ($SD = 0.618$), with a median and mode of 5. The *efficiency of activities in gaining children's attention* had a mean score of $M = 5.00$ ($SD = 0.512$), and both the median and mode were also 5.

b. Data from the Questionnaire given to SLPs during BETA-Prototype Evaluation

Table 5

Descriptive statistics - SLP

	Perceived effectiveness of the games in targeting your therapeutic strategies	Perceived efficiency of the specific activities in enabling you to reach target goals	Perceived efficiency of the activities in gaining children's compliance	Perceived effectiveness of the board game to guide the children in carrying out therapeutic tasks, when compared to traditional therapeutic materials e.g. flashcards	Perceived satisfaction of using the board game in reaching your goals when compared to traditional therapeutic activities
N	10	10	10	10	10
Mean	3.90	3.70	3.60	4.10	3.60
Median	4.00	4.00	4.00	4.00	4.00
Mode	4	4	4	4	4
Std. Deviation	.568	.483	.843	.738	1.350
Variance	.322	.233	.711	.544	1.822
Range	2	1	3	2	4
Minimum	3	3	2	3	1
Maximum	5	4	5	5	5

In **Table 5**, the opinions presented by clinicians during BETA-Prototype evaluations during Phase 3 of data collection are summed up. For "*perceived effectiveness of the games in targeting therapeutic strategies*" the mean score is 3.90 (SD = 0.568), and the median and mode are 4. For the "*perceived efficiency of the specific activities in enabling the therapist to reach target goals*," the mean is 3.70 (SD = 0.483), with a median and mode of 4. Regarding the "*perceived efficiency of the activities in gaining children's compliance*," the mean is 3.60 (SD = 0.843), while the median and mode are again 4.

The "*perceived effectiveness of the board game to guide the children in carrying out therapeutic tasks compared to traditional materials*" has a slightly higher mean of 4.10 (SD = 0.738). The median and mode are both 4, indicating consistency in responses. Finally, the "*perceived satisfaction of using the board game compared to traditional therapeutic activities*" has the lowest mean score of 3.60 (SD = 1.350), with a median and mode of 4.

c. Data from the Observation Form for Typically Developing Children (Filled in by Observing Researcher)

Table 6

Distribution of TD Children based on specific variables

Variable	Category	Frequency	Percentage
<i>Game Duration</i>	30 minutes	7	14
	35 minutes	7	14
	40 minutes	14	28
	45 minutes	22	44
<i>Game Completion</i>	No	2	4
	Yes	48	96
<i>Replay Activity 1: Categories</i>	0 times	40	80
	1 time	7	14
	2-5 times	3	6

<i>Replay Activity 2: Odd One Out</i>	0 times	40	80
	1 time	8	16
	More than 5 times	2	4
<i>Replay Activity 3: Matching Pairs</i>	0 times	44	88
	1 time	5	10
	2-5 times	1	2
<i>Replay Activity 4: Let's Guess</i>	0 times	32	64
	1 time	16	32
	2-5 times	2	4
<i>Replay Activity 5: Possessive Pronouns</i>	0 times	47	94
	1 time	3	6
<i>Replay Activity 6: Adjectives</i>	0 times	45	90
	1 time	4	8
	2-5 times	1	2
<i>Replay Activity 7: Actions</i>	0 times	40	80
	1 time	8	16
	2-5 times	2	3

<i>Replay Activity 8: Describe</i>	0 times	33	66
	1 time	14	28
	2-5 times	2	4
	More than 5 times	1	2

Table 6 outlines the game duration and activity replay frequencies for TD children as noted by the observing researcher during the evaluation sessions. Most children (44%, $n = 22$) played the game for 45 minutes, followed by 40 minutes (28%, $n = 14$), 35 minutes (14%, $n = 7$), and 30 minutes (14%, $n = 7$). Game completion was achieved by 96% of the children ($n = 48$), with only 2 children (4%) not completing the game.

The replay frequencies for various activities are also detailed. For "*Activity 1: Categories*", 80% of the children ($n = 40$) did not replay the activity, while 14% ($n = 7$) replayed it once and 6% ($n = 3$) replayed it between 2-5 times. Similar patterns are observed for "*Activity 2: Odd One Out*", with 80% of children not replaying it, 16% replaying it once, and 4% replaying it more than 5 times. For "*Activity 3: Matching Pairs*", 88% did not replay, while 10% replayed once, and 2% replayed 2-5 times.

For "*Activity 4: Let's Guess*", 64% of children did not replay, while 32% replayed once, and 4% replayed 2-5 times. For "*Activity 5: Possessive Pronouns*", 94% did not replay the activity, and only 6% replayed it once. Similar trends are observed for "*Activity 6: Adjectives*" (90% no replay), "*Activity 7: Actions*" (80% no replay), and "*Activity 8: Describe*" (66% no replay), though more children chose to replay "*Describe*" (28% replayed once, 4% 2-5 times, and 2% more than 5 times).

6.3 Non-parametric testing

Parametric tests inherently rely on assumptions such as normality of the data distribution and homogeneity of variances across groups. However, with small and unequal sample sizes, these assumptions are often violated, increasing the likelihood of inaccurate results and potentially compromising the validity of statistical inferences. Due to the nature of the dataset in question, which is characterized by unequal and small sample sizes, parametric statistical methods were deemed unsuitable for this analysis (Yu, 2012).

Given the above-mentioned characteristics of the dataset, non-parametric testing was chosen for this analysis. Before moving forward with non-parametric testing, the caregiver questionnaire sample pool required equalisation when compared to the SLP questionnaire sample pool. Therefore, the original TD caregiver questionnaire sample was divided by the different years in the evaluated age range (ages 5, 6, 7 and 8) to maintain a representative sample. Following that, 5 participants from each age were randomly chosen through the use of randomisation software and then used during non-parametric testing (Xiang, 2015).

Non-parametric tests, do not require these strict assumptions. Instead, they utilize the ranking of data, which allows for greater flexibility in handling smaller and unequal samples. This approach enhances the robustness of the analysis and reduces the risk of Type I and Type II errors that could arise from the improper application of parametric techniques (Nahm, 2016).

In this case, non-parametric methods were applied to compare various aspects of user experiences between two key groups: caregivers and speech-language pathologists (SLPs). Additionally, the analysis includes a comparison of performance scores given by caregivers and those scored by the observing researcher using observation forms. This approach promoted a more holistic understanding of the gathered user experience profiles by integrating both subjective and observational perspectives.

The main aim of using non-parametric methods, was to enhance the reliability and validity of the analysis, reducing the risk of errors due to unmet parametric assumptions while capturing a comprehensive view of the user experiences.

a. Board Game Features

Table 7

U Mann Whitney comparison between CG and SLP considering the board game features

Board Game Features	Group	N	Mean Rank	U	Z	p-value
<i>Effectiveness of the design of the board game in attracting the child's attention</i>	CG	20	18.43	45.500	-	.002
	SLP	10	9.65			
<i>Effectiveness of the reward system and incentives used in the board game</i>	CG	20	20.10	8.000	-	.000
	SLP	10	6.30			
<i>Satisfaction of the parent/guardian in view of the child's progress</i>	CG	20	19.65	17.000	-	.000
	SLP	10	7.20			
<i>Perceived satisfaction of the child using this concept as a learning tool</i>	CG	20	19.68	16.500	-	.000
	SLP	10	7.15			

<i>Satisfaction of using the companion app</i>	CG	20	19.83	13.500	-	.000
					4.261	
	SLP	10	6.85			

The results in **Table 7** compare the board game features between two groups CG and SLP, using the U Mann-Whitney test. The results demonstrate significant differences in several aspects. For the "*effectiveness of the design of the board game in attracting the child's attention*", CG had a higher mean rank (18.43) compared to SLP (9.65), with a significant U-value of 45.500 ($Z = -3.079$, $p = .002$). This suggests that CG found the design more effective in capturing the child's attention.

Additionally, the "*effectiveness of the reward system and incentives*" yielded an even larger difference between CG (mean rank = 20.10) and SLP (mean rank = 6.30), $U = 8.000$, $Z = -4.362$, $p < .001$. This significant result implies that CG viewed the reward system more positively.

Similarly, other aspects such as "*satisfaction of the parent/guardian in view of the child's progress*" ($U = 17.000$, $Z = -4.132$, $p < .001$) and "*perceived satisfaction of the child using the concept as a learning tool*" ($U = 16.500$, $Z = -4.155$, $p < .001$) showed significant differences, with CG reporting higher levels of satisfaction.

The "*satisfaction of using the companion app*" also differed significantly, with CG having a mean rank of 19.83, indicating greater satisfaction compared to SLP (mean rank = 6.85), $U = 13.500$, $Z = -4.261$, $p < .001$.

b. Game Use

Table 8

U Mann Whitney Comparison between CG and SLP considering the game use

Game Use	Group	N	Mean Rank	U	Z	p-value
How often would you use the board game with your child if this was available at home? (CG) vs If the board game was available at your clinic, how often would you use the board game during therapy? (SLP)	CG	20	17.68	56.600	-2.045	.041
	SLP	10	11.15			

Table 8 shows the comparison between CG and SLP regarding game usage frequency. The mean ranks reveal a significant difference, with CG having a mean rank of 17.68 and SLP having a mean rank of 11.15 (U = 56.600, Z = -2.045, p = .041). This indicates that CG participants were more likely to use the board game frequently compared to SLP participants.

c. Board Game Properties

Table 9

U Mann Whitney comparison between CG and SLP considering the board game properties

Board Game Properties	Group	N	Mean Rank	U	Z	p-value
<i>Board Game Quality</i>	CG	20	16.25	85.000	-.777	.437
	SLP	10	14.00			
<i>User-Friendliness</i>	CG	20	17.65	57.000	-2.068	.039
	SLP	10	11.20			

<i>Time Efficiency</i>	CG	20	19.00	30.000	-3.217	.001
	SLP	10	8.50			
<i>Strategic Value</i>	CG	20	18.10	48.000	-2.608	.009
	SLP	10	10.30			
<i>Player Interaction</i>	CG	20	16.70	76.000	-1.365	.172
	SLP	10	13.10			
<i>Fun Factor</i>	CG	20	16.08	89.500	-.627	.531
	SLP	10	14.35			
<i>Satisfaction</i>	CG	20	17.30	64.000	-1.966	.049
	SLP	10	11.90			
<i>Directions for use</i>	CG	20	17.75	55.000	-2.174	.030
	SLP	10	11.00			
<i>Visual Design</i>	CG	20	15.43	98.500	-.083	.934
	SLP	10	15.65			

In **Table 9**, the Mann-Whitney U test compares the perceived board game properties between CG and SLP. There was no significant difference in the perceived "*board game quality*" (U = 85.000, p = .437).

However, "*user-friendliness*" demonstrated a significant difference, with CG having a higher mean rank (17.65) than SLP (11.20), U = 57.000, Z = -2.068, p = .039.

Furthermore, the attribute "*time efficiency*" had a large and significant difference (CG = 19.00, SLP = 8.50, U = 30.000, Z = -3.217, p = .001), suggesting that CG found the game to be more time-efficient. "*Strategic value*" also differed significantly, with CG reporting higher satisfaction (U = 48.000, Z = -2.608, p = .009). "*Player interaction*," "*fun factor*," and "*visual design*" did not show significant differences between the groups. The "*satisfaction*" (U = 64.000, Z = -1.966, p = .049) and "*directions for use*" (U = 55.000, Z = -2.174, p = .030) attributes, however, yielded significant differences, favouring CG.

d. Board Game Mechanics

Table 10

*Crosstabulation - Group * Do you feel the game mechanics are easy to follow?*

			Do you feel the game mechanics are easy to follow?		
			Yes	No	Total
Group	CG	Count	20	0	20
		Expected Count	18.0	2.0	20.0
	SLP	Count	7	3	10
		Expected Count	9.0	1.0	10.0
Total		Count	27	3	30
		Expected Count	27.0	3.0	30.0

Table 11

Chi-Square Tests

	Asymptotic Significance Value df (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)

Pearson Chi-Square	6.667 ^a 1	.010	
Continuity Correction ^b	3.750 1	.053	
Likelihood Ratio	7.288 1	.007	
Fisher's Exact Test		.030	.030
Linear-by-Linear Association	6.444 1	.011	
N of Valid Cases	30		

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.00.

b. Computed only for a 2x2 table

Table 10 presents a crosstabulation comparing whether participants felt the game mechanics were easy to follow. CG reported that all 20 participants found the game mechanics easy to follow, whereas, in the SLP group, 7 reported ease of use while 3 did not. The Pearson Chi-Square test presented in *Table 5* was significant ($\chi^2 = 6.667$, $p = .010$), indicating that the ease of following game mechanics was significantly higher for CG. Fisher's exact test confirmed this result with $p = .030$.

e. Number of Mistakes

Table 12

U Mann Whitney comparison between CG and Observation Form considering the number of mistakes

Number of Mistakes	Group	N	Mean Rank	U	Z	p-value
How frequently did you observe your child make mistakes during gameplay? (CG) vs	CG	20	25.70	96.000	-3.202	.001

How frequently did you observe the child make mistakes during gameplay (OF)?	OF	20	15.30
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In **Table 12**, the Mann-Whitney U test compares the number of mistakes observed during gameplay. The CG group (*mean rank* = 25.70) reported significantly more mistakes compared to the OF group (*mean rank* = 15.30), with $U = 96.000$, $Z = -3.202$, $p < .001$. This result highlights that OF participants observed fewer mistakes during gameplay, indicating a smoother user experience for the group.

f. Frustrations Levels

Table 13

Comparison between CG and SLP considering the frustration levels

Frustrations Levels	Group	N	Mean Rank	U	Z	p-value
<i>Activity 1: Categories</i>	CG	20	19.50	180.000	-1.432	.152
	OF	20	21.50			
<i>Activity 2: Odd One Out</i>	CG	20	19.50	180.000	-1.432	.152
	OF	20	21.50			
<i>Activity 3: Matching Pairs</i>	CG	20	20.00	190.000	-1.000	.317
	OF	20	21.00			
<i>Activity 4: Let's Guess!</i>	CG	20	20.50	200.000	.000	1.000
	OF	20	20.50			
<i>Activity 5: Possessive Pronouns</i>	CG	20	19.50	180.000	-1.433	.152

	OF	20	21.50			
<i>Activity 6: Adjectives</i>	CG	20	20.00	190.000	-1.000	.317
	OF	20	21.00			
<i>Activity 7: Actions</i>	CG	20	20.00	190.000	-1.000	.317
	OF	20	21.00			
<i>Activity 8: Describe</i>	CG	20	20.50	200.000	.000	1.000
	OF	20	20.50			

Finally, **Table 13** displays comparisons of frustration levels during various board game activities. For activities such as "*Categories*," "*Odd One Out*," "*Possessive Pronouns*," and "*Adjectives*," no significant differences were found between CG and SLP ($p > .05$ for all).

However, for other activities such as "*Let's Guess!*" and "*Describe*", no significant differences emerged, as both groups had nearly identical mean ranks (CG = 20.50, SLP = 20.50), with a non-significant U-value ($U = 200.000$, $Z = .000$, $p = 1.000$).

This suggests that frustration levels were comparable between the two groups across the board game activities.

6.4 Discussion of Results

The following section will delve into the results of the statistical analysis presented above, connecting them to relevant literature to provide a sound rationale for the gathered data.

Table 7 presents the opinions of caregivers of typically developing children and clinicians on the various features of the board game. It is important to note that these opinions pertain to the BETA prototype of the SALTT-CITY tool. Across all five features in question, significant differences in favour of the caregiver group are evident. This suggests that caregivers had a more positive experience with the mentioned features.

Starting with “*Effectiveness of the design of the board game in attracting the child’s attention*” and “*Effectiveness of the reward system and incentives used in the board game*”, the main reason behind the difference in scores for these two features seems to be the diverging pre-existing experiences of the two distinct user groups. The majority of caregivers presented their opinions with only typically developing children in mind, despite being given an explanation of the tool’s main aim (i.e., clinical use for children diagnosed with DLD). The majority had been previously unaware of the condition’s existence. On the other hand, clinicians, with prior experience working with children diagnosed with DLD, based their feedback on practical and theoretical evidence. According to Smolak et al. (2020), children with DLD exhibit significant deficits in sustained auditory attention compared to their typically developing peers. While visual-spatial attention deficits are somewhat less consistent in research findings, Smolak et.al., (2020), concur with the meta-analysis by Ebert and Kohnert (2011) and conclude that children with DLD face substantial challenges in both auditory and visual-spatial sustained attention. Thus, this may explain why clinicians rated the game’s ability to capture attention more negatively than TD caregivers.

As for the reward system, clinicians, unlike caregivers, may have been more critical of the incentives because of their familiarity with concerns raised in educational psychology, where tangible rewards can undermine intrinsic motivation. Tsang and Zhang (2022) highlight the potential drawbacks of tangible rewards, including the risk of shifting focus from the learning process to the reward itself and the possibility of fostering negative behaviours geared towards competition. Clinicians, aware of these issues, may have questioned the long-term efficacy of the reward system for children diagnosed with DLD, leading to a divergence in how the two groups evaluated this feature.

In contrast, the features “*Satisfaction of the parent/guardian in view of the child’s progress*” and “*Perceived satisfaction of the child using this concept as a learning tool*” reveal a distinction between subjective and objective perspectives. Caregivers had the advantage of directly observing their children’s interactions with the tool, allowing them to base their evaluations on firsthand experience. Clinicians, however, were asked to provide feedback based on how they anticipated children in their caseload might engage with the material. This reliance on personal judgment, rather than direct observation, introduced an element of subjectivity that could have influenced their ratings. Had clinicians been able to use the tool in their clinical practice, their assessments might have been more objective and yielded more comparable results.

When considering the “*Satisfaction of using the companion app,*” clinicians tended to be more critical, given that the apps they employ need to meet specific therapeutic goals rather than offer broad learning opportunities. In clinical practice, apps must align with targeted outcomes, such as improving speech or language skills, and any limitations in functionality or usability could hinder progress. This focus on goal-oriented tools may explain why clinicians scrutinize app features more rigorously. As Du et al. (2022) highlight, reviews of speech-language apps often acknowledge positive content but raise usability concerns, particularly in areas such as navigation, control, and compatibility with different devices. Additionally, complaints frequently address the visual and audio appeal of these apps, which must be engaging for children with communication disorders while also being functional for their caregivers and clinicians. These findings, further inferred in Tables 9 and 10, suggest that while app content may be praised, challenges in usability remain a significant factor influencing clinician satisfaction.

Table 8 explored the frequency of potential use of the game if made available at home for caregivers and in the clinic for clinicians. Clinicians were informed that the target clinical group for this tool consisted of children aged 5 to 8 who were diagnosed with developmental language disorder (DLD) and were bilingual in Maltese and English, as the tasks were specifically designed and evaluated with this population in mind. The low reported frequency of use among clinicians could be attributed to the relatively low prevalence of DLD in their caseloads, as well as the condition's frequent underdiagnosis. According to McGregor (2020), many SLPs in different settings often avoid using formal diagnostic labels when it comes to DLD, instead offering parents vague descriptors like "language disorder" or no label at all. This lack of clear identification can hinder the understanding of DLD and affect their ability to support these children effectively. Such barriers to diagnosis may help explain why clinicians foresee limited use of the game in their practice, as reflected in the findings of Table 8.

Continuing on, Table 9 discussed a variety of quality-enhancing or diminishing characteristics, which yielded one of two kinds of results. Either the obtained values were similar among the sample pools in question or else the caregivers rated them more positively than the SLPs. Both caregivers and clinicians gave similar rankings to the game's quality, its promotion of player interaction, the fun factor, and the overall visual design. This alignment in ratings can be attributed to several factors. First, the game's quality likely stood out to both groups as it was designed with a clinical focus while remaining accessible and enjoyable for all children. The promotion of player interaction may have resonated with both caregivers, who value social engagement during play, and clinicians, who see interaction as a key component in language development. Additionally, the game's fun factor would have been appreciated by both groups for its ability to support children's interest and engagement, a crucial aspect for both home-based learning and therapy. Finally, the game's visual design,

which attempts to balance appeal and functionality, would have appealed to both caregivers and SLPs for its child-friendly aesthetic.

Conversely, there were notable areas where caregivers rated the game more favourably than clinicians. For instance, caregivers found the game to be more user-friendly. This perception likely stems from the fact that caregivers require tools that are easy to navigate and can be used independently without professional oversight. As such, any features that simplify gameplay or reduce the learning curve would have been particularly appreciated by caregivers, who may not have the same level of training or technical familiarity as clinicians. In contrast, SLPs often seek more complex functionalities that support clinical goal tracking, which may explain their comparatively lower ratings in this area.

Additionally, caregivers viewed the game as more time-efficient. This could be due to the flexibility they have in incorporating the tool into their daily routines, without the need to adhere to the structured time constraints typical of a clinical setting. Unlike clinicians, who must balance multiple therapeutic goals within a limited session time, caregivers are free to explore the game at their own pace and adapt its use according to their child's needs. Thus, the perceived time efficiency reflects their ability to engage with the game for longer periods without the pressure of meeting specific session objectives.

The strategic value of the game was also rated higher by caregivers. This may be because caregivers tend to view games through a broader lens, focusing on long-term developmental benefits and the potential for repeated sustained engagement. In this context, the game's ability to support varied learning experiences over time could have been perceived as a strategic advantage for continued play at home using the same toy.

Finally, caregivers expressed greater satisfaction with the game's instructions and ease of understanding. This could be attributed to the fact that they received detailed guidance and

hands-on support during the initial stages of gameplay. Caregivers had the opportunity to familiarize themselves with the game through multiple demonstrations and direct interaction, which likely contributed to their higher comfort level. In contrast, clinicians might have felt like they had limited exposure given that they only had time to go through the game's activities once, potentially leading to less confidence in navigating the game's features independently.

Continuing on, Table 10 addresses users' perceptions of the game's ease of use, specifically focusing on whether the game mechanics were straightforward and easy to follow. In this regard, caregivers provided significantly higher ratings compared to the SLPs. This difference could be attributed to the fact that caregivers typically approach the game from a more flexible perspective. Since their primary role is to support their child's enjoyment and engagement, they are less concerned with closely monitoring goal-specific outcomes. For caregivers, the emphasis is on facilitating play and fostering a positive experience, making the game's educational value an added benefit rather than a strict requirement. As such, even if children simply engage with the game for fun, caregivers still view the activity positively, which likely contributed to their higher satisfaction with the game's usability.

In contrast, SLPs may have found the game mechanics more challenging to assess within a therapeutic framework, where they must ensure that each component aligns with targeted intervention goals. The need to evaluate whether the game effectively supports specific language objectives could have led to a more critical view, as they must balance enjoyment with functional outcomes. This more structured approach may explain why clinicians rated the ease of use lower, as they naturally scrutinized whether the mechanics directly supported clinical aims.

Table 12 outlines the number of mistakes children made during gameplay, comparing caregiver reports with those recorded by the researcher. Interestingly, caregivers reported a higher number of errors than the researcher. This difference could be due to human error, but it is more likely influenced by the fact that caregivers were not explicitly informed of what constituted a mistake in the context of the game. As a result, misunderstandings may have arisen regarding what should be classified as an error.

For example, if the researcher used fading prompts to gradually reduce support during gameplay, caregivers might have interpreted these moments as the child making mistakes and being corrected. In reality, these instances reflect a normal part of the learning process rather than true errors. As Batu (2014) highlights, parents and caregivers who are not formally trained in instructional strategies may misinterpret such teaching techniques, leading to discrepancies in how they report errors.

These findings underscore the importance of establishing clear criteria and expectations when involving caregivers in monitoring a child's performance to minimize inconsistencies and ensure more accurate assessments.

Table 13 compares the frustration levels noted in children during gameplay as reported by caregivers and the observing researcher. In this case, the scores indicated a notable agreement between both groups, highlighting that children did not appear to exhibit frustration throughout the gameplay experience.

The consensus on low frustration levels highlights a positive interactional experience with the material. Such findings are essential, as they indicate that the game's design successfully fosters a supportive environment conducive to learning without the negative emotional barriers that frustration can create.

6.5. Concluding Points

This chapter illustrated how important statistical analysis is for understanding and interpreting data. Descriptive statistics gave insight into the dataset's structure, whereas non-parametric tests were used due to the limitations in the sample sizes. Together, these methodologies enabled a meaningful comparison of user experiences between caregivers and speech-language pathologists (SLPs), resulting in a more comprehensive understanding of performance ratings and improving the study's findings.

Chapter 7: Case Study of Mason’s Language Therapy Session using the SALTT-CITY BETA Prototype.

7.1 Introduction

The following chapter presents a case study detailing the clinical evaluation of the SALTT-CITY tool’s BETA prototype. The case study outlines phase 4’s therapy session, where an SLP, a child diagnosed with DLD and his caregiver used the SALTT-CITY tool during SLT. The primary aim of this analysis is to evaluate the game’s practical application in the clinical setting, examining its potential to engage users and serve as a channel to consolidate language skills in children.

As opposed to previous chapters, this analysis does not focus on defining themes from the gathered data, instead, it highlights salient points observed during the session. These include the SLP’s interactions with the child and caregiver, the child’s response to the game, and the practical benefits and challenges encountered during gameplay. Through inductive analysis, these observations are then compared to existing literature to examine how the SALTT-CITY tool aligns with or differs from established intervention practices (when keeping the child’s pre-defined intervention goals in mind).

7.2 Session’s context

The present clinical session, which was conducted in May 2024, lasted approximately 45 minutes and involved three participants. The session's methodology was previously outlined in section 3.3e of this write-up, providing a background to the participants and intervention targets.

The primary participant, referred to as Mason (to retain the pseudonymity of participants), was a male child aged five years and seven months diagnosed with DLD.

Mason had a bilingual Maltese-English background but predominantly expressed himself in English during the session. At the time of evaluation, he had been attending speech and

language therapy since March 2022. Initially, his therapeutic goals focused on language goals, however, his goals expanded in October 2023 to address emerging intelligibility difficulties.

At the time of the session, Mason's goals included tackling word-finding difficulties, increasing his Mean Length of Utterance, improving his use of prepositions, and enhancing his syntax through the use of Colourful Semantics. Furthermore, his speech intelligibility was targeted using the Core Vocabulary Approach (Dodd et.al, 2006), and as of March 2024, verbal reasoning was also included in his list of targets.

Mason's mother, referred to as Veronica in this study, attended the session with her son and participated in the evaluation by interacting with the tool, offering additional insights into Mason's therapeutic journey and completing a caregiver questionnaire. Veronica reported that she is a learning support educator pursuing a postgraduate degree in inclusive education.

Jane, the speech-language pathologist who took over Mason's therapy in March 2024, was the third participant, her role in this evaluation was to target Mason's goals by using the SALTT CITY tool and then completing a self-report questionnaire along with an observation form to detail Mason's performance.

This session was analysed in-depth through an audio transcription, which provided a detailed outlook on the interactions, therapeutic strategies, and participants' dynamics which took place during the 45 minutes of interaction.

7.3 Observed Interactions

The observed session identified various types of interactions, including nonverbal, dyadic, and triadic interactions, each intrinsically facilitating different aspects of language and social development for Mason.

7.3a Non-Verbal Interaction

Non-verbal interactions in this session consisted of eye contact, facial expressions, and gestures, each central towards providing foundational communication cues which aided Mason's grasp of socio-emotional nuances in the session. Tübele and Anoško (2019) state that non-verbal communication, namely gestures, often serves as a critical communication tool for children with DLD, as it is a means of unconsciously reflecting emotions.

During the session, Mason's non-verbal communication was described as "good" to "excellent," with the SLP and observing researcher noting in the observation form that he "made use of gestures, pointing, eye contact, joint attention and at times shook his head for yes and no." He further demonstrated "open body language, smiling to the present adults, establishing eye contact when speaking and being spoken to, and gesturing to answer at times." Notably, SALT-CITY's design aims to facilitate non-verbal interaction by embedding opportunities for non-verbal responses into its activities. For example, three out of the 8 activities presented (i.e. Categories, Matching Pairs and Odd One Out) inherently allow players to respond through gestures and pointing rather than forcibly requiring verbal answers. Hence, throughout the session, these activities served as a dynamic platform to promote non-verbal communication and maintain joint attention through both cooperative and competitive tasks. Therefore, the integration of such elements in the design helped facilitate Mason's social connection with the tool acting as a bridge for interaction regardless of the child's verbal limitations (Christopoulos & Mystakidis, 2023).

7.3b Dyadic Interaction

The interactions observed during the session primarily occurred between the clinician and Mason. These one-on-one communications were crucial for facilitating the session, allowing the clinician to support Mason's responses using techniques such as questioning, modelling, and prompting.

Direct interactions like those allowed the clinician to monitor and adapt to Mason's responses spontaneously, tailoring assistance according to his performance on the day. As Hughes (2024) states, dyadic exchanges are beneficial for children who have difficulties with language since they create opportunities for targeted skill development in a controlled and supportive setting.

Children with DLD often encounter unique challenges in conversational exchanges due to differences in their language and communication skills. These challenges can significantly affect their interactions with family and peers (Bishop et al., 2017; Croteau et al., 2015). For instance, children diagnosed with DLD, like Mason, may struggle with word-finding difficulties (Best et al., 2021) and may use vague utterances as fillers in conversation (Redmond & Redmond, 2017). This was noted throughout the session when Mason would reply with the words "*this*" and "*that*" as an answer to questions posed by the SLP or the game's activities. Such characteristics can lead to breakdowns in conversation, prompting the child to rely on communicative repair strategies, which may discourage them from initiating discussions (Forrester, 2012; Yont et al., 2002).

However, despite the use of word-fillers, this was not the case for Mason as there were no instances during the session in which he experienced conversational breakdowns.

Remarkably, observational notes indicated that "*throughout the game, the child engaged and initiated conversations with both the SLP and his mother.*" Mason demonstrated two-way interaction with both adults, showing intentional communication, as he often "*asked for help from either the SLP or his mother*" and even encouraged his mother to engage with her game pieces. The dyadic exchanges highlighted above appeared to mitigate some of the typical asymmetry seen in adult-child interactions, as highlighted by Hughes (2024). By allowing Mason to assume the lead communication partner role at times, he was meaningfully

empowered to initiate his exchanges in a supportive and structured scenario which was tailored to his strengths and weaknesses.

A notable example of this is the Adjectives activity, where Mason was required to independently select an adjective and decide which noun to pair it with. This task inherently placed him in a decision-making role, prompting him to initiate communication and guide the flow of interaction. By encouraging Mason to make these choices without immediate adult direction, the tool allowed for the shift of conversational responsibility to the child, allowing him to actively steer the interaction which was then enhanced through the SLP's scaffolding interventions. Therefore, this aligns with Hughes' (2024) findings which state that effective communication with children diagnosed with DLD relies on their communicative partners' ability to provide flexible and responsive exchanges which do not diminish the child's efforts in communicating.

7.3c Triadic Interaction

Triadic interactions added additional social dynamics to Mason's session, involving him, the clinician, and his mother, with the observing researcher occasionally stepping in as a communicative partner when needed. This type of interaction allowed Mason to experience varied communicative exchanges, with diverse communication partners, providing him with valuable opportunities to observe and practice pragmatic techniques which could later on be reinforced beyond the session and clinical context.

In particular, these triadic interactions offered a supportive, multi-partner context in which Mason could practice advanced discourse skills. As Brown and Woods (2016) explain, a hallmark of triadic intervention lies in each participant's role: the clinician models strategies, the parent supports these techniques with the child, and the child is encouraged to respond within this structured framework. Additionally, Kelly et.al., (2022) highlight the fact that triadic interactions, as opposed to dyadic interactions, expose children to complex

conversational dynamics by introducing diverse language patterns and speaking skills from each partner. Hence, supporting the development of such advanced discourse abilities through means of exposure. This benefit became evident in the evaluation as Mason actively participated with both adults, providing both help and guidance to them throughout gameplay. For instance, as Jane outlined in her observation form, Mason “*corrected the moderator as she was handing out the points and also showed his mother how to accurately scan her card*”, showcasing his growing conversational confidence as the session progressed and his understanding of how to use the tool.

At one point, Mason also expressed a desire for his mother to win, prompting him to check in with both the clinician and his mother about her progress. He first asked his mother if she wanted to win, verbally encouraged her to do so, and then turned to the clinician to ask how many points his mother would need to secure the win. This demonstrated not only Mason’s emerging awareness of others’ perspectives but also his motivation to use language collaboratively to influence the outcome of the game. Notably, two out of the eight activities found in the tool promote multiplayer interactions: "Let’s Guess" and "Describe." These activities encourage interaction among all users. This was demonstrated during the observed session when Mason was selected as the supporting player in "Let’s Guess," while his mother, Veronica, took on the role of the active player. In this setup, Mason was required to respond to questions posed by Veronica; however, he needed Jane’s assistance to do so. As a result, the game’s mechanics facilitated triadic interactions, which were duly noted.

However, certain difficulties regarding processing were still noted in these exchanges. Foltz et.al., (2015) suggest that consistency in language use within triadic settings can significantly enhance comprehension for children with DLD by reducing processing demands. In Mason’s case, despite the SLPs attempts at minimising his processing load, he still displayed some auditory processing difficulties (the child struggled to decode game instructions provided by

the game guide, SLP and researcher), thus requiring multiple repetitions at times to proceed with gameplay. Nevertheless, the support given by both the surrounding adults helped to provide a structured environment in which Mason could navigate these challenges.

7.4 Observed Therapeutic Strategies

The evaluation session highlighted several therapeutic strategies aimed at enhancing Mason's language use/development, each of the employed techniques was supported by both practice and evidence-based practices in the field of language therapy. Among the key techniques used, questioning played a crucial role in engaging the child. The use of questioning as a therapeutic technique has been a fundamental practice for centuries, given its effectiveness in stimulating recall, promoting comprehension, and encouraging critical thinking (Tofade, Elsner, & Haines, 2013). The adult participants employed both closed-ended and open-ended questions.

Çakır and Cengiz (2016) emphasise that closed-ended questions are effective for confirming children's understanding of specific concepts, however, they often limit communication depth and encourage restricted responses. For instance, when a clinician asked Mason, "*Do you know what it's called?*", he replied, "*Yes!*", which required further probing to elicit the desired answer. Through the game's flexible design, the clinician was not bound by a distinct selection of questions to ask the child. Therefore, she was able to take the app's prompt and scaffold Mason's responses accordingly.

Consequently, Jane's use of open-ended questions encouraged more elaborate and syntactically complex responses from the child (Çakır & Cengiz, 2016). For example, questions like "*Why does the cat need to wash?*" prompted reasoning and elaboration, to which the child answered, "*Because he jumped in the mud*". Despite not being the desired response outlined by the game, this was still a valid answer from Mason and an additional attempt at providing a lengthier response in conversation.

Questioning techniques form the basis for language understanding and increasing critical thinking, however, modelling and prompting provide vital scaffolds to help children imitate and internalise linguistic skills. Stehle Wallace et al. (2022) highlight the fact that these techniques offer structured linguistic frameworks for children to gradually adopt.

Modelling provides ideal language structures within context, aiding vocabulary and syntax development (Stehle Wallace et.al., 2022). An example of this during the session was when Jane modelled sentences like “*The boy is wearing a shirt*”, to guide Mason in replicating and understanding her use of such syntactic forms. This was made possible by the game's visual representation of individual subjects, verbs, and objects. These elements were shown as a model for how the sentence should ideally be constructed and served as a way to prompt players to respond verbally.

Prompting complements modelling by supporting children when they find independent responses to be challenging. As Roth and Worthington (2023) outline, prompts can be attentional, aimed at enhancing focus, or instructional, offering guidance towards specific targets. During the session, Jane used both types with Mason, calling his name to maintain attention and providing instructional prompts to refine his answers. For instance, after Mason responded briefly to “*Whose is that?*” with “*A dog,*” Jane encouraged elaboration, resulting in “*The dog is hers,*” helping him construct complete, context-appropriate sentences, facilitated by the pictorial prompts being provided by the app and the accompanying physical items in the board game. Admittedly, the game does not go beyond the pictorial model/prompt unless triggered to provide further help. Thus, supplying the SLP with more freedom when it comes to the frequency of prompting and modelling.

Creating a language-rich environment is essential for fostering communicative independence in children. Modelling and prompting, as demonstrated in Jane’s interaction with Mason, provide effective scaffolding to develop vocabulary and syntactic complexity. Pairing

nonverbal with verbal reasoning could further reinforce Mason's cognitive and linguistic skills.

During the paradigmatic relationships task (Categories), Mason was able to engage his nonverbal reasoning by matching pictures through categorical links, such as animals or vehicles.

For example, Jane's prompt, "*What goes with the bus?*" led Mason to choose "*the car,*" while also showing her the physical car piece, highlighting his understanding of the vehicle category. According to Chiu and Lu (2015), paradigmatic (categorical) and syntagmatic (functional) relationships are key to building semantic depth in language.

In the associations activity (What goes together?), Jane shifted focus to syntagmatic relationships, encouraging Mason to verbalise functional associations between nouns. After the child matched the dog with the ball, Jane prompted Mason to explain his reasoning to which he said, "*The dog wants a ball,*" illustrating sound reasoning. Thus, the game's intentional presentation of more than one correct response, as was the case in this presentation where Mason could have chosen either the 'bone' or 'ball', encourages the players to go beyond simply selecting the correct physical pieces that go together and to veer into verbalising their reasoning. Such activities align with Sandgren et al. (2021), who note that children with DLD often struggle with paradigmatic and syntagmatic relationships, underscoring the need for targeted interventions to enhance cognitive flexibility and semantic understanding.

Reinforcement and rewards were used throughout the session to maintain Mason's motivation and engagement, aligning with behaviourist learning approaches. Verbal praise and tangible incentives, such as moving his penguin game piece forward, reinforced his successes. For example, after categorising objects and labelling the categories, Mason earned the opportunity to advance his penguin, which sustained his enthusiasm. This was carried out

for each activity attempt. A particular reward was included in the game itself (traffic lights), this incentive captured Mason's interest and could be noted as he wanted to shuffle the cards to get extra tries at this activity. The game also dictates that extra points should be awarded for players assisting another player during the game, thus, promoting prosocial behaviours alongside learning. These strategies reflect findings that positive reinforcement effectively fosters engagement, sustains language use, and encourages supportive behaviours (Chow, Zimmerman, & Senter, 2021; Keller-Bell & Short, 2019).

Another activity (Actions), which was outlined previously, focused on sentence construction to aid Mason's use of Subject-Verb-Object (SVO) sentences and expand them with adjectives (during the separate Adjectives activity), encouraging the use of complex structures. For example, when prompted by Jane, "*The boy is...*", Mason responded, "*Wearing...*", and Jane affirmed with "*Shirt*," celebrating his full sentence, "*The boy is wearing a shirt.*" In the Adjectives task, Mason described a character's cleanliness, saying, "*The cat is dirty*," after imagining it had "*jumped in the mud.*" These scaffolded interactions emphasised segmental construction to support syntactic development, aided by the flexible presentation of only symbols on the app. Through this, the prompting and answer expectation could be tailored to the child's progression in his planned intervention programme and also abilities/attention levels on the day of the session.

Justice et al. (2018) highlight the value of using expansions, similar to those outlined above, where an adult extends a child's response by adding vocabulary and syntax, offering a model sentence for comparison. Similarly, Davies et al. (2016) note that children with DLD often struggle with using complex syntax, such as adjectives, modified noun phrases, and clauses beyond basic SVO structures. Guided exercises, like combining "*dirty cat*" into a fuller sentence, address these challenges and promote expressive language use, which was one of Mason's predefined targets for therapy (to increase his MLU).

The session also included an exercise on relational language, through the activity of possessive pronouns. During this activity, Mason correctly identified ownership, pointing to the female penguin and stating, "*Hers*," when asked about the dog. When prompted with, "*Is the dog his?*" he responded, "*No...Hers*," showing his grasp of relational language. Jane reinforced this by recasting his response as, "*So the dog is hers*," subtly correcting and expanding his utterance. The BETA prototype of the board game included three distinct physical penguin pieces. These pieces were designed to help players better visualise possession during the game. The aim was to assist children in understanding how to use possessive pronouns such as "his," "hers," and "theirs."

Continually, the technique observed in the example above is known as recasting and as Cleave et al. (2015) highlight it is an effective method towards addressing morphosyntactic difficulties through the reformulation of the child's response to provide a model without explicitly teaching grammatical rules. Sweeney et.al., (2024) further this by stating that recasting reduces demands on working memory while aiding syntactic abstraction, additionally, repeated exposure to recast models in context enhances the understanding of morphological structure. Similarly, Frizelle and McKean (2022) note that frequent opportunities for children with DLD to practise target structures through recasting lead to improvements in syntactic development.

Another game attempted during the session was that of "Describe", which aims to encourage the decoding and description of scenes from images randomly generated by the app (depending on difficulty level). During this activity, Mason made a semantic error, labelling a 'basketball' as a 'football'. Although the error was not addressed, the task supported his expressive skills by prompting him to both name and accurately describe what he could see. Smith et al. (2021) highlight the value of such tasks for children with language difficulties, as visual aids help organise thoughts and facilitate descriptive language use.

7.5 Positive and Negative Effects of SALTT-CITY in the Session.

The session was intended to use SALTT-CITY to target Mason's language therapy goals, focusing on word-finding difficulties, increasing MLU, encouraging the use of prepositions and enhancing syntax. Even though speech intelligibility was one of Mason's goals, this was not targeted as the tool is designed specifically for language rather than speech sound intervention.

The gamified elements of the tool encourage Mason's word retrieval through interactive tasks that allow for repeated opportunities for expressive language use. The tasks encouraged Mason to retrieve labels in response to visual prompts, and with the built-in gamification of the tool he was able to earn rewards immediately after successful naming attempts.

Therefore, increasing his motivation and reinforcing the retention of the labels presented.

This was further facilitated through Jane's use of phonological cues as an assistive prompt for Mason, an example of this being, her saying "*It's called an ah-*" to elicit "*Armchair*". Thus, highlighting the adaptability that the tool has through the ability to incorporate supporting strategies like cueing into its use. However, the limited use of semantic cues, meant the game's potential to reinforce word-retrieval was not fully realised. Meteyard and Bose (2018) explain that the combination of phonological and semantic cues activates overlapping processes and is most effective when integrated into tasks of interest to the child. Notably, the inclusion of an additional cueing feature in the app could further encourage the use of both phonological and semantic cues while enhancing users' lexical access.

Furthermore, the game's activities also supported Jane's efforts to increase Mason's MLU by encouraging sentence expansion using a variety of grammatical categories. For instance, as instructed by the tool, Jane guided Mason to combine nouns using connectors like "and" (E.g. "The dog and the ball"). SALTT-CITY's prompts for users to gain bonus points encourage the production of more complex sentences and descriptive phrases, offering

opportunities to naturally practice syntactic structures under the guise of a game. This aligns with the findings of Frizelle et.al., (2021), who emphasise the effectiveness of merging implicit methods of instruction with explicit sentence-building tasks to promote syntactic development. A positive characteristic of gamification is its ability to such methods within an interactive framework, increasing the likelihood of repeated exposure and hence skill generalisation.

However, the session also revealed certain negative aspects of using connected gamified tools; namely their inherent unpredictability. The tool's picture description task was designed with the potential to provide material aimed at targeting preposition use, however, the randomised nature of prompts within the app meant that Mason did not consistently encounter such opportunities despite needing to work on this as an intervention target. This unpredictability poses a challenge for structured language intervention since specific targets would need consistent practice. Kempler and Goral (2011) underscore the importance of drill-based approaches, which provide repetitive exposure to language structures. This limitation in the tool could be mitigated through a feature which allows clinicians to control the number of prompts in a task, encouraging a better balance between structured drilled practice and gamified engagement.

The tool's reinforcement system, while motivating, also introduced a challenging element. Ample bonuses allowed Mason to reach the game's end faster than anticipated, hence prematurely finishing the game before completing the session's goals. Mason was then asked if he wanted to explore the tool's remaining activities; however, having already won, this led to a reduction in engagement and shifted Mason's focus away from intervention tasks and toward game completion. This negative side to gamification, where excessive focus is placed on rewards undermining educational goals, is outlined by Damaševičius, Maskeliūnas, and

Blažauskas (2023) who state that reward systems in gamified materials need to be adaptable to sustain motivation without detracting from educator objectives. Therefore, to maintain the initial attention-capturing quality of SALTT-CITY (i.e. Mason demonstrated enthusiastic participation at the start of the session) while ensuring that the SLP would be able to target goals comprehensively, a pacing system could be integrated into the tool.

At the time of writing, the research team was working to address these limitations to promote the tool's strengths.

7.6 Concluding Remarks

The case study of Mason's therapy session with the SALTT-CITY BETA prototype highlights the possibilities of connected gamified tools for children with DLD. The tool facilitated a variety of interactions and supported fundamental therapy strategies, all while supporting child-led communication. However, issues such as unpredictable gamified aspects and potential distraction from goals were identified. To better address clinical demands, recommendations include improved task settings and reinforcement pacing. According to the study, SALTT-CITY could be a significant resource in language therapy, allowing children with language difficulties to progress in their language development using gamified tools. The upcoming chapter will sum up this research study and provide various concluding remarks.

Chapter 8: Conclusion and Recommendations

8.1 Introduction

This chapter concludes the study by summarising its aims, key findings, and contributions and providing conclusions based on those findings. It also presents the practical implications elicited, recommendations for further research, and a reflection on the study's potential impact.

8.2 Summary of the Study

This study investigated the design, development and evaluation process of the SALTT-CITY bilingual language intervention board game and companion app. The study sought to target gaps in SLT resources for Maltese English bilingual children aged between five and eight years old, namely those diagnosed with DLD. By integrating insights from children, caregivers and SLPs, this research developed and tested a connected bilingual intervention tool for language therapy. The study's literature background explored language development and disorders, the role of play, games and toys in therapy, and the innovation of connected technologies. By bridging theoretical perspectives with practical evidence, three iterations of SALTT-CITY came to fruition during the study's progression (i.e. The ALPHA-Prototype, BETA-Prototype and Pre-Production Prototype). Thus, the conclusion of this research project brought forth a user-centred, inclusive tool designed to meet the needs of both clinical and home-based language intervention.

8.3 Outcomes of Research Aims and Objectives

This section provides an overview of the extent to which the research aims and objectives were addressed, outlining the study's key findings in relation to its core goals. By examining each aim, this section highlights how the insights gathered contribute to the development of SALTT-CITY, supporting the creation of smart tools with the potential to impact SLT. This

underscores the relevance of the research outcomes and lays the foundation for future applications and exploration in this niche field.

8.3a Outcomes of Aim 1: To explore the subjective opinions and perspectives of speech and language pathologists (SLPs) regarding the SALTT CITY board game/Companion App concept and their current views on using similar materials in clinical practice.

This section summarises the outcomes of Aim 1, which focused on understanding SLPs' perspectives on using board games and apps in therapy. By recording their subjective opinions during Phase 1 of data collection, the study gathered useful background insights into experts' perspectives on the possible use of connected technology in language intervention. Along with their opinions on the concept of SALTT-CITY, before any fabrication and evaluations.

Overall, in targeting the objectives found in Aim 1, the study revealed both enthusiasm and concerns about incorporating connected technologies into therapy. SLPs acknowledged the potential for smart tools like SALTT-CITY to enhance engagement and augment intervention, particularly when targeting expressive and receptive language skills. Specific examples included SALTT-CITY's ability to facilitate collaborative play and improve children's motivation during sessions. However, SLPs also expressed concerns about the time required to adapt the tool to different clients and the need for adequate training to ensure effective use. They also noted potential limitations for clients who have fine-motor difficulties. Ultimately, these opinions were used to formulate apt design guidelines for the creation of the SALTT-CITY BETA-Prototype.

8.3b Outcomes of Aim 2: To develop comprehensive design guidelines for the content and accompanying application of the SALTT CITY board game based on the themes emerging from the SLPs' feedback.

This section summarises the outcome of the development of design guidelines for the final version of SALTT-CITY, based on the gathered feedback across the entire research study. Through thematic analysis of feedback from the target users, comprehensive guidance,

emphasising user-friendly interfaces, culturally relevant content, and adaptable features to meet diverse needs were created to transition from ALPHA to BETA to Pre-Production prototypes.

The key themes outlined included the importance of attention-grabbing visuals, activities with flexible presentations, and the inclusion of rewards which sustain engagement. This feedback directly informed the design of the SALTT-CITY board, physical pieces, in-app activities and its overall game mechanics. This led to the creation of SALTT-CITY's activities, which integrate evidence and practice-based intervention strategies to target vocabulary acquisition and morphosyntactic development through gamified tasks. Namely, activities were designed to progressively build the child's language skills, while allowing SLPs/adults to tailor them to each child's skill set.

8.3c Outcomes of Aim 3: To investigate the potential assistance provided to children with language difficulties in speech and language therapy sessions through the content elements of the SALTT CITY Board Game and Companion App.

Aim 3 sought to evaluate how SALTT-CITY's content and activities aligned with potential therapeutic objectives, focusing on their effectiveness in supporting key areas of language development. Findings indicated that the board game and app possessed the potential to support key areas of language development, such as vocabulary acquisition, morphosyntax enhancement, and social communication encouragement. Particularly, activities like "Describe" (i.e. picture description) and "Let's Guess" (i.e. answering and posing questions), promoted both individual and group engagement with the tool. Feedback from caregivers highlighted the tool's potential to reinforce the carry-over of goals at home, creating opportunities for guided practice without requiring excessive clinician interference. The multi-user functionality of the tool was further praised as it encouraged collaborative learning practices among children and their surrounding adults, fostering multiple supportive environments for language practice (e.g. at home, in the clinic, in the classroom).

8.3d Outcomes of Aim 4: To identify the advantages and challenges associated with the integration of connected technologies into Speech and Language Therapy Tools (SALTTs) from the perspectives of SLPs and active participants in therapy.

Through Aim 4's objectives, the benefits and challenges of integrating connected technologies in language therapy were outlined. In terms of the diverse user pools' positive responses, the study identified significant advantages including the tool's ability to quickly be personalised, the increased engagement noted during the clinical session, and the opportunities it provides for guided home practice. Furthermore, SALTT-CITY's ability to track progress and adapt difficulty levels to support children as they increase their competence across diverse language tasks was also lauded. However, challenges related to technical literacy among users and potential accessibility limitations were also highlighted. The main takeaway from this aim was the fact that such a tool would need a simplified onboarding process to maximise its accessibility and usability. Along with that, the app would require ongoing maintenance and regular updates to remain relevant, ensuring its content, features, and functionality continue to meet the evolving needs of users and advancements in intervention practices.

8.4 Key Findings and Implications

The findings of this study provide an innovative insight into the integration of gamified connected technological methodologies in language therapy. By examining the development and evaluation of the SALTT-CITY tool, this research highlights several key outcomes and their implications towards advancements in this field.

The integration of smart connected technologies within the SALTT-CITY platform has proven effective in enhancing user engagement and delivering interactive interventions. The platform supports both explicit and implicit approaches during play, making it particularly appealing for SLPs. They noted that this method allows interventions to be delivered

naturally within a play-based context, which often leads to significant benefits for both expressive and receptive language development.

Another finding related to the platform's ability to enhance accessibility to language intervention activities. Its user-centred design facilitates use across different tiers of language service delivery, aligning seamlessly with the inclusive model of tiered intervention. Beyond the clinical setting, the tool has the potential to be integrated into mainstream classrooms as a supplemental resource for Maltese and English language lessons. Continually, it can be used to target carryover through its application at home. Hence, offering caregivers an empowering medium for home-based practice fosters greater collaboration between families and clinicians. At the individualised level, the tool functions effectively within SLT sessions. Across the collected data, caregivers and clinicians alike highlighted the advantages of tools that can be used across diverse settings, thereby fostering greater inclusivity.

The iterative, feedback-driven development process also emerged as a key strength of the tool. Involving children, caregivers, and SLPs in refining the content and usability underscored the importance of user-centred practices in designing effective therapeutic tools. Furthermore, as far as the research team is aware, SALTT-CITY is the first bilingual Maltese-English-connected board game with therapeutic intentions, thus filling in a gap in the locally available resources. Its cultural and linguistic relevance not only enhances intervention delivery but also addresses the unique needs of Maltese children, hence making it an innovative addition to SLT practices locally.

To sum up, the SALTT-CITY tool's innovative design and positive reception among stakeholders and potential users emphasise its potential in language therapy. By bridging traditional methods with technological advancements, it establishes a new benchmark for supporting bilingual children with language difficulties/DLD. Hence, this study not only

contributes to the growing field of connected therapeutic technologies but also advocates for the inclusion of culturally relevant tools to promote linguistic effectiveness in SLT.

8.5 Empirical Limitations

While methodological limitations were outlined in earlier chapters, this section seeks to provide a reflection on empirical constraints, framed in light of the study's outcomes. While the findings offer valuable insights into stakeholder experiences and design considerations, the small and context-specific sample limits the generalisability of results, particularly for Phases 1 and 4. The single-case study involving a child with DLD provided rich descriptive data but does not allow for broader claims about therapeutic effectiveness. The bilingual Maltese-English context further narrows transferability, as sociolinguistic norms that shaped tool development and data interpretation may not align with other cultural or linguistic communities. Furthermore, while the study demonstrated feasibility and user engagement, it did not evaluate long-term language outcomes or therapeutic gains. The results, therefore, speak to perceived usability and design alignment rather than measurable clinical impact. Finally, although reflexivity and triangulation were employed, the qualitative interpretation of themes, particularly regarding stakeholder perceptions, remains influenced by the researcher's professional background, and this should be acknowledged as a lens through which findings were shaped.

Together, these limitations highlight the need for future studies to validate the tool in broader contexts, assess long-term outcomes, and further disentangle the influence of researcher positionality in practice-based design research.

8.6 Recommendations for Future Research

Based on the findings of this study, several recommendations can be made for future research, practice, and policy developments. Future research should focus on conducting longitudinal studies to evaluate the long-term impact of the tool on language intervention

outcomes. Additionally, expanding the research scope to include diverse linguistic and cultural contexts would provide insights into the tool's versatility and contribute to SLT resources in other communities. For example, the tool could be adapted for other bilingual language pairs, incorporating culturally relevant items into its design. Furthermore, integrating artificial intelligence into the tool's mechanics could enhance its ability to deliver personalised experiences by generating recommendations based on individual performance. For its use in SLT practices, targeted training could be delivered to equip SLPs with the skills needed to manoeuvre the effective integration of connected tools into their interventions. This would be done to address the concerns brought forward by SLPs who were not familiar with the concept of such tools. Furthermore, accessibility barriers, such as cost, need to be kept in mind when trying to integrate such a tool into SLT clinics, particularly since this was the downfall of "Olly-Speaks", the predecessor of SALTT-CITY. Should the tool be manufactured, costs would need to be kept to a minimum while still prioritising material quality and not diminishing market value. Consequently, partnerships between the designers and clinicians would need to be established as the tool is further revised to foster continuous improvement and relevance of therapeutic techniques through modular changes.

At the policy level, it would be advantageous to advocate for further studies to be carried out about the tool to facilitate evidence-based adoption in clinical settings. Given that this tool has the potential to be adapted for other languages, the presence of further studies would enhance its appeal to international bilingual researchers who could adopt and adapt it to their cultural contexts. Additionally, public awareness campaigns of the tool's existence can emphasise its benefits, encouraging acceptance and widespread use among individuals.

8.7 Final Comments

This study demonstrated the potential of SALTT-CITY in advancing bilingual language intervention. By merging play-based learning with connected technologies, the research

sought to address gaps in existing SLT resources. SALTT-CITY not only provided a pathway for structured and naturalistic intervention to be delivered through smart means but also encouraged collaboration among researchers, developers and end-users. Its unique integration of multiple user-friendly and adaptable features, along with its culturally relevant design with bilingual considerations, produced a scalable model with potential for broader application. These findings shed light on how thoughtful design and user-centred approaches can create tools in SLT that resonate with both clients' and clinicians' needs while aligning themselves with family dynamics and meaningfully engaging children. Ultimately, SALTT-CITY sets a benchmark for future tools that strive to balance traditional practices with modern innovations.

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Appendix A: Ethical Approval



Donia Stellini <donia.stellini.19@um.edu.mt>

Re: FHS-2023-00592 Donia Stellini ACCELERATED REVIEW

Research Ethics HEALTHSCI <research-ethics.healthsci@um.edu.mt>

4 December 2023 at 11:47

To: Donia Stellini <donia.stellini.19@um.edu.mt>

Cc: Paulann Grech <paulann.grech@um.edu.mt>, Daniela Gatt <daniela.gatt@um.edu.mt>

Dear Donia,

I am pleased to inform you that UREC-DP has reviewed your application and it was found to be consistent with the University of Malta Research Code of Practice.

Approval is therefore granted and you may start collecting data.

Good Luck with your study!

Sincere Regards,
Christabel



Christabel Vella | Administration Specialist

B.A. (Hons) in Maltese

FREC Secretary

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Appendix B: Information Letters

List of Information Letters:

1. Information Letter for SLPs Participating in Phase 1
2. Information Letter for Caregivers Participating in Phase 2 (EN)
3. Information Letter for Caregivers Participating in Phase 2 (MT)
4. Information Letter for Student Researchers Participating in Phase 2
5. Information Letter for SLPs Participating in Phase 3
6. Information Letter for SLPs Participating in Phase 4
7. Information Letter for Caregivers Participating in Phase 4 (EN)
8. Information Letter for Caregivers Participating in Phase 4 (MT)



Dear Participant,

My name is Donia Stellini, and I am a prospective MSc (By Research) in Communication Therapy student, working on the SALTT-CITY project at the University of Malta. I would like to invite you to participate in an upcoming research study that forms part of this project. The study aims to develop a clinically applicable instrument, specifically the SALTT CITY board game and companion app, to improve language intervention delivery for children with language difficulties. Your valuable input as a Speech and Language Pathologist (SLP) is crucial in shaping the design and development of this tool to cater to the needs of clinicians like yourself and your clients.

If you agree to participate in this research study, you are kindly requested to attend an online focus group whose date and time will be forwarded to you in due course. The focus group will be conducted virtually on Zoom (this meeting's audio will be recorded for later analysis) and will last approximately 45 minutes. During this session, the SALTT CITY board game will be presented, and guided discussions will take place. Your feedback and suggestions will be gathered to ensure the tool integrates the elements you want and need in such a clinical instrument.

In addition to the focus group, you are kindly asked to complete two questionnaires using links to Google Forms that will be disseminated to you on the day of the focus group. Each questionnaire should not take longer than 10 minutes to complete. The first questionnaire will be provided before the focus group takes place, and the second will be given after the focus group.

These questionnaires will further contribute to our understanding of your perspectives and experiences.

Participation in this study is completely voluntary, and you are free to accept or refuse to take part without giving a reason. You are also free to withdraw from it at any point, without any repercussions.

Any data that is collected will be pseudonymized through the assignment of codes to ensure utmost confidentiality. After a period of eighteen (18) months passes from the final date of data collection, September 2025, personally identifiable data and recordings will be destroyed. However, the anonymized data shall be retained indefinitely. All the hard copies of data collection instruments will be securely stored in a locked cabinet for up to eighteen (18) months after their collection. Whereas, all the soft copies shall be stored on an encrypted disk and USB, only the researcher will have access to these. If you opt to withdraw from the study, all the collected data that concerns you will be destroyed. This may be done until it is technically feasible (i.e. before it is anonymised). The researcher's supervisor and examiners will have access to coded data only. In exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes.

As a participant, you have the right, under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation, to access, rectify, and, where applicable, request the data concerning you to be erased. Notably, there are no foreseen risks to participating in the study. You may keep a copy of this information letter and your consent will be gathered through a virtually disseminated Google Form.

Thank you for considering participating in this research. If you have any questions or concerns, please do not hesitate to contact me at 99309495 or via email at donia.stellini.19@um.edu.mt. Alternatively, you may contact my supervisor, Prof. Daniela Gatt, at 23401101 or via email at daniela.gatt@um.edu.mt.

Yours Sincerely,

Donia Stellini



Ms Donia Stellini

Email Address: donia.stellini.19@um.edu.mt

Tel: [99309495](tel:99309495)



Student's Supervisor: Prof. Daniela Gatt

Email Address: daniela.gatt@um.edu.mt

Tel: [23401101](tel:23401101)



L-Università
ta' Malta

A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Dear Caregiver,

I hope this message finds you well. My name is Donia Stellini, and I am a post-graduate student pursuing a Master's by Research in Communication Therapy at the University of Malta. I am writing to extend a warm invitation to you and your child to participate as participants in the SALTT-CITY project, a collaborative effort between the Department of Communication Therapy and the Department of Industrial and Manufacturing Engineering at the University of Malta.

The SALTT-CITY project, which stands for "A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City," is aimed at creating an interactive board game designed to complement a newly developed virtual application based on the existing locally designed speech and language therapeutic toy, Olly Speaks. The expected benefit of this study is the apt development of a platform that enables the creation of linked Speech and Language Therapeutic Toys (SALTTs) in a smart city setting, for bilingual Maltese-English speaking children, which is currently unavailable in the local context.

The study will involve a group of children aged between 5 years and 8 years old and their caregiver. The participating children and caregivers like yourself will be asked to engage with functional prototypes of our interactive board game during a scheduled gameplay session at a central venue (The Central Public Library in Floriana). The undersigned researcher will assist in the gameplay for the entire duration of the session. The sessions will last approximately 35-40 minutes each, audio recording will occur following consent from each active participant. After the gameplay interaction, Input will be gathered from your child and yourself, through a questionnaire which will take approximately five minutes to complete. In this study, you and your child will only be asked to share data that is necessary for the research. Personal information or identifiable information will not be revealed in any publication, reports or presentations arising from this research.

Any data that is collected will be pseudonymized through the assignment of codes to ensure utmost confidentiality. After a period of eighteen (18) months passes from the final date of data collection, September 2025, personally identifiable data and recordings will be destroyed. However, the anonymized data shall be retained indefinitely. All the hard copies of data collection instruments will be securely stored in a locked cabinet for up to eighteen (18) months after their collection. Whereas, all the soft copies shall be stored on an encrypted disk and USB, only the researcher will have access to these. If you and your child opt to withdraw from the study, all the collected data that concerns you will be destroyed, whenever possible and until technically feasible (i.e., before it is anonymised). The researcher's supervisor and



examiners will have access to coded data only. In exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes. Participation is entirely on a voluntary basis and both you and your child are free to withdraw from it at any point, without the need to provide a reason. As participants, you and your child have the right under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation to access, rectify, and where applicable ask for the data concerning you to be erased (or retained in anonymised form). Notably, there are no foreseen risks to participating in the study

If your child:

1. Is between the ages of 5 years and 8 years old.
2. Has a Maltese-English bilingual background,
3. Is typically developing, meaning that s/he has acquired all language developmental milestones (started producing his/her first words, combining words and forming sentences) in an age-appropriate manner AND s/he does not have/has never had any of the following difficulties:
 - a) Hearing problems/impairment;
 - b) Speech and language difficulties;
 - c) Any difficulties that affect cognitive abilities;
 - d) Attention difficulties
 - e) Behavioural difficulties;
4. Has never required speech and language intervention in the past or present

I would like to invite him/her to take part in this research study. By completing the following Google Form you will be automatically granting consent to both your child's participation and your own participation in the aforementioned study. Virtual copies of this information letter and consent form will be provided to you so that you may keep them for your convenience.

Should you have any questions, please do not hesitate to contact me at donia.stellini.19@um.edu.mt or by phone at 99309495. You may also reach out to my main supervisor, Professor Daniela Gatt, at daniela.gatt@um.edu.mt or by phone at 23401101.

Your participation would greatly contribute to the success of our project, and we sincerely appreciate your consideration of this invitation.

Thank you for your time and potential involvement.

Warm regards,

Donia Stellini

Ms Donia Stellini
Email Address: donia.stellini.19@um.edu.mt
Tel: 99309495

Student's Supervisor: Prof. Daniela Gatt
Email Address: daniela.gatt@um.edu.mt
Tel: 23401101



A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Għażiż Ġenitur/Tutor,

Nispera li dan il-messaġġ isibek tajjeb. Jisimni Donia Stellini, jien studenta *post-graduate* li qed issegwi *Master's by Research* fil-kors tal-*Communication Therapy* fl-Università ta' Malta. Qed nikteb biex nagħmel stedina lilek u lil bintek/ibnek biex tipparteċipaw bħala parteċipanti fil-proġett SALTT-CITY, sforz kollaborattiv bejn id-Dipartiment tal-*Communication Therapy* u d-Dipartiment tal-Industrial and Manufacturing Engineering at the University of Malta.

Il-proġett SALTT-CITY, li jfisser "*A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City*", huwa mmirat biex johloq *board game* interattiva iddisinjata biex tikkumplimenta applikazzjoni virtwali żviluppata riċentament ibbażata fuq il-proġett eżistenti. Ġugarell terapewtiku tad-diskors u l-lingwa ddisinjat lokalment, Olly Speaks. Il-benefiċċju mistenni ta' dan l-istudju huwa l-iżvilupp xieraq ta' pjattaforma li tippermetti l-holqien ta' Ġugarelli Terapewtiċi tad-Diskors u tal-Lingwa (SALTTs) marbuta f'ambjent ta' *smart city*, għal-tfal bilingwi li jtkellmu bil-Malti u l-Ingliż, li bħalissa mhumiex disponibbli fil-kuntest lokali.

L-istudju se jinvolvi grupp ta' tfal ta' bejn il-5 snin u t-8 snin, flimkien mal-ġenitur/tutor tagħhom. It-tfal parteċipanti u l-ġenitur/tutor tagħhom (bħalek) se jintalbu li jużaw prototip funzjonali tal-*board game* interattiva tagħna waqt sessjoni f'post ċentrali (*Central Public Library* tal-Furjana). It-terapisti tad-diskors u tal-lingwa li ser ikunu preżenti (ir-riċerkatriċi hija terapista tad-diskors u tal-lingwa) se jassistu fil-logħba għat-tul kollu tas-sessjoni. Is-sessjonijiet se jdumu madwar 35-40 minuta kull waħda. Is-sessjoni ser tkun irrekordjata bl-awdjo u ir-registrazzjoni tal-awdjo se ssir biss wara l-kunsens jiġi miġbur minn kull membru. Wara l-użu tal-logħba, se jingbru ċerta opinjonijiet mingħand it-tifel/tifla tiegħek u mingħandek, permezz ta' kwestjonarju li se jieħu madwar ħames minuti biex jitlesta. F'dan l-istudju, int u t-tifel/tifla tiegħek ser tintalbu li taqsmu d-dejta li hija meħtieġa għar-riċerka biss. Informazzjoni personali jew informazzjoni identifikabbli qatt mhu ser tiġi żvelata f'pubblikazzjoni, rapporti jew preżentazzjonijiet li johorġu minn din ir-riċerka.

Jekk inti tagħti kunsens għall-parteeipazzjoni tat-tifel/tifla tiegħek, imla ġentilment din il-Formola Kunsens mehmuża u ffirmaha, u rritornaha lis-Sa Donia Stellini qabel is-sessjoni tal-logħob. Il-kopji stampati kollha ser jinħażnu b'mod sigur f'post imsakkar. Min-naħa l-oħra, il-kopji elettronici kollha se jinħażnu fuq diska u USB kriptati. Kwalunkwe dejta li tingabar se tiġi psewdonimizzata u kkodifikata biex tiżgura l-akbar anonimità. L-uniċi eċċezzjonijiet għal dan huma r-registrazzjonijiet tal-awdjo tat-tfal, li ma jistgħux jiġu anonimizzati b'mod inerenti. Madankollu, f'Settembru 2025, dawn ir-registrazzjonijiet se jinqerdu. Id-dejta identifikabbli miġbura kollha se tithassar f'Settembru, 2025. Madankollu,



id-dejta anonimizzata ser tinżamm b'mod indefinit. Jekk tagħzel li tirtira mill-istudju, id-dejta kollha miġbura li tikkonċerna lilek se tinqered. Dan se jsir sakemm ikun teknikament fattibbli (eż., qabel ma tiġi anonimizzata). Is-superviżur u l-eżaminaturi tar-riċerkatriċi se jkollhom aċċess għad-dejta kodifikata biss. F'każijiet eċċezzjonali, is-superviżur u l-eżaminaturi msemmija hawn fuq se jingħataw aċċess għad-dejta personali għall-finijiet ta' verifika. Il-partecipazzjoni hija kollha kemm hi fuq bażi volontarja u kemm int u kif ukoll it-tifel/tifla tiegħek tinsabu liberi li tirtiraw mill-istudju fi kwalunkwe hin, mingħajr l-ebda riperkussjonijiet. Bħala partecipant, għandek id-dritt skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Dejta (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeċifika aktar id-dispożizzjonijiet rilevanti tal-imsemmi regolament biex taċċessa, tirrettifika, u fejn ikun applikabbli titlob li d-dejta li tikkonċerna lilek tiffassar (jew tinżamm f'forma anonimizzata). B'mod partikolari, ma hemm l-ebda riskju prevedibbli talli tiegħu sehem fl-istudju. Tista' żżomm din l-ittra ta' informazzjoni. Se tiġi pprovduta kopja tal-formola talkunsens sabiex tkun tista' żżommha għall-konvenjenza tiegħek.

Jekk it-tifel/tifla tiegħek:

1. Huwa/hija bejn l-età ta' hames snin, u ta' tmien snin;
2. Għandu/għandha sfond bilingwi ta' Malti-Ingliż (preferibbilment espost/a primarjament għall-Malti fid-dar)
3. Huwa/hija qed tiżviluppa b'mod normali, jiġifieri kiseb/kisbet l-istadji importanti kollha tal-iżvilupp tal-lingwa (beda/bdjet jipproduċi /tipproduċi l-ewwel kliem tiegħu/tagħha, jgħaqqad/tgħaqqad il-kliem u jiffirma/tiffirma s-sentenzi) b'mod xieraq skont l-età U li m' għandux/m'għandhiex JEW qatt ma kellu/kellha l-ebda waħda mid-diffikultajiet li ġejjin:
 - a) Problemi/insuffiċjenza tas-smiġh;
 - b) Diffikultajiet fid-diskors u l-lingwa;
 - c) Kwalunkwe diffikultà li taffettwa l-kapaċitajiet konjittivi;
 - d) Diffikultajiet fl-attenzjoni
 - e) Diffikultajiet fl-imġiba;
4. Qatt ma kellu/kellha bżonn l-intervent ta' speċjalist sabiex jiġi megħjun fid-diskors u l-lingwa fil-passat jew fil-preżent

Nixtieq nistiednu/nistedinha jieħu/tieħu sehem f' din ir-riċerka.

Jekk jogħġbok toqgħodx lura milli tikkuntattjani fuq donia.stellini.19@um.edu.mt jew 99309495 jew lis-superviżur tiegħi fuq daniela.gatt@um.edu.mt jew fuq 23401101 għandek ikollok xi mistoqsijiet dwar l-istudju u/jew l-involviment tat-tifel/tifla tiegħek. Jekk inti tixtieq li t-tifel/tifla tiegħek tipparteċipa fl-istudju iżda teħtieġ assistenza addizzjonali sabiex timla l-kwestjonarju pprovdut, jekk jogħġbok toqgħodx lura milli tikkuntattjani permezz tal-mezzi ta' kuntatt msemmija hawn fuq.

Nirringrazzjak bil-quddiem tal-kooperazzjoni tiegħek,

Tislijiet,

Donia Stellini

Ms Donia Stellini
Email Address: donia.stellini.19@um.edu.mt
Tel: 99309495

Student's Supervisor: Prof Daniela Gatt
Email Address: daniela.gatt@um.edu.mt
Tel: 23401101



Hands-On Opportunity for Undergraduate Students

Donia Stellini <donia.stellini.19@um.edu.mt>
To: Ritiene Grima <ritienne.grima@um.edu.mt>
Cc: Daniela R Gatt <daniela.gatt@um.edu.mt>

10 January 2024 at 09:52

Dear Dr Grima,

I hope this email finds you well. As we previously discussed, could you kindly forward the following information to the third and fourth-year students? Many thanks in advance!

Dear Students,

I hope this message finds you all well! My name is Donia Stellini, and I am a post-graduate student pursuing a Master's by Research in Communication Therapy at the University of Malta. I am writing to extend a warm invitation to you to participate as research assistants in the SALT-CITY project, a collaborative effort between the Department of Communication Therapy and the Department of Industrial and Manufacturing within the Faculty of Engineering at the University of Malta.

Our current aim is to create an interactive board game designed to complement a newly developed virtual application based on the existing locally designed speech and language therapeutic toy, Oly Speaks. With the intended purpose of being used as an intervention tool with children aged 5 to 8 years old who are diagnosed with Developmental Language Disorder.

As part of the data collection phase, my research team plans to recruit typically developing children and their caregivers for game-play sessions with the game. It is estimated that these sessions will take place during March and April.

Your role will be integral to the success of this project since you will be directly assisting in the delivery of game-play sessions with child-caregiver dyads, using the first prototype of our game. Additionally, each assisting student will be responsible for completing an observation form for the sessions they contribute to. I believe this presents a valuable hands-on experience opportunity, especially for those of you who are interested in working with the paediatric population.

If any students express an interest in volunteering, I will then conduct one or two training sessions before the data collection's start date so that you may familiarise yourselves with the game. Should you wish to participate you can reach out to me directly at donia.stellini.19@um.edu.mt for more information.

I look forward to potentially working with you all! Wishing you the best of luck with your studies.

Kind Regards,
Donia Stellini

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Donia Stellini
Speech & Language Pathologist: Registration Number 196
BSc (Hons.) Communication Therapy (University of Malta);
MSc (By Research.) in Communication Therapy Student (University of Malta).

Information Letter, Consent Form and NDA (SLPs Gameplay Workshops).

Below you will also find an information letter which describes the purpose of these play sessions and the research that is being done by the SALT CITY Consortium. You are kindly asked to fill in the following information gathering boxes thus automatically indicating that you have read the information provided and that you give your consent for your participation.

* Indicates required question

Information Letter

I hope this message finds you well. My name is Donia Stellini, and I am a post-graduate student pursuing a Master's by Research in Communication Therapy at the University of Malta. I am writing to extend a warm invitation to you to participate as a delegate and participant in the SALT-CITY project, a collaborative effort between the Department of Communication Therapy and the Department of Industrial and Manufacturing within the Faculty of Engineering at the University of Malta. The SALT-CITY project, which stands for "A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City," is aimed at creating an interactive board game designed to complement a newly developed virtual application based on the existing locally designed speech and language therapeutic toy, Olly Speaks. The expected benefit of this study is the apt development of a platform that enables the creation of linked Speech and Language Therapeutic Toys (SALTs) in a smart city setting, for bilingual Maltese-English speaking children, which is currently unavailable in the local context.

Your role will be integral to the success of this project. Registered Speech and Language Pathologists (SLPs) are being sought so that they can assist in trying out the BETA Prototype of the SALT-CITY Game and providing feedback based on your experience. Your involvement will include:

Active participation during data collection: During the study, participating clinicians will engage with functional prototypes of our interactive board game, while the researcher observes each interaction. The sessions will last approximately 35-40 minutes each, transcribed recordings of observed interactions will be taken note of following consent from each active participant.

Feedback: Your insights and observations during the data collection sessions will be critical in providing feedback for the further refinement of the product.

Questionnaire Administration: Input will be gathered from you through a questionnaire administered during the scheduled data collection session. The questionnaire will take approximately five minutes to complete.

Any data that is collected will be pseudonymized through the assignment of codes to ensure utmost confidentiality. After a period of eighteen (18) months passes from the final date of data collection, September 2025, personally identifiable data and recordings will be destroyed. However, the anonymized data shall be retained indefinitely.

All the hard copies of data collection instruments will be securely stored in a locked cabinet for up to eighteen (18) months after their collection. Whereas, all the soft copies shall be stored on an encrypted disk and USB, only the researcher will have access to these. If you opt to withdraw from the study, all the collected data that concerns you will be destroyed. This may be done until it is technically feasible (i.e. before it is anonymised). The researcher's supervisor and examiners will have access to coded data only. In exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes. Participation is entirely on a voluntary basis and both you and your clients are free to withdraw from it at any point, without any repercussions. As a participant, you have the right under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation to access, rectify, and where applicable ask for the data concerning you to be erased (or retained in anonymised form). Notably, there are no foreseen risks to participating in the study. If you would like to participate in the SALT-CITY project, you are kindly requested to sign the attached consent form. You may keep this information letter. A copy of the consent form will be provided so that you may keep it for your convenience.

If you have any questions, please do not hesitate to contact me at donia.stellini.19@um.edu.mt or by phone at 99309495. You may also reach out to my main supervisor, Professor Daniela Gatt, at daniela.gatt@um.edu.mt or by phone at 23401101.

Your participation would greatly contribute to the success of our project, and we sincerely appreciate your consideration of this invitation.

Thank you for your time and potential involvement.

Warm regards,

Donia
Stellini

Consent Form

I, the undersigned, grant my consent to participate in the study that is being conducted by Ms. Donia Stellini. This document serves the purpose of specifying the terms of participation in the research study.

- The aims and details of the study 'A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY)' have been explained to me by Ms Donia Stellini in her information letter.
- Ms. Donia Stellini answered all the questions that I had regarding the study and my participation.
- I understand that I have been invited to participate in a study, which will involve my active interaction with functional prototypes of an interactive board game during a scheduled gameplay session with my client and his/her caregiver.
- I also understand that by contributing to this study I shall be helping with the gathering of data about 5 to 8-year-old Maltese-English bilingual children's language performance when engaging with speech and language therapeutic toys built in a smart city environment, which is currently unavailable in the local context.
- I am aware that the information collected shall remain confidential and will only be used for scientific and educational purposes.
- I understand that the information gathered in this study will be included in Ms. Donia Stellini's dissertation write-up and possibly in other scientific analyses and publications. However, my client and I shall not be identifiable in any way, due to the coding and pseudonymization of the data.
- I am aware that the collected data shall be stored securely and separately from any codes and personal data.
- I am also aware of the fact that the coded data files will be stored on Ms Donia Stellini's personal computer which is password protected and that the files will be stored in an encrypted format. And that any hard copies of materials will also be stored in a secure place and kept only until the study's completion and publishing of results.
- I am knowledgeable of the fact that Ms. Donia Stellini's supervisor and examiners will have access to coded data only. And that in exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes.
- I am aware that during each data collection session, my participation should not take longer than 35 to 45 minutes.
- I understand that I am required to pass on this signed consent form to Ms Donia Stellini before the scheduled session.
- I am also aware that after the gameplay session, I will be asked to complete a questionnaire about my experience with the board game and its companion app, this questionnaire will take approximately 10 to 15 minutes to complete.
- I know that as a participant, I have the right under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation to access, rectify, and where applicable ask for the data concerning me to be erased (or retained in anonymised form).
- I also accept that parts of the game play session will be transcribed, by Ms Donia Stellini and quoted in write-ups relevant to the study.
- I know that if I choose to withdraw from the study, any collected data will be destroyed until this is technically feasible (e.g. before it is anonymized or published) and unless the destruction of the said data would render or gravely hinder the achievement of the research's objectives.
- I understand that there are no foreseeable risks associated with participating in this study.

Therefore, by signing this document, I give my consent to the person responsible for this study to collect the necessary information from my participation. I am aware that I am under no obligation to do so and that my consent may be withdrawn at any moment without a given reason. In case of any difficulties during the study, I can contact Ms. Donia Stellini at the email address donia.stellini.19@um.edu.mt or mobile number 99309495 or her supervisor Prof. Daniela Gatt at the email address daniela.gatt@um.edu.mt or on 23401101.

1. Do you grant your consent to participate in this study? *

Mark only one oval.

Yes

No

One-Way Confidentiality Form

1. The Discloser intends to disclose information (the Confidential Information) to the Recipients for the purpose of data collection using contained interviews, to generate feedback from stakeholders (the Permitted Purpose). For the avoidance of doubt, all information disclosed between the Parties on the Permitted Purpose shall be deemed to be Confidential irrespective of whether the Discloser has marked the information as confidential.
2. The Recipients undertake not to use the Confidential Information for any purpose except the Permitted Purpose, without first obtaining the written agreement of the Discloser.
3. The Recipients shall not issue any such Confidential Information, or any press release or any other information to the public containing the name of the Discloser, without first obtaining the written agreement of the Discloser.
4. The Recipients undertake to keep the Confidential Information secure and not to disclose it to any third party, except to its employees and professional advisers, who need to know the same for the Permitted Purpose, who know they owe a duty of confidence to the Discloser and who are bound by obligations equivalent to those in this Declaration.
5. The obligations in this Declaration apply to all of the information disclosed by the Discloser to the Recipients, regardless of the way or form in which it is disclosed or recorded but they do not apply to:
 - a. any information which is or in future comes into the public domain (unless as a result of the breach of this Declaration); or
 - b. any information which is already known to the Recipients and which was not subject to any obligation of confidence before it was disclosed to the Recipients by the Discloser; or
 - c. any information obtained by the Recipients from a third party with a valid right to disclose such Confidential Information, provided that said third party is not under a confidentiality obligation to the Discloser; or
 - d. any information which was independently developed by Recipients without reference to Discloser's Confidential Information as shown by Recipients' written records.
6. Nothing in this Declaration will prevent the Recipients from making any disclosure of the Confidential Information required by law or by any competent authority. Provided that, if such a disclosure is required, the Recipients shall promptly notify the Discloser.
7. The Recipients understand that the Discloser gives no warranties in relation to the Confidential Information disclosed and in particular (but without limiting the foregoing) no warranty or representation, express or implied, is given by the Discloser as to the accuracy, efficacy, completeness, capabilities or safety of any materials or information.
8. The Recipients will, on request from the Discloser, return all copies and records of the Confidential Information and will not retain any copies or records of the Confidential Information.
9. Neither this Declaration nor the supply of any information grants the Recipients any licence, interest or right in respect of any intellectual property rights of the Discloser.
10. The Recipients understands that no agency or partnership relationship between the Recipients and the Discloser, whether express or implied, shall be created by this Declaration.
11. The Recipients undertakes this obligation of confidentiality as of _24/01/2024_ and shall terminate five (5) years later. The undertakings in clauses 2 and 4 will continue in force for five (5) years from the termination of this obligation.
12. All notices required to be served pursuant to this Declaration shall be made in writing to the addresses at the head of this Declaration. This Declaration may not be modified.
13. This Declaration shall be governed by the laws of Malta. In the event of any dispute between the Parties, the Parties agree to attempt to reach an amicable settlement in good faith. Should an attempt to reach an amicable settlement be unsuccessful, the Parties agree to resort to arbitration in terms of Chapter 387 of the Laws of Malta.

Signature:

By filling in the following questions you will be automatically indicating that you have read the information letter and confidentiality form provided. Therefore giving your explicit consent for both your child and your own participation.

2. Agreement Date: *

Example: January 7, 2019

3. Full Name: *

4. ID Card Number:

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Google Forms

A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Invitation to Participate as a Delegate in the SALTT-CITY Project

To whom it may concern,

I hope this message finds you well. My name is Donia Stellini, and I am a post-graduate student pursuing a Master's by Research in Communication Therapy at the University of Malta. I am writing to extend a warm invitation to you to participate as a delegate and participant in the SALTT-CITY project, a collaborative effort between the Department of Communication Therapy and the Department of Industrial and Manufacturing within the Faculty of Engineering at the University of Malta.

The SALTT-CITY project, which stands for "A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City," is aimed at creating an interactive board game designed to complement a newly developed virtual application based on the existing locally designed speech and language therapeutic toy, Olly Speaks. The expected benefit of this study is the apt development of a platform that enables the creation of linked Speech and Language Therapeutic Toys (SALTTs) in a smart city setting, for bilingual Maltese-English speaking children, which is currently unavailable in the local context.

Your role will be integral to the success of this project. Registered Speech and Language Pathologists (SLPs) are being sought so that they can assist in the recruitment of suitable child and parent pairs to participate in our study. The study will involve children aged 5-8 years, diagnosed with language difficulties.

Here's what your involvement would entail:

1. **Recruitment:** You will be responsible for identifying and recruiting children who meet our study's recruitment criteria from your current caseload, together with their main caregiver. Therefore, it would be expected that you take care of the dissemination of information letters and consent forms to eligible clients.
2. **Active participation during data collection:** During the study, participating children will engage with functional prototypes of our interactive board game. You will support these sessions by interacting with the child and his/her caregiver while the researcher observes each interaction. The sessions will last approximately 35-40 minutes each, audio recording following consent from each active participant will occur.
3. **Feedback:** Your insights and observations during the data collection sessions will be critical in providing feedback for the further refinement of the product.

4. **Questionnaire Administration:** Input will be gathered from you and the present caregiver through a questionnaire administered during the scheduled data collection session. The questionnaire will take approximately five minutes to complete.

Any data that is collected will be pseudonymized through the assignment of codes to ensure utmost confidentiality. After a period of eighteen (18) months passes from the final date of data collection, September 2025, personally identifiable data and recordings will be destroyed. However, the anonymized data shall be retained indefinitely. All the hard copies of data collection instruments will be securely stored in a locked cabinet for up to eighteen (18) months after their collection. Whereas, all the soft copies shall be stored on an encrypted disk and USB, only the researcher will have access to these. If you opt to withdraw from the study, all the collected data that concerns you will be destroyed. This may be done until it is technically feasible (i.e. before it is anonymised). The researcher's supervisor and examiners will have access to coded data only. In exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes. Participation is entirely on a voluntary basis and both you and your clients are free to withdraw from it at any point, without any repercussions. As a participant, you have the right under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation to access, rectify, and where applicable ask for the data concerning you to be erased (or retained in anonymised form). Notably, there are no foreseen risks to participating in the study. If you would like to participate in the SALTT-CITY project, you are kindly requested to sign the attached consent form. You may keep this information letter. A copy of the consent form will be provided so that you may keep it for your convenience.

If you have any questions, please do not hesitate to contact me at donia.stellini.19@um.edu.mt or by phone at 99309495. You may also reach out to my main supervisor, Professor Daniela Gatt, at daniela.gatt@um.edu.mt or by phone at 23401101.

Your participation would greatly contribute to the success of our project, and we sincerely appreciate your consideration of this invitation.

Thank you for your time and potential involvement.

Warm regards,

Donia Stellini



Ms Donia Stellini
Email Address: donia.stellini.19@um.edu.mt
Tel: 99309495



Student's Supervisor: Prof. Daniela Gatt
Email Address: daniela.gatt@um.edu.mt
Tel: 23401101

A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Dear Caregiver,

I hope this message finds you well. My name is Donia Stellini, and I am a post-graduate student pursuing a Master's by Research in Communication Therapy at the University of Malta. I am writing to extend a warm invitation to you and your child to participate as participants in the SALTT-CITY project, a collaborative effort between the Department of Communication Therapy and the Department of Industrial and Manufacturing Engineering at the University of Malta.

The SALTT-CITY project, which stands for "A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City," is aimed at creating an interactive board game designed to complement a newly developed virtual application based on the existing locally designed speech and language therapeutic toy, Olly Speaks. The expected benefit of this study is the apt development of a platform that enables the creation of linked Speech and Language Therapeutic Toys (SALTTs) in a smart city setting, for bilingual Maltese-English speaking children, which is currently unavailable in the local context.

The study will involve a group of children aged between 5 years and 8 years old, who are currently attending speech and language services due to difficulties with language, together with their caregiver and speech-language pathologist. The participating children and caregivers like yourself will be asked to engage with functional prototypes of our interactive board game during a scheduled speech and language intervention session. The present speech and language pathologists (the undersigned researcher is a warranted speech and language pathologist) will assist in the gameplay for the entire duration of the session. The sessions will last approximately 35-40 minutes each, audio recording will occur following consent from each active participant. After the gameplay interaction, Input will be gathered from your child, the present Speech and Language Pathologist and yourself, through a questionnaire which will take approximately five minutes to complete. In this study, you and your child will only be asked to share data that is necessary for the research. Personal information or identifiable information will not be revealed in any publication, reports or presentations arising from this research.

Any data that is collected will be pseudonymized through the assignment of codes to ensure utmost confidentiality. After a period of eighteen (18) months passes from the final date of data collection, September 2025, personally identifiable data and recordings will be destroyed. However, the anonymized data shall be retained indefinitely. All the hard copies of data collection instruments will be securely stored in a locked cabinet for up to eighteen (18) months after their collection. Whereas, all the soft copies shall be stored on an encrypted disk



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and USB, only the researcher will have access to these. If you and your child opt to withdraw from the study, all the collected data that concerns you will be destroyed, whenever possible and until technically feasible (i.e., before it is anonymised). The researcher's supervisor and examiners will have access to coded data only. In exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes. Participation is entirely on a voluntary basis and both you and your child are free to withdraw from it at any point, without the need to provide a reason. Refusing to participate or withdrawing from the study would involve no penalty or loss of benefits to which you and your child are otherwise entitled. As participants, you and your child have the right under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation to access, rectify, and where applicable ask for the data concerning you to be erased (or retained in anonymised form). Notably, there are no foreseen risks to participating in the study. If you and your child would like to participate in the SALTT-CITY project, you are kindly requested to sign the attached consent form. You may keep this information letter. A copy of the consent form will be provided so that you may keep it for your convenience.

If you have any questions, please do not hesitate to contact me at donia.stellini.19@um.edu.mt or by phone at 99309495. You may also reach out to my main supervisor, Professor Daniela Gatt, at daniela.gatt@um.edu.mt or by phone at 23401101.

Your participation would greatly contribute to the success of our project, and we sincerely appreciate your consideration of this invitation.

Thank you for your time and potential involvement.

Warm regards,

Donia Stellini

A handwritten signature in blue ink that reads "D. Stellini".

Ms Donia Stellini
Email Address: donia.stellini.19@um.edu.mt
Tel: 99309495

A handwritten signature in blue ink that reads "Daniela Gatt".

Student's Supervisor: Prof. Daniela Gatt
Email Address: daniela.gatt@um.edu.mt
Tel: 23401101



A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Għażiż Ġenitur/Tutor,

Nispera li dan il-messaggj isibek tajjeb. Jisimni Donia Stellini, jien studenta *post-graduate* li qed issegwi *Master's by Research* fil-kors tal-*Communication Therapy* fl-Università ta' Malta. Qed nikteb biex nagħmel stedina lilek u lil bintek/ibnek biex tipparteċipaw bħala parteċipanti fil-proġett SALTT-CITY, sforz kollaborattiv bejn id-Dipartiment tal-*Communication Therapy* u d-Dipartiment tal-Industrial and Manufacturing Engineering at the University of Malta.

Il-proġett SALTT-CITY, li jfisser "*A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City*", huwa mmirat biex joħloq *board game* interattiva iddisinjata biex tikkumplimenta applikazzjoni virtwali żviluppata riċentament ibbażata fuq il-proġett eżistenti. Ġugarell terapewtiku tad-diskors u l-lingwa ddisinjat lokalment, Olly Speaks. Il-benefiċċju mistenni ta' dan l-istudju huwa l-iżvilupp xieraq ta' pjattaforma li tippermetti l-holqien ta' Ġugarelli Terapewtiċi tad-Diskors u tal-Lingwa (SALTTs) marbuta f'ambjent ta' *smart city*, għal-tfal bilingwi li jitkellmu bil-Malti u l-Ingliż, li bħalissa mhumiex disponibbli fil-kuntest lokali.

L-istudju se jinvolvi grupp ta' tfal ta' bejn il-5 snin u t-8 snin, li bħalissa qed jattendu servizzi tat-terapija tad-diskors u tal-lingwa minhabba diffikultajiet bil-lingwa, flimkien mal-ġenitur/tutor tagħhom u t-terapista tal-lingwa u d-diskors. It-tfal parteċipanti u l-ġenitur/tutor tagħhom (bħalek) se jintalbu li jużaw prototip funzjonali tal-*board game* interattiva tagħna waqt sessjoni skedata tal-intervent lingwistiku. It-terapisti tad-diskors u tal-lingwa li ser ikunu preżenti (ir-riċerkatriċi hija wkoll terapista tad-diskors u tal-lingwa) se jassistu fil-logħba għat-tul kollu tas-sessjoni. Is-sessjonijiet se jdumu madwar 35-40 minuta kull waħda. Is-sessjoni ser tkun irrekordjata bl-awdjio u ir-registrazzjoni tal-awdjio se ssir biss wara l-kunsens jiġi miġbur minn kull membru. Wara l-użu tal-logħba, se jingbru ċerta opinjonijiet minghand it-tifel/tifla tiegħek, it-terapista tad-Diskors u l-Lingwa preżenti u minghandek, permezz ta' kwestjonarju li se jieħu madwar hames minuti biex jitlestha. F'dan l-istudju, int u t-tifel/tifla tiegħek ser tintalbu li taqsmu d-dejta li hija meħtieġa għar-riċerka biss. Informazzjoni personali jew informazzjoni identifikabbli qatt mhux ser tiġi żvelata f'pubblikazzjoni, rapporti jew preżentazzjonijiet li joħroġu minn din ir-riċerka.

Jekk inti tagħti kunsens għall-parteeċipazzjoni tat-tifel/tifla tiegħek, imla ġentilment din il-Formola Kunsens mehmuża u ffirmaha, u rritornaha lis-Sa Donia Stellini qabel is-sessjoni tal-logħob. Il-kopji stampati kollha ser jinħażnu b'mod sigur f'post imsakkar. Min-naħa l-oħra, il-kopji elettronici kollha se jinħażnu fuq diska u USB kriptati. Kwalunkwe dejta li tingabar se tiġi psewdonimizzata u kkodifikata biex tiżgura l-akbar anonimità. L-uniċi eċċezzjonijiet għal dan huma r-registrazzjonijiet tal-awdjio tat-tfal, li ma jistgħux jiġu



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anonimizzati b'mod inerenti. Madankollu, f'Settembru 2025, dawn irreġistrazzjonijiet se jinqerdu. Id-dejta identifikabbli miġbura kollha se tithassar f'Settembru, 2025. Madankollu, id-dejta anonimizzata ser tinżamm b'mod indefinit. Jekk tagħzel li tirtira mill-istudju, id-dejta kollha miġbura li tikkonċerna lilek se tinqered. Dan se jsir sakemm ikun teknikament fattibbli (eż., qabel ma tiġi anonimizzata). Is-superviżur u l-eżaminaturi tar-riċerkatriċi se jkollhom aċċess għad-dejta kodifikata biss. F'każijiet eċċezzjonali, is-superviżur u l-eżaminaturi msemmija hawn fuq se jingħataw aċċess għad-dejta personali għall-finijiet ta' verifika. Il-partecipazzjoni hija kollha kemm hi fuq bażi volontarja u kemm int u kif ukoll it-tifel/tifla tiegħek tinsabu liberi li tirtiraw mill-istudju fi kwalunkwe hin, mingħajr l-ebda riperkussjonijiet jew telf ta' servizzi li inthom intitolati għalihom. Bħala partecipant, għandek id-dritt skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Dejta (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeċifika aktar id-dispożizzjonijiet rilevanti tal-imsemmi regolament biex taċċessa, tirrettifika, u fejn ikun applikabbli titlob li d-dejta li tikkonċerna lilek tithassar (jew tinżamm f'forma anonimizzata). B'mod partikolari, ma hemm l-ebda riskju prevedibbli talli tiegħu sehem fl-istudju. Tista' żżomm din l-ittra ta' informazzjoni. Se tiġi pprovduta kopja tal-formola talkunsens sabiex tkun tista' żżommha għall-konvenjenza tiegħek.

Jekk jogħġbok toqgħodx lura milli tikkuntattjani fuq donia.stellini.19@um.edu.mt jew 99309495 jew lis-superviżur tiegħi fuq daniela.gatt@um.edu.mt jew fuq 23401101 għandek ikollok xi mistoqsijiet dwar l-istudju u/jew l-involvement tat-tifel/tifla tiegħek. Jekk inti tixtieq li t-tifel/tifla tiegħek tipparteċipa fl-istudju iżda tehtieg assistenza addizzjonali sabiex timla l-kwestjonarju pprovdut, jekk jogħġbok toqgħodx lura milli tikkuntattjani permezz tal-mezzi ta' kuntatt msemmija hawn fuq.

Nirringrazzjak bil-quddiem tal-kooperazzjoni tiegħek,

Tislijiet,

Donia Stellini

Ms Donia Stellini
Email Address: donia.stellini.19@um.edu.mt
Tel: 99309495

Student's Supervisor: Prof. Daniela Gatt
Email Address: daniela.gatt@um.edu.mt
Tel: 23401101

Appendix C: Consent Forms

List of Consent Forms:

1. Consent Form for Caregivers Participating in Phase 2 (EN)
2. Consent Form for Caregivers Participating in Phase 2 (MT)
3. Assent Form for Children Participating in Phase 2 & 4 (EN)
4. Assent Form for Children Participating in Phase 2 & 4 (MT)
5. Consent Form for SLPs Participating in Phase 4
6. Consent Form for Caregivers Participating in Phase 4 (EN)
7. Consent Form for Caregivers Participating in Phase 4 (MT)



A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Consent Form

I, the undersigned, grant my consent for my child to participate in the study that is being conducted by Ms. Donia Stellini. This document serves the purpose of specifying the terms of participation in the research study.

- The aims and details of the study 'A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY)' have been explained to me by Ms Donia Stellini in her information letter.
- Ms. Donia Stellini answered all the questions that I had regarding the study and my child's participation.
- I have explained to my child what he/she will be participating in and what the study entails.
- I understand that my child and I have been invited to participate in a study, which will involve our active interaction with functional prototypes of an interactive board game during a scheduled gameplay session at the Central Public Library in Floriana with the observing researcher.
- I also understand that by contributing to this study I shall be helping to gather data about 5 to 8-year-old Maltese-English bilingual children's language performance when engaging with speech and language therapeutic toys built in a smart city environment, which is currently unavailable in the local context.
- I am aware that the information collected shall remain confidential and will only be used for scientific and educational purposes.
- I understand that the information gathered in this study will be included in Ms. Donia Stellini's dissertation write-up and possibly in other scientific analyses and publications. However, my child and I shall not be identifiable in any way, due to the coding and pseudonymization of the data.
- I am aware that the collected data shall be stored securely and separately from any codes and personal data.
- I am also aware of the fact that the coded data files will be stored on Ms Donia Stellini's personal computer which is password protected and that the files will be stored in an encrypted format. And that any hard copies of materials will also be stored in a secure place and kept only until the study's completion and publishing of results.
- I am knowledgeable of the fact that Ms. Donia Stellini's supervisor and examiners will have access to coded data only. And that in exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes.
- I am aware that during each data collection session, my child's participation should not take longer than 35 to 40 minutes.
- I understand that I am required to pass on this signed consent form to Ms Donia Stellini before the scheduled session.



- I am also aware that after the gameplay session I will be asked to complete a questionnaire about my experience with the board game and its companion app, this questionnaire will take approximately five minutes to complete.
- I know that as a participant, I have the right under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation to access, rectify, and where applicable ask for the data concerning me and my child to be erased (or retained in anonymised form).
- I also accept that my child and I will be audio-recorded, using an audio-recording device during the gameplay session.
- I know that if I choose to withdraw from the study, any collected data will be destroyed until this is technically feasible (e.g. before it is pseudonymized or published) and unless the destruction of the said data would render or gravely hinder the achievement of the research's objectives.
- I understand that there are no foreseeable risks associated with participating in this study. And that if my child shows any signs of distress or expresses the wish to stop during the session, this shall be done immediately without need for a reason or any repercussions.

Therefore, by signing this document, I give my consent to the person responsible for this study to collect the necessary information from my child. I am aware that I am under no obligation to do so and that my consent may be withdrawn at any moment without a given reason. In case of any difficulties during the study, I can contact Ms. Donia Stellini at the email address donia.stellini.19@um.edu.mt or mobile number 99309495 or her supervisor Prof. Daniela Gatt at the email address daniela.gatt@um.edu.mt or on 23401101.

Initials of parent/guardian:

Parent/Guardian's contact information:.....

Signature:.....

Child's Initials: _____

Child's date of birth: _____

Name of person responsible for this study: Ms Donia Stellini

Signature: 

Email address: donia.stellini.19@um.edu.mt

Tel: 99309495

Name of the student's supervisor: Prof. Daniela Gatt

Signature: 

Email address: daniela.gatt@um.edu.mt

Tel: 2340110

A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Formola tal-kunsens

Jiena, is-sottoskritt, nagħti l-kunsens tiegħi biex it-tifel/tifla tiegħi jipparteċipa/tipparteċipa fl-istudju mwettaq mis-Sa Donia Stellini. Dan id-dokument għandu l-għan li jispeċifika t-termini tal-partecipazzjoni fl-istudju ta' riera.

- L-għanijiet u d-dettalji tal-istudju 'A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY)' ġew spjegati lili mis-Sa Donia Stellini fl-ittra ta' informazzjoni tagħha.
- Is-Sa Donia Stellini wiegħbet il-mistoqsijiet kollha li kelli fir-rigward tal-istudju u l-partecipazzjoni tat-tifel/tifla tiegħi.
- Spjegajt lit-tifel/tifla tiegħi fiex se jkun/tkun qed jieħu/tieħu sehem u x'jinvolvi l-istudju
- Nifhem li t-tifel/tifla tiegħi ġie/ġiet mistieden/mistiedna jipparteċipa/tipparteċipa fi studju, li se jinvolve/tinvolve loġħob interattiv bl-użu ta prototip ta *boardgame* waqt sessjoni ta *gameplay* fis- *Central Public Library* tal-Furjana mar-riċerkatrici.
- Nifhem ukoll li billi nikkontribwixxi għal dan l-istudju se nkun qed ngħin fil-ġbir ta' dejta dwar il-prestazzjoni lingwistika tat-tfal bilingwi Maltin-Inglizi ta' bejn il-5 u 8 snin meta jilgħabu bi *speech and language therapeutic toys* ddisinjati f'ambjent ta *smart city*, li bħalissa tali dejta mhijiex disponibbli fil-kuntest lokali.
- Jiena konxju/a li l-informazzjoni miġbura se tibqa' kunfidenzjali, u se tintuża biss għal skopijiet xjentifiċi u edukattivi.
- Nifhem li l-informazzjoni miġbura f'dan l-istudju se tiġi inkluża fil-kitba tat-teżi tas-Sa Donia Stellini u possibbilment f'analizi u pubblikazzjonijiet xjentifiċi oħra. Madankollu, it-tifel/tifla tiegħi u jien mhux se nkunu nistgħu niġu identifikati bl-ebda mod, minhabba l-kodifikar u l-pseudonimizzazzjoni tad-dejta.
- Jiena konxju/a li d-dejta miġbura se tinhażen b'mod sigur u separat minn kwalunkwe kodiċijiet u dejta personali.
- Jiena konxju/a wkoll mill-fatt li l-fajls tad-dejta kodifikati se jinhażnu fuq il-kompjuter personali tas-Sa Donia Stellini li huwa protett bil-password u li l-fajls se jinhażnu f'format kriptat. U li kwalunkwe kopji stampati tal-materjali se jinhażnu f'post sigur ukoll u se jinżammu biss sakemm jitlestew u jiġu ppubblikati r-riżultati tal-istudju.
- Jiena konxju/a mill-fatt li is-superviżur u l-eżaminaturi tas-Sa Donia Stellini se jkollhom aċċess għal dejta kodifikata biss. U li f'każijiet eċċezzjonali, is-superviżur u l-eżaminaturi msemmija hawn fuq se jingħataw aċċess għad-dejta personali għall-finijiet ta' verifika.
- Jiena konxju/a li matul kull sessjoni ta' ġbir tad-dejta, il-partecipazzjoni tat-tifel/tifla tiegħi m'għandhiex tieħu aktar minn 35 sa 40 minuta.

- Nifhem li jien meħtieġ/a li ngħaddi din il-formola ta' kunsens iffirmata lis-Sa Donia Stellini qabel iseħħ is-sessjoni tal-*gameplay*.
- Naf li wara li sseħħ is-sessjoni tal-*gameplay* jien ser nintalab nimla kwestjonarju dwar l-esperjenza tiegħi waqt li użajt il-*board game* u l-*app* li takkumpanja, dan il-kwestjonarju se jieħu madwar hames minuti biex jitlesta.
- Naf li bhala partecipant, għandi d-dritt skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Dejta (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeçifika aktar id- dispożizzjonijiet rilevanti tal-imsemmi regolament biex naççessa, nirrettifika, u fejn ikun applikabbli, nitlob li d-dejta li tikkoncerna lili u lit-tifel/tifla tiegħi titħassar (jew tinzamm f' forma anonimizzata).
- Jiena naççetta wkoll li t-tifel/tifla tiegħi jiġi/tiġi rrekordjat/a, permezz tal-użu ta' apparat ta' rekordjar tal-awdjo matul it-twettiq tal-attivitjiet ta' espressjoni verbali ppjanati.
- Jiena konxju/a mill-fatt li jekk nagħżel li nirtira mill-istudju, kwalunkwe dejta miġbura se tinqered sakemm dan ikun teknikament fattibbli (eż., qabel ma tiġi anonimizzata jew ippubblikata) u sakemm il-qerda tad-dejta msemmija ma xxekkilk jew ma tfixkilk serjament il-kisba tal-għanijiet tar-riçerka.
- Nifhem li ma hemm l-ebda riskju prevedibbli assoçjat mal-partecipazzjoni f'dan l-istudju. U li jekk it-tifel/tifla tiegħi juri/turi xi sinjali ta' skomfort jew jesprimi/tesprimi x-xewqa li jieqaf/tieqaf matul it-twettiq tal-attivitajiet, dan se jsir immedjatament mingħajr il-ħtieġa ta' raġuni u mingħajr ebda riperkussjonijiet.

Għalhekk billi niffirma dan id-dokument, nagħti l-kunsens tiegħi lill-persuna responsabbli għal dan l-istudju biex tiġbor l-informazzjoni meħtieġa mingħand it-tifel/tifla tiegħi. U jien konxju/a li m'għandi l-ebda obbligu li nagħmel dan u li l-kunsens tiegħi jista' jiġi rtirat fi kwalunkwe mument mingħajr ma għandi nagħti raġuni għaliex. F'każ ta' xi diffikultajiet matul l-istudju, nista' nikkuntattja lis-Sa Donia Stellini fuq l-indirizz elettroniku donia.stellini.19@um.edu.mt jew numru tal-mowbajl 99309495 jew tas-supervizur tagħha Prof. Daniela Gatt fuq l-indirizz elettroniku daniela.gatt@um.edu.mt jew fuq 23401101.

Inizjali il-ġenitur/gwardjan: _____

Informazzjoni ta' kuntatt tal-ġenitur/tutor:

Firma:

Data tat-twelid tat-tifel/tifla: _____

Isem tal-persuna responsabbli għall-istudju: Donia Stellini

Firma: 

Indirizz elettroniku: donia.stellini.19@um.edu.mt

Tel: 99309495

Isem tas-supervizur tal-istudenta: Prof. Daniela Gatt

Firma: 

Indirizz elettroniku: daniela.gatt@um.edu.mt

Tel: 23401101



A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Consent Form

I, the undersigned, grant my consent for my child to participate in the study that is being conducted by Ms. Donia Stellini. This document serves the purpose of specifying the terms of participation in the research study.

- The aims and details of the study 'A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY)' have been explained to me by Ms Donia Stellini in her information letter.
- Ms. Donia Stellini answered all the questions that I had regarding the study and my child's participation.
- I have explained to my child what he/she will be taking part in and what the study entails.
- I understand that my child and I have been invited to participate in a study, which will involve our active interaction with functional prototypes of an interactive board game during a scheduled gameplay session with my child's speech and language pathologist and/or the observing researcher. The gameplay session will take place during a scheduled speech and language therapy session.
- I also understand that by contributing to this study I shall be helping with the gathering of data about 5 to 8-year-old Maltese-English bilingual children's language performance when engaging with speech and language therapeutic toys built in a smart city environment, which is currently unavailable in the local context.
- I am aware that the information collected shall remain confidential and will only be used for scientific and educational purposes.
- I understand that the information gathered in this study will be included in Ms. Donia Stellini's dissertation write-up and possibly in other scientific analyses and publications. However, my child and I shall not be identifiable in any way, due to the coding and pseudonymization of the data.
- I am aware that the collected data shall be stored securely and separately from any codes and personal data.
- I am also aware of the fact that the coded data files will be stored on Ms Donia Stellini's personal computer which is password protected and that the files will be stored in an encrypted format. And that any hard copies of materials will also be stored in a secure place and kept only until the study's completion and publishing of results.
- I am knowledgeable of the fact that Ms. Donia Stellini's supervisor and examiners will have access to coded data only. And that in exceptional cases, the supervisor and examiners will be given access to personal data for verification purposes.
- I am aware that during each data collection session, my child's participation should not take longer than 35 to 40 minutes.
- I understand that I am required to pass on this signed consent form to Ms Donia Stellini before the scheduled session.



- I am also aware that after the gameplay session I will be asked to complete a questionnaire about my experience with the board game and its companion app, this questionnaire will take approximately five minutes to complete.
- I know that as a participant, I have the right under the General Data Protection Regulation (GDPR) and national legislation that implements and further specifies the relevant provisions of said regulation to access, rectify, and where applicable ask for the data concerning me and my child to be erased (or retained in anonymised form).
- I also accept that my child and I will be audio-recorded, using an audio-recording device during the gameplay session.
- I know that if I choose to withdraw from the study, any collected data will be destroyed until this is technically feasible (e.g. before it is pseudonymized or published) and unless the destruction of the said data would render or gravely hinder the achievement of the research's objectives.
- I understand that there are no foreseeable risks associated with participating in this study. And that if my child shows any signs of distress or expresses the wish to stop during the session, this shall be done immediately without need for a reason or any repercussions.

Therefore, by signing this document, I give my consent to the person responsible for this study to collect the necessary information from my child. I am aware that I am under no obligation to do so and that my consent may be withdrawn at any moment without a given reason. In case of any difficulties during the study, I can contact Ms. Donia Stellini at the email address donia.stellini.19@um.edu.mt or mobile number 99309495 or her supervisor Prof. Daniela Gatt at the email address daniela.gatt@um.edu.mt or on 23401101.

Initials of parent/guardian:

Parent/Guardian's contact information:.....

Signature:.....

Child's Initials:

Child's date of birth:

Name of person responsible for this study: Ms Donia Stellini

Signature: 

Email address: donia.stellini.19@um.edu.mt

Tel: 99309495

Name of the student's supervisor: Prof. Daniela Gatt

Signature: 

Email address: daniela.gatt@um.edu.mt

Tel: 2340110

A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY).

Formola tal-kunsens

Jiena, is-sottoskritt, nagħti l-kunsens tiegħi biex it-tifel/tifla tiegħi jipparteċipa/tipparteċipa fl-istudju mwettaq mis-Sa Donia Stellini. Dan id-dokument għandu l-għan li jispeċifika t-termini tal-partecipazzjoni fl-istudju ta' rċerka.

- L-għanijiet u d-dettalji tal-istudju 'A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City (SALTT-CITY)' ġew spjegati lili mis-Sa Donia Stellini fl-ittra ta' informazzjoni tagħha.
- Is-Sa Donia Stellini wiegħbet il-mistoqsijiet kollha li kelli fir-rigward tal-istudju u l-partecipazzjoni tat-tifel/tifla tiegħi.
- Spjegajt lit-tifel/tifla tiegħi fiex se jkun/tkun qed jieħu/tieħu sehem u x'jinvolvi l-istudju
- Nifhem li t-tifel/tifla tiegħi ġie/ġiet mistieden/mistiedna jipparteċipa/tipparteċipa fi studju, li se jinvolve/tinvolve logħob interattiv bl-użu ta prototip ta *boardgame* waqt sessjoni ta *gameplay* akkumpanjata mit-terapista tad-diskors u il-lingwa tat-tifel/tifla tiegħi u ir-riċerkatriċi. Is-sessjoni ta *gameplay* ser issir waqt sessjoni skedata tat-terapija tad-diskors u il-lingwa.
- Nifhem ukoll li billi nikkontribwixxi għal dan l-istudju se nkun qed ngħin fil-ġbir ta' dejta dwar il-prestazzjoni lingwistika tat-tfal bilingwi Maltin-Ingliżi ta' bejn il-5 u 8 snin meta jilgħabu bi *speech and language therapeutic toys* ddisinjati f'ambjent ta *smart city*, li bħalissa tali dejta mhijiex disponibbli fil-kuntest lokali.
- Jiena konxju/a li l-informazzjoni miġbura se tibqa' kunfidenzjali, u se tintuża biss għal skopijiet xjentifiċi u edukattivi.
- Nifhem li l-informazzjoni miġbura f'dan l-istudju se tiġi inkluża fil-kitba tat-teżi tas-Sa Donia Stellini u possibbilment f'analizi u pubblikazzjonijiet xjentifiċi oħra. Madankollu, it-tifel/tifla tiegħi u jien mhux se nkunu nistgħu niġu identifikati bl-ebda mod, minhabba l-kodifikar u l-pseudonimizzazzjoni tad-dejta.
- Jiena konxju/a li d-dejta miġbura se tinħażen b'mod sigur u separat minn kwalunkwe kodifikazzjoni tad-dejta personali.
- Jiena konxju/a wkoll mill-fatt li l-fajls tad-dejta kodifikati se jinħażnu fuq il-kompjuter personali tas-Sa Donia Stellini li huwa protett bil-password u li l-fajls se jinħażnu f'format kriptat. U li kwalunkwe kopji stampati tal-materjali se jinħażnu f'post sigur ukoll u se jinżammu biss sakemm jitlestew u jiġu ppubblikati r-riżultati tal-istudju.
- Jiena konxju/a mill-fatt li is-superviżur u l-eżaminaturi tas-Sa Donia Stellini se jkollhom aċċess għal dejta kodifikata biss. U li f'każijiet eċċezzjonali, is-superviżur u l-eżaminaturi msemmija hawn fuq se jingħataw aċċess għad-dejta personali għall-finijiet ta' verifika.
- Jiena konxju/a li matul kull sessjoni ta' ġbir tad-dejta, il-partecipazzjoni tat-tifel/tifla tiegħi m'għandhiex tieħu aktar minn 35 sa 40 minuta.

- Nifhem li jien meħtieġ/a li ngħaddi din il-formola ta' kunsens iffirmata lis-Sa Donia Stellini qabel iseħħ is-sessjoni tal-*gameplay*.
- Naf li wara li sseħħ is-sessjoni tal-*gameplay* jien ser nintalab nimla kwestjonarju dwar l-esperjenza tiegħi waqt li użajt il-*board game* u l-*app* li takkumpanja, dan il-kwestjonarju se jieħu madwar hames minuti biex jitlesta.
- Naf li bhala partecipant, għandi d-dritt skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Dejta (GDPR) u l-leġiżlazzjoni nazzjonali li timplimenta u tispeçifika aktar id- dispożizzjonijiet rilevanti tal-imsemmi regolament biex naççessa, nirrettifika, u fejn ikun applikabbli, nitlob li d-dejta li tikkoncerna lili u lit-tifel/tifla tiegħi titħassar (jew tinzamm f' forma anonimizzata).
- Jiena naççetta wkoll li t-tifel/tifla tiegħi jiġi/tiġi rrekordjat/a, permezz tal-użu ta' apparat ta' rekordjar tal-awdjo matul it-twettiq tal-attivitjiet ta' espressjoni verbali ppjanati.
- Jiena konxju/a mill-fatt li jekk nagħżel li nirtira mill-istudju, kwalunkwe dejta miġbura se tinqered sakemm dan ikun teknikament fattibbli (eż., qabel ma tiġi anonimizzata jew ippubblikata) u sakemm il-qerda tad-dejta msemmiya ma xxekkilk jew ma tfixkilk serjament il-kisba tal-għanijiet tar-riçerka.
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Inizjali il-ġenitur/gwardjan: _____

Informazzjoni ta' kuntatt tal-ġenitur/tutor:

Firma:

Data tat-twelid tat-tifel/tifla: _____

Isem tal-persuna responsabbli għall-istudju: Donia Stellini

Firma: 

Indirizz elettroniku: donia.stellini.19@um.edu.mt

Tel: 99309495

Isem tas-supervizur tal-istudenta: Prof. Daniela Gatt

Firma: 

Indirizz elettroniku: daniela.gatt@um.edu.mt

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Participant Initials:

Participant's Contact Information:

Signature:

Underline your current therapeutic setting: Primary Health Care, School, Private Practice.

Name of person responsible for this study: Ms Donia Stellini

Signature: 

Email address: donia.stellini.19@um.edu.mt

Tel: 99309495

Name of the student's supervisor: Prof. Daniela Gatt

Signature: 

Email address: daniela.gatt@um.edu.mt

Tel: 2340110

Appendix D: Questionnaires

List of Questionnaires:

1. Background Questionnaire for SLPs Participating in Phase 1
2. Post-Interview Questionnaire for SLPs Participating in Phase 1
3. Questionnaire for Caregivers Participating in Phase 2 (EN)
4. Questionnaire for Caregivers Participating in Phase 2 (MT)
5. Questionnaire for SLPs Participating in Phase 3
6. Questionnaire for SLPs Participating in Phase 4
7. Questionnaire for Caregivers Participating in Phase 4 (EN)
8. Questionnaire for Caregivers Participating in Phase 4 (MT)

Pre-Design Focus Group Background Questionnaire (For Speech and Language Pathologists)

This questionnaire is part of the pre-design focus group, seeking to understand your experiences and preferences in using board games and apps for language therapy sessions. Your input will shape the development of the SALT CITY board game and companion app, helping us in creating a clinically applicable tool for enhanced therapy and outcomes for children with language difficulties.

By filling in this questionnaire, you will be automatically granting your consent to participate in its related focus group which will be held online through Zoom conferencing software.

1. How frequently do you use board games in your clinical practice?

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always

2. Is there a target age-range/clinical population with whom you prefer to use boardgames?

3. Is there a specific age group/clinical population with whom you avoid using board games?

4. Kindly outline the most frequently used board games in your practice. (Did you create them yourself, or were they readily available for purchase?)

5. What are the main features that attracted you to these board games?

6. How frequently do you use mobile applications in your clinical practice?

Mark only one oval.

- Never
- Occasionally
- Sometimes
- Often
- Always

7. Is there a target age group or clinical population with whom you prefer to use mobile applications?

8. Is there a specific age group/clinical population with whom you avoid using mobile applications?

9. Kindly indicate the most frequently used mobile applications in your practice.

10. What features attracted you to these applications?

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Post Focus Group Questionnaire

Thank you for your participation in the pre-design focus group discussion. Your insights on the SALT CITY board game and companion app would be much appreciated. You are invited to complete the following questionnaire which will further assist the design team's ability to refine the product to better meet the needs of clinicians.

1. Would you use this product (the SALT CITY board game and companion app) on a regular basis with the proposed age group and clinical population?

Mark only one oval.

Not at all

1

2

3

4

5

Regularly

2. What made you choose that frequency?

3. In your opinion, what problems would this product (the SALT CITY board game and companion app) solve?

4. From your perspective, what potential problems would this product (the SALT CITY board game and companion app) create?

5. What aspects of the board game and app would you improve upon, and why?

6. Would you prefer to resume the game from the previous session, or start one afresh each session?

Mark only one oval.

- Resume the game from one session to the next.
- Start a new game each session
- Other: _____

7. Please give a reason for your previous answer

8. What price would expect the SALT CITY board game (with the included companion app) to cost?

Mark only one oval.

- Less than 25€
- Between 25€ to €50
- Between €50 to €75
- More than €75

9. Any other thoughts that you would like to share on the overall concept?

This content is neither created nor endorsed by Google.

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QUESTIONNAIRE FOR PARENTS/GUARDIANS

This questionnaire is designed to assist in capturing specific opinions from the caregivers of typically developing children during the SALT CITY game workshops.

1. **Participant reference no.:**

2. **Child's Date of Birth**

Example: January 7, 2019

3. **Date:**

4. **Relation to child:**

Section 1 - Board game features

5. **1. Please rate the following:**

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Effectiveness of the board game in engaging children during gameplay.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the design of the board game in attracting the child's attention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the reward system and incentives used in the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of the parent/guardian in view of child's progress	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of using the companion app.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 2 - Board game play and use

6. **2. If you had the board game available at home, would you make use of it with your child?**

Check all that apply.

Yes

No

7. **3. Which features of the activities did you like most and why?**

8. **4. Which aspects or features of the activities did you dislike and why?**

9. **5. Do you see any scope of extending this board game to teach or help children with Maths and other school subjects, e.g. science?**

10. **6. How much would you be ready to pay for such a board game? Please provide reasons for your answer**

11. **7. Please rate as follows:**

1 – never

2 – once a month

3 – once a week

4 – 2 or 3 times week

5 – daily

Check all that apply.

	1	2	3	4	5
How often would you use the board game with your child if this was available at home?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 3 - SALTT-CITY games and activities

12. **8. Please rate as follows:****1 – very low****2 – low****3 – moderate****4 – high****5 – very high***Check all that apply.*

	1	2	3	4	5
Effectiveness of the games in making language learning fun for your child.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Efficiency of the activities in gaining the children's attention when playing the game	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 4 - Board game Properties

13. **9. Kindly rate the following board game properties accordingly:****1 – very low****2 – low****3 – moderate****4 – high****5 – very high***Check all that apply.*

	1	2	3	4	5
Board game quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
User-friendliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strategic value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Player interaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fun factor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Directions for use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visual design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 5 - Board game – Design

14. **10. Do you feel the game mechanics are easy to follow?**

Check all that apply.

Yes

No

15. **11. How do you feel about the art style of the board game?**

16. **12. How do you feel about using the companion app to change certain aspects of the board game?**

17. **13. Have you played similar games ? If yes, please elaborate.**

18. **14. To what extent do you think the User Experience module integrated in the companion app is useful and why?**

Section 6 - Game Metrics

19. **15. How easy was the game to use and understand?**

Mark only one oval.

1 2 3 4 5

Very Very Difficult

20. **16. How frequently did you observe your child to make mistakes during gameplay?**

Mark only one oval.

1 2 3 4 5

Never Very Frequently

21. 17. In your opinion, how frustrated was your child whilst playing each and every game?

(1 Highly frustrated; 5 - Not frustrated at all)

Check all that apply.

	1	2	3	4	5
Activity 1: Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 2: Odd one out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 3: Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 4: Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 5: Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 6: Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 7: Actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 8: Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

22. 18. Would you recommend this game to other parents/caregivers?

Mark only one oval.

Yes

No

Section 7 - Further Feedback

23. **Do you have any further comments, recommendations or suggestions?**

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Kwestjonarju għat-tuturi

Dan il-kwestjonarju huwa mfassal biex jgħin fil-ġbir tal-opinjonnijiet speċifiċi tat-tuturi tat-tfal li ħadhu sehem fil-*gameplay workshops* tal-logħoba SALT-CITY.

1. **Numru ta referenza tal-partecipant/a:**

2. **Data tat-twelid tat-tifel/tifla**

Example: January 7, 2019

3. **Data:**

4. **Ir-relazzjoni tiegħek mat-tifel/tifla:**

Sezzjoni 1 - Karatteristiċi tal-*board game*

5. **1. Immarka il-kaxxa relevanti:**

- 1 – Ma jien sodisfatt/a xejn
- 2 – Ma tantx jien sodisfatt/a
- 3 – Moderatament sodisfatt/a
- 4 – Sodisfatt/a
- 5 – Sodisfatt/a ħafna

Check all that apply.

	1	2	3	4	5
Kemm int sodisfatt/a bl-effettività ta-logħba u kif ġibdet l-attenzjoni tat-tifel/tifla tiegħek	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kemm int sodisfatt/a bil-premjijiet u l-inċentivi provduti fil-logħba	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kemm kont sodisfatt/a bil-progress tat-tifel/tifla tiegħek waqt il-logħba	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kemm kont sodisfatt/a bl-app murija?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sezzjoni 2 - L-użu tal-Board game

6. **2. Kieku jkollok il-board game disponibbli d-dar, tagħmel użu minnha mat-tifel/tifla tiegħek?**

Check all that apply.

- Iva
 Le

7. **3. Liema karatteristiċi tal-attivitajiet għoġbuk l-aktar u għaliex?**

8. **4. Liema aspetti jew karatteristiċi tal-attivitajiet ma għoġbokx u għaliex?**

9. **5. Tara xi skop li din il-logħba tal-bord tiġi estiża biex tgħallem jew tgħin litfal bil-Matematika u suġġetti oħra tal-iskola, eż. ix-xjenza?**

10. **6. Kemm int lest/a li tħallas għal-logħba bħal din? Jekk jogħġbok ipprovdni raġuni għat-twegħiba tiegħek**

11. **7. Immarka il-kaxxa relevanti:****1 – Qatt****2 – Darba f'xahar****3 – Darba f'gimgħa****4 – 2-3 Darbiet f'gimgħa****5 – Kuljum***Check all that apply.*

	1	2	3	4	5
Kieku jkollok din il-logħba disponibbli id-dar, kemm il darba taħseb li tintuża?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 3 - SALT-CITY games and activities

12. **8. Immarka il-kaxxa relevanti:**

- 1 – Ma rnexxiet xejn**
- 2 – Ma tantx irnexxiet**
- 3 – Irnexxiet moderatament**
- 4 – Irnexxiet**
- 5 – Irnexxiet ħafna**

Check all that apply.

	1	2	3	4	5
Il-logħba irnexxiela tagħmel it- tagħlim tal- lingwa divertenti għat- tifel/tifla tiegħek	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L-attivitajiet irnexxielhom jiksbu l- attenzjoni tat-tifel/tifla tiegħek matul il- logħba.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sezzjoni 4 - Aspetti tal-Board game

13. **9. Immarka il-kaxxa relevanti:****1 – kwalità baxxa ħafna****2 – kwalità baxxa****3 – kwalità moderata****4 – kwalità għolja****5 – kwalità għolja ħafna***Check all that apply.*

	1	2	3	4	5
Kwalità ġenerali tal-Board game	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Faċli għall-utent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effiċjenza tal-ħin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Valur strateġiku	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interazzjoni tal-plejers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fattur tal-pjaċir	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sodisfazzjon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Direzzjonijiet għall-użu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disinji vizwali	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sezzjoni 5 - Disinn tal-Board game

14. 10. Tħoss li l-mekaniżmi tal-logħba huma faċli biex ssegwihom?

Check all that apply.

Iva

Le

15. 11. Kif tħossok dwar l-istil tal-arti tal-board-game?

16. 12. Kif tħossok dwar l-użu tal-app anċillari biex tbiddel ċerti aspetti tal-board game?

17. 13. Ġieli lgħabt logħob simili? Jekk iva, jekk jogħġbok elabora.

18. **14. Kemm taħseb li huwa utli l-modulu User Experience li huwa integrat fl-app anċillari u għaliex?**

Sezzjoni 6 - Metriċi tal-logħob

19. **15. Kemm kienet faċli biex tifhem u tuża il-logħba?**

Mark only one oval.

1 2 3 4 5

Faċl Diffiċli ħafna

20. **16. Kemm-il darba osservajt lit-tifel/tifla tiegħek t/jagħmel żbalji waqt il-logħba?**

Mark only one oval.

1 2 3 4 5

Qatt Frekwenti ħafna

21. **17. Fl- opinjoni tiegħek, kemm kien frustrat it-tifel/tifla tiegħek waqt li kien qed j/tilgħab kull logħba?**

(1 Frustrat/a ħafna; 5 - Mhux frustrat/a xejn)

Check all that apply.

	1	2	3	4	5
Attività 1: Kategoriji	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 2: Liema ma taqbilx?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 3: Pari li Jaqblu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 4: Ejja naqtgħu!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 5: Pronomi possessivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 6: Aġġettivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 7: Azzjonijiet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 8: Iddeskrivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

22. **18. Tirrakkomanda din il-logħba lil ġenituri/tuturi oħrajn?**

Mark only one oval.

Iva

Le

Sezzjoni 7 - Aktar Feedback

23. **Għandek xi kummenti, rakkomandazzjonijiet jew sugġerimenti oħra?**

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QUESTIONNAIRE FOR SLPs - Workshops

This questionnaire is designed to assist in capturing specific opinions from speech and language pathologists during the SALT CITY game workshops.

1. Randomly Allocated Case Study:

Mark only one oval.

- Child A
- Child B
- Child C
- Child D

2. Which randomly allocated role did you receive?

Mark only one oval.

- Child
- Caregiver
- SLP

3. What goals did your team decide to target in the case study?

4. SLP reference no:

5. Date of Attendance:

Example: January 7, 2019

Section 1: Board game features

6. 1. Please rate the following:

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Perceived effectiveness of the board game in engaging children during therapeutic activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived effectiveness of the design of the board game in attracting the attention of children during therapy..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived satisfaction of the children in playing the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the reward system and the incentives used in the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived satisfaction of SLP using this concept in intervention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived satisfaction of using the companion app.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. 1. Please rate the following:

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Perceived effectiveness of the board game in engaging children during therapeutic activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived effectiveness of the design of the board game in attracting the attention of children during therapy..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived satisfaction of the children in playing the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the reward system and the incentives used in the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived satisfaction of SLP using this concept in intervention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived satisfaction of using the companion app.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 2: Board game play and use

8. 2. Which features of the activities did you like most and why?

9. 3. Which aspects or features of the activities did you not find useful or interesting and why?

10. 4. Which characteristics of the app did you like the most and why?

11. 5. What characteristics of the app would you remove and why?

12. 6. If the board game was available at your clinic, how often would you use the board game during therapy?

Mark only one oval.

1 2 3 4 5

New Daily

13. 7. Would you make use of the board game to carry out remote therapy?

Mark only one oval.

Yes

No

Section 3: SALTT-CITY games and activities

14. 8. Please rate the following:

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Perceived effectiveness of the games in targeting your therapeutic strategies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived efficiency of the specific activities in enabling you to reach target goals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived efficiency of the activities in gaining children's compliance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived effectiveness of the board game to guide the children in carrying out therapeutic tasks, when compared to traditional therapeutic materials e.g. flashcards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perceived satisfaction of using the board game in reaching your goals when compared to traditional therapeutic activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. 9. Kindly rate the following board game properties accordingly:

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Board game quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
User-friendliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strategic value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Player interaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fun factor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Directions for use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visual design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 5: Board game – Design

16. 10. Do you feel the game mechanics are easy to follow?

Mark only one oval.

Yes

No

17. 11. How do you feel about the art style of the board game?

18. 12. How do you feel about using the companion app to change certain aspects of the board game? (E.g. Difficulty level, Language of instruction etc).

19. 12a. Would you rather complete the game in one-session or have it carry-over onto the next? Why?

20. 12b. Would you rather have the ability to collect data through the app or not? Why? (E.g. Accuracy Percentage in an activity).

21. 13. How much would you be willing to spend to buy something like this?

22. 14. Do you own, have you seen or have you tried similar games in therapy?

23. 15. Do you feel the materials used are durable enough to be used in a clinical setting?

24. 15a. Would you change anything about the dimensions of the physical elements?

25. 16. To what extent do you think the User Experiences module integrated in the SLP app is useful and why?

Section 6: Further Feedback

26. 17. Do you have any further comments, recommendations or suggestions?

QUESTIONNAIRE FOR SLPs

This questionnaire is designed to assist in capturing specific opinions from speech and language pathologists during the SALT CITY game workshops.

1. SLP reference no:

2. Client's reference no:

3. Date:

Example: January 7, 2019

Section 1: Board game features

4. **1. Please rate the following:**

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Effectiveness of the board game in engaging children during therapeutic activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the design of the board game in attracting the child's attention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of the children in playing the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the reward system and the incentives used in the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of the SLP following intervention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of using the SLP app.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 2: Board game play and use

5. 2. Would you make use of the board game to carry out therapy remotely?

Mark only one oval.

Yes

No

6. 3. Did you see the difference on the effectiveness of the board game between one client and another?

Mark only one oval.

Yes

No

7. 4. Which features of the activities did you like most and why?

8. 5. Which aspects or features of the activities did you not find useful or interesting and why?

9. 6. Which characteristics of the SLP app would you add to the existing app?

10. 7. What characteristics of the SLP app would you remove from the existing app?

11. 8. If the board game was available at your clinic, how often would you use the board game during therapy?

Mark only one oval.

1 2 3 4 5

Never Daily

Section 3: SALTT-CITY games and activities

12. 9. Please rate the following:

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Effectiveness of the games in targeting your therapeutic strategies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Efficiency of the specific activities in enabling you to reach the target goals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Efficiency of the activities in gaining the children's compliance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the board game to guide the children in carrying out therapeutic tasks, when compared to traditional therapeutic activities e.g. pictures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of using the board game in reaching your expectations when compared to traditional therapeutic activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. 10. Kindly rate the following board game properties accordingly:

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Board game quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
User-friendliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strategic value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Player interaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fun factor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Directions for use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visual design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 5: Board game – Design

14. 11. Do you feel the game mechanics are easy to follow?

Mark only one oval.

Yes

No

15. 12. How do you feel about the art style of the board game?

16. 13. How do you feel about using a mobile phone or tablet to change certain aspects of the board game?

17. 14. How much would you be willing to spend to buy something like this?

18. 15. Do you have, have you seen similar or have you tried similar games in therapy?

19. 16. Do you feel the materials used are durable enough to be used in a clinical setting?

20. 17. To what extent do you think the User Experiences module integrated in the SLP app is useful and why?

Section 6: Further Feedback

21. 18. Do you have any further comments, recommendations or suggestions?

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QUESTIONNAIRE FOR PARENTS/GUARDIANS

This questionnaire is designed to assist in capturing specific opinions from the caregivers of children attending speech and language therapy during the SALTT CITY game workshops.

1. **Participant reference no.:**

2. **Child's Date of Birth**

Example: January 7, 2019

3. **Date:**

4. **Relation to child:**

Section 1 - Board game features

5. **1. Please rate the following:**

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Effectiveness of the board game in engaging children during therapeutic activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the design of the board game in attracting the child's attention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effectiveness of the reward system and incentives used in the board game.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of the parent/guardian in view of child's progress	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction of using the companion app.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 2 - Board game play and use

6. **2. If you had the board game available at home, would you make use of it with your child?**

Check all that apply.

- Yes
 No

7. **3. Would you use of the board game with your children so that therapy can be carried out remotely?**

Mark only one oval.

- Yes
 No

8. **3. Which features of the activities did you like most and why?**

9. **4. Which aspects or features of the activities did you dislike and why?**

10. **5. Do you see any scope of extending this board game to teach or help children with Maths and other school subjects, e.g. science?**

11. **6. How much would you be ready to pay for such a board game? Please provide reasons for your answer**

12. **7. Please rate as follows:**

1 – never

2 – once a month

3 – once a week

4 – 2 or 3 times week

5 – daily

Check all that apply.

	1	2	3	4	5
How often would you use the board game with your child if this was available at home?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 3 - SALTT-CITY games and activities

13. **8. Please rate as follows: ***

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Effectiveness of the games in making therapy fun for your child.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Efficiency of the specific activities in enabling the child to reach the target goals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Efficiency of the activities in gaining the children’s attention when playing the game	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Effectiveness of the board game to guide the children in carrying out therapeutic tasks, when compared to traditional therapeutic activities e.g. pictures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Satisfaction of using the board game in reaching therapy expectations when compared to traditional therapeutic activities.

Section 4 - Board game Properties

14. **9. Kindly rate the following board game properties accordingly:****1 – very low****2 – low****3 – moderate****4 – high****5 – very high***Check all that apply.*

	1	2	3	4	5
Board game quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
User-friendliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strategic value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Player interaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fun factor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Directions for use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visual design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 5 - Board game – Design

15. **10. Do you feel the game mechanics are easy to follow?**

Check all that apply.

Yes

No

16. **11. How do you feel about the art style of the board game?**

17. **12. How do you feel about using the companion app to change certain aspects of the board game?**

18. **14. Have you seen similar or have you tried similar games in therapy?**

19. **14. To what extent do you think the User Experience module integrated in the companion app is useful and why?**

Section 6 - Game Metrics

20. **15. How easy was the game to use and understand?**

Mark only one oval.

1 2 3 4 5

Very Very Difficult

21. **16. How frequently did you observe your child to make mistakes during gameplay?**

Mark only one oval.

1 2 3 4 5

Never Very Frequently

22. **18. Please provide appropriate rating for each game to help children work on their speech and language skills.**

1 – very low

2 – low

3 – moderate

4 – high

5 – very high

Check all that apply.

	1	2	3	4	5
Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Let's Guess	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. 17. In your opinion, how frustrated was your child whilst playing each and every game?

(1 Highly frustrated; 5 - Not frustrated at all)

Check all that apply.

	1	2	3	4	5
Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

24. 18. Would you recommend this game to other parents/caregivers?

Mark only one oval.

Yes

No

Section 7 - Further Feedback

25. **Do you have any further comments, recommendations or suggestions?**

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Kwestjonarju għat-tuturi

Dan il-kwestjonarju huwa mfassal biex jgħin fil-ġbir tal-opinjoni speċifiċi tat-tuturi tat-tfal li jattendu it-terapija tad-diskors u lingwa li ħadhu sehem fil-*gameplay workshops* tal-logħoba SALTT-CITY.

1. **Numru ta referenza tal-partecipant/a:**

2. **Data tat-twelid tat-tifel/tifla**

Example: January 7, 2019

3. **Data:**

4. **Ir-relazzjoni tiegħek mat-tifel/tifla:**

Sezzjoni 1 - Karatteristiċi tal-*board game*

5. 1. **Imminka il-kaxxa relevanti:**

- 1 – Ma jien sodisfatt/a xejn
- 2 – Ma tantx jien sodisfatt/a
- 3 – Moderatament sodisfatt/a
- 4 – Sodisfatt/a
- 5 – Sodisfatt/a ħafna

Check all that apply.

	1	2	3	4	5
Kemm int sodisfatt/a bl-effettività tal-logħba u kif ġibdet l-attenzjoni tat-tifel/tifla tiegħek waqt il-hin tat-terapija	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kemm int sodisfatt/a bil-premjijiet u l-inċentivi provduti fil-logħba	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kemm kont sodisfatt/a bil-progress tat-tifel/tifla tiegħek waqt il-logħba	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kemm kont sodisfatt/a bl-app murija?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sezzjoni 2 - L-użu tal-Board game

6. **2. Kieku jkollok il-board game disponibbli d-dar, tagħmel użu minnha mat-tifel/tifla tiegħek?**

Check all that apply.

Iva

Le

7. **2. Kieku jkollok tuża il-board game mat-tifel/tifla tiegħek biex it-terapija tkun tista sseħħ b'mod virtwali. Tagħmel użu minnha?**

Check all that apply.

Iva

Le

8. **3. Liema karatteristiċi tal-attivitajiet għoġbuk l-aktar u għaliex?**

9. **4. Liema aspetti jew karatteristiċi tal-attivitajiet ma għoġbokx u għaliex?**

10. **5. Tara xi skop li din il-logħba tal-bord tiġi estiża biex tgħallem jew tgħin litfal bil-Matematika u suġġetti oħra tal-iskola, eż. ix-xjenza?**

11. **6. Kemm int lest/a li tħallas għal-logħba bħal din? Jekk jogħġbok ipprovdni raġuni għat-twegħiba tiegħek**

12. **7. Immarka il-kaxxa relevanti:**

1 – Qatt

2 – Darba f'xahar

3 – Darba f'gimġha

4 – 2-3 Darbiet f'gimġha

5 – Kuljum

Check all that apply.

	1	2	3	4	5
Kieku jkollok din il-logħba disponibbli id-dar, kemm il darba taħseb li tintuża?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 3 - SALTT-CITY games and activities

13. 8. Immarka il-kaxxa relevanti:

- 1 – Ma rnexxiet xejn
 2 – Ma tantx irnexxiet
 3 – Irnexxiet moderatament
 4 – Irnexxiet
 5 – Irnexxiet ħafna

Check all that apply.

	1	2	3	4	5
Il-Hogħba irnexxiela tagħmel il- ħin tat- terapija divertenti għat- tifel/tifla tiegħek	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kemm irnexxielhom jiksbu l- iskopijiet tat-terapija l- attivitajiet tal-Hogħba?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L-attivitajiet irnexxielhom jiksbu l- attenzjoni tat-tifel/tifla tiegħek matul il- logħba.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Meta tqabbel l- attivitajiet tal-Hogħba ma dawk tat-terapija tradizzjonali, kemm huma effettivi?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sezzjoni 4 - Aspetti tal-Board game

14. 9. Immarka il-kaxxa relevanti:

1 – kwalità baxxa ħafna

2 – kwalità baxxa

3 – kwalità moderata

4 – kwalità għolja

5 – kwalità għolja ħafna

Check all that apply.

	1	2	3	4	5
Kwalità generali tal-Board game	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Faċli għall-utent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effiċjenza tal-ħin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Valur strategiku	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interazzjoni tal-plejers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fattur tal-pjaċir	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sodisfazzjon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Direzzjonijiet għall-użu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disinji vizwali	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sezzjoni 5 - Disinn tal-Board game

15. **10. Tħoss li l-mekaniżmi tal-logħba huma faċli biex ssegwihom?**

Check all that apply.

Iva

Le

16. **11. Kif tħossok dwar l-istil tal-arti tal-board-game?**

17. **12. Kif tħossok dwar l-użu tal-app anċillari biex tbiddel ċerti aspetti tal-board game?**

18. **13. Ġieli lgħabt logħob simili fit-terapija? Jekk iva, jekk jogħġbok elabora.**

19. **14. Kemm taħseb li huwa utli l-modulu User Experience li huwa integrat fl-app anċillari u għaliex?**

Sezzjoni 6 - Metriċi tal-logħob

20. **15. Kemm kienet faċli biex tifhem u tuża il-logħba?**

Mark only one oval.

1 2 3 4 5

Faċl Diffiċli ħafna

21. **16. Kemm-il darba osservajt lit-tifel/tifla tiegħek t/jagħmel żbalji waqt il-logħba?**

Mark only one oval.

1 2 3 4 5

Qatt Frekwenti ħafna

22. **17. Jekk jogħġbok ipprovdli klassifikazzjoni xierqa għal kull logħba li intużat biex tgħin lit-tfal jaħdmu fuq il-ħiliet tad-diskors u tal-lingwa tagħhom.**

(1 Tajba ħafna; 5 - Mhix tajba xejn)

Check all that apply.

	1	2	3	4	5
Attività 1: Kategoriji	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 2: Liema ma taqbilx?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 3: Pari li Jaqblu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 4: Ejja naqtgħu!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 5: Pronomi possessivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 6: Aġġettivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 7: Azzjonijiet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 8: Iddeskrivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. **17. FI- opinjoni tiegħek, kemm kien frustrat it-tifel/tifla tiegħek waqt li kien qed j/tilgħab kull logħba?**

(1 Frustrat/a ħafna; 5 - Mhux frustrat/a xejn)

Check all that apply.

	1	2	3	4	5
Attività 1: Kategoriji	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 2: Liema ma taqbilx?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 3: Pari li Jaqblu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 4: Ejja naqtgħu!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 5: Pronomi possessivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 6: Aġġettivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 7: Azzjonijiet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attività 8: Iddeskrivi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

24. **18. Tirrakkomanda din il-logħba lil ġenituri/tutori oħrajn?**

Mark only one oval.

Iva

Le

Sezzjoni 7 - Aktar Feedback

25. **Għandek xi kummenti, rakkomandazzjonijiet jew suggerimenti oħra?**

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Appendix E: Observation Forms

List of Observation Forms:

1. Observation Form for Observing Researcher (Phase 2)
2. Observation Form for Observing Researcher and Participating SLP (Phase 4)

Observation Form (To be filled in by the observing researcher/SLP)

This observation form is designed to assist in capturing specific details and behaviors exhibited by typically developing children and their caregivers during the SALT CITY game workshops.

1. Participant Reference No:

2. Date of Observation:

Example: January 7, 2019

Section 1: Engagement Metrics

3. What was the average duration of the gameplay session for this child?

4. How often did the child express the desire to replay a particular activity in the game?

Check all that apply.

	0 times	1 time	2-5 times	More than 5 times
Activity 1: Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 2: Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 3: Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 4: Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 5: Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 6: Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 7: Actions!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 8: Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Did the child complete the game during the workshop?

Mark only one oval.

Yes

No

Other: _____

6. Are there any specific moments or activities within the game that captured the child's attention more effectively?

Section 2: Game Interaction Metrics

7. How frequently did the child make mistakes while playing the game? (Per Activity)

Check all that apply.

	0 times	1-2 times	3-5 times	More than 5 times
Activity 1: Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 2: Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 3: Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 4: Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 5: Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 6: Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 7: Actions!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 8: Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Were these errors a result of the game's design or other factors? (Per Activity)

Mark only one oval per row.

	Yes	No	Other
Activity 1: Categories	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 2: Matching Pairs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 3: Odd One Out	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 4: Let's Guess!	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 5: Possessive Pronouns	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 6: Adjectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 7: Actions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 7: Describe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. Additional Comments in regards to the errors made:

Section 3: User Satisfaction Metrics

10. How frustrated did the child appear while playing each activity?

Check all that apply.

	Not at all frustrated	Slightly frustrated	Moderately frustrated	Very frustrated	Extremely frustrated
Activity 1: Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 2: Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 3: Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 4: Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 5: Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 6: Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 7: Actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 8: Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 4: Further Feedback:

11. Further Comments in relation to the observation/Checklist Items:

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Observation Form (To be filled in by the observing researcher/SLP)

This observation form is designed to assist in capturing specific details and behaviors exhibited by children with language difficulties, their caregivers and SLPs, during the SALT CITY therapeutic sessions.

1. Participant Reference No:

2. Date of Observation:

Example: January 7, 2019

Section 1: Engagement Metrics

3. What was the average duration of the gameplay session for this child?

4. How often did the child express the desire to replay a particular activity in the game?

Check all that apply.

	0 times	1 time	2-5 times	More than 5 times
Activity 1: Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 2: Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 3: Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 4: Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 5: Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 6: Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 7: Actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 8: Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Did the child complete the game during the session?

Mark only one oval.

Yes

No

Other: _____

6. Are there any specific moments or activities within the game that captured the child's attention more effectively?

Section 2: Game Interaction Metrics

7. How frequently did the child make mistakes while playing the game? (Per Activity)

Check all that apply.

	0 times	1 time	2-5 times	More than 5 times
Activity 1: Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 2: Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 3: Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 4: Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 5: Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 6: Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 7: Actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 8: Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Were these errors a result of the game's design or other factors? (Per Activity)

Mark only one oval per row.

	Yes	No	Other
Activity 1: Categories	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 2: Matching Pairs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 3: Odd One Out	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 4: Let's Guess!	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 5: Possessive Pronouns	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 6: Adjectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 7: Actions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Activity 8: Describe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. Additional Comments in regards to the errors made:

10. How appropriate do you perceive the game to be in terms of the participant's skill level and developmental needs?

Mark only one oval.

1 2 3 4 5

Not Very Appropriate

11. Additional Comments in terms of Appropriateness Level

Section 3: User Satisfaction Metrics

12. How frustrated did the child appear while playing each activity?

Check all that apply.

	Not at all frustrated	Slightly frustrated	Moderately frustrated	Very frustrated	Extremely frustrated
Activity 1: Categories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 2: Matching Pairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 3: Odd One Out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 4: Let's Guess!	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 5: Possessive Pronouns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 6: Adjectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 7: Actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity 8: Describe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 4: Further Feedback:

13. Further Comments in relation to the observation/Checklist Items:

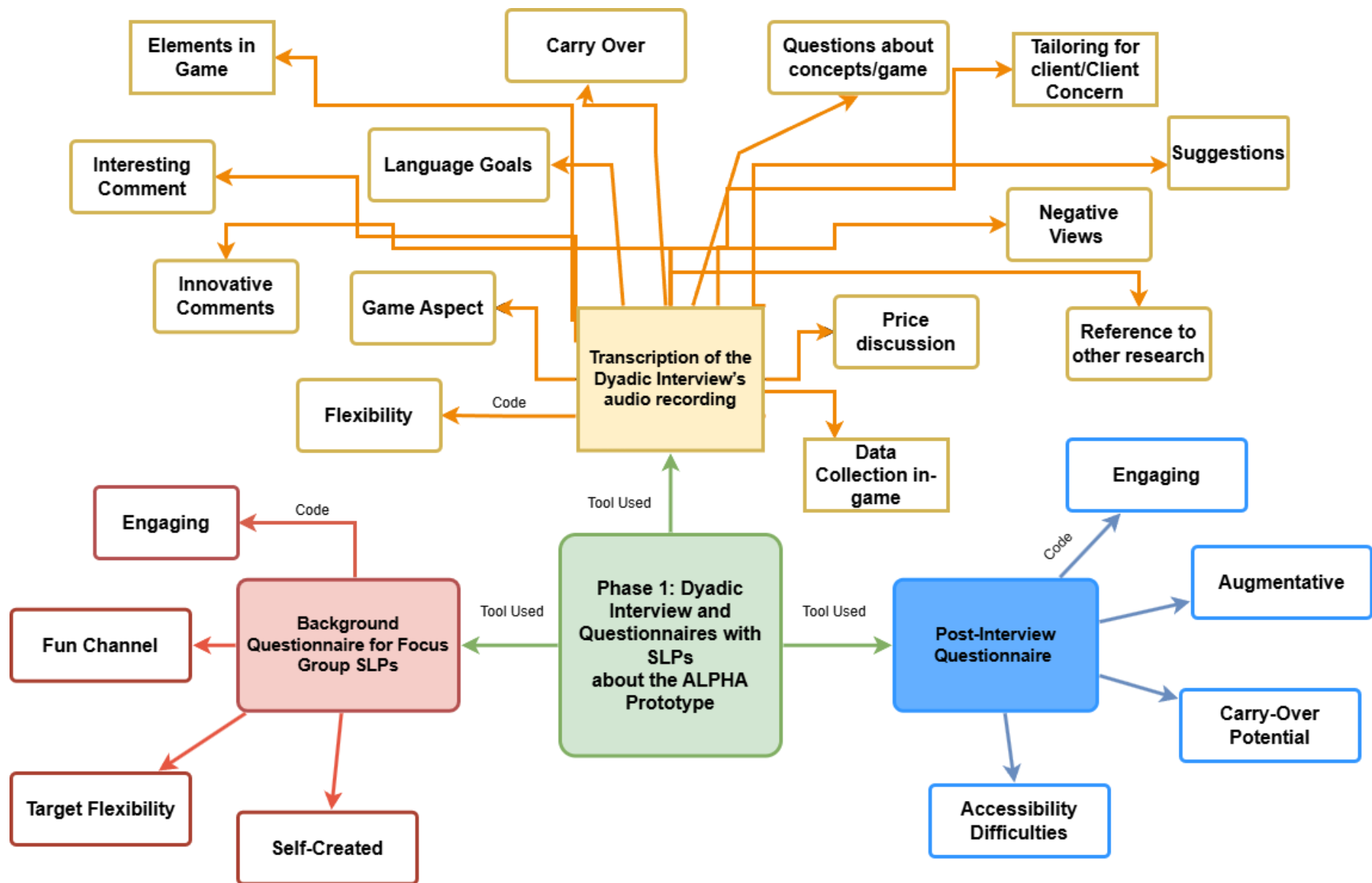
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Appendix F: Enlarged Figures

List of Enlarged Figures:

1. Figure 6: Codes Elicited from Phase 1's Data Collection
2. Figure 7: Data Coding Scheme for Phase 1's Codes
3. Figure 8: Codes Elicited from Phase 2's Data Collection
4. Figure 9: Data Coding Scheme for Phase 2's Codes
5. Figure 10: Codes Elicited from Phase 3's Data Collection
6. Figure 11: Data Coding Scheme for Phase 3's Codes
7. Figure 12: Codes Elicited from Phase 4's Data Collection
8. Figure 13: Data Coding Scheme for Phase 4's Codes
9. Figure 14: Thematic Map of the Main Themes and Emerging Sub-Themes





Code	Theme	Subtheme
Carry Over	3	10
Elements in Game	1	2
Interesting Comment	2	7
Innovative Comment	2	7
Game Aspect	1	2
Flexibility	4	11
Data Collection in-game	3	9
Price Discussion	1	6
Negative Views	5	13
Reference to other Research	1	4
Suggestions	1	5
Tailoring to client/Client concern	4	11
Questions about concept/game	2	7
Language Goals	4	12

Code	Theme	Subtheme
Engaging	1	3
Augmentative	2	7
Carry Over Potential	3	10
Accessibility Difficulties	5	13

Code	Theme	Subtheme
Engaging	1	3
Fun Channel	1	6
Target Flexibility	4	11
Self-Created	2	7

Phase 2: Observed gameplay workshops and self-input questionnaires with TD children and their caregivers

Typically Developing (TD) Caregiver Questionnaire

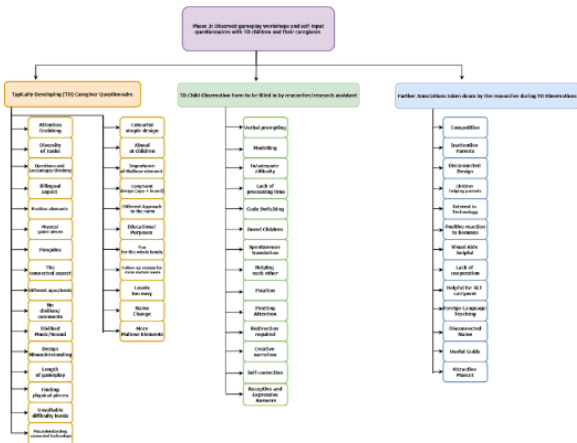
- Attention Grabbing
- Diversity of Tasks
- Questions and Encourages thinking
- Bilingual aspect
- Positive elements
- Physical game pieces
- Penguins
- The connected aspect
- Different ages/levels
- No dislikes/comments
- Disliked Music/Sound
- Design Misunderstanding
- Length of gameplay
- Finding physical pieces
- Unsuitable difficulty levels
- Misunderstanding connected technology
- Colourful simple design
- Aimed at children
- Importance of Maltese element
- Congruent design (app + board)
- Different Approach to the norm
- Educational Purposes
- Fun for the whole family
- Follow-up version for more mature users
- Levels too easy
- Name Change
- More Maltese Elements

TD Child Observation Form to be filled in by researcher/research assistant

- Verbal prompting
- Modelling
- In/adequate difficulty
- Lack of processing time
- Code Switching
- Bored Children
- Spontaneous translation
- Helping each other
- Fixation
- Fleeting Attention
- Redirection required
- Creative narration
- Self-correction
- Receptive and Expressive Answers

Further Annotations taken down by the researcher during TD Observations

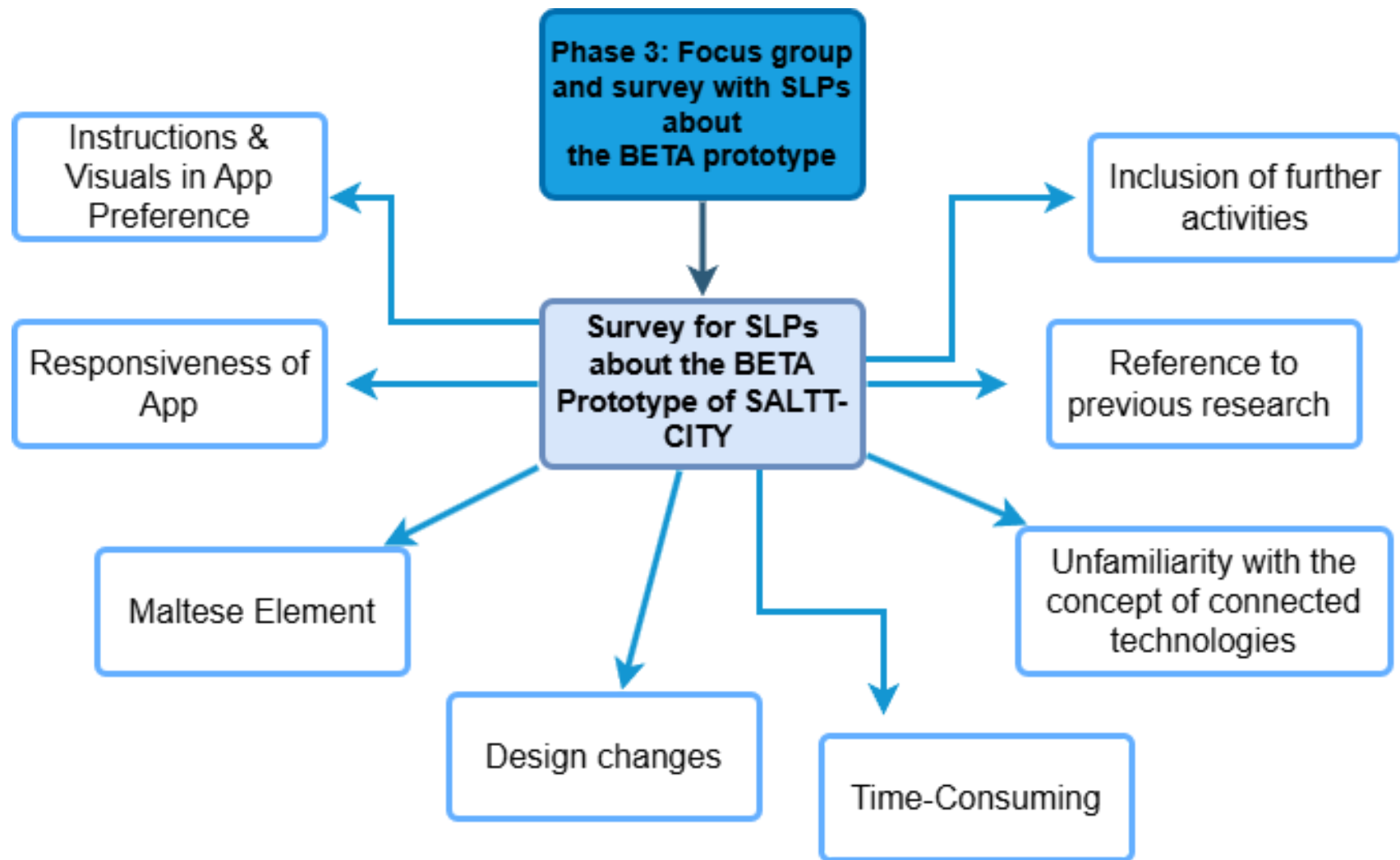
- Competitive
- Inattentive Parents
- Disconnected Design
- Children helping parents
- Interest in Technology
- Positive reaction to bonuses
- Visual Aids helpful
- Lack of cooperation
- Helpful for SLT carryover
- Foreign Language Teaching
- Disconnected Name
- Useful Guide
- Attractive Mascot

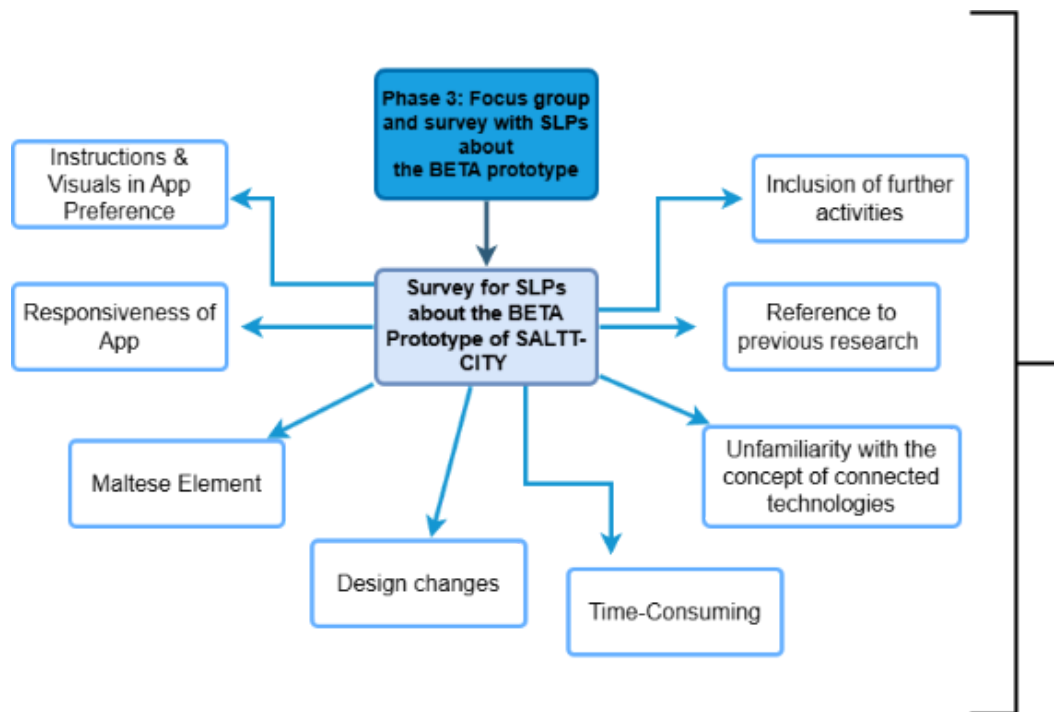


Code	Theme	Subtheme
Attention Grabbing	1	3
Diversity of Tasks	1	2
Questions and Encourages Thinking	4	12
Bilingual Aspect	4	12
Positive Elements	2	7
Physical Game Pieces	1	2
Penguins	1	4
The connected aspect	2	7
Different ages/levels	4	11
No dislikes/comments	1	5
Disliked Music/Sound	5	13
Design Misunderstanding	1	5
Length of Gameplay	1	5
Finding Physical Pieces	1	2
Unsuitable Difficulty levels	1	5
Misunderstanding Connected Technology	2	7
Colourful simple design	1	1
Aimed at children	1	3
Importance of Maltese Element	4	12
Congruent design (app + board)	2	7
Different approach to the norm	2	7
Educational Purposes	3	8
Fun for the whole family	1	3
Follow up version for mature users	3	10
Levels too easy	5	13
Name Change	1	5
More Maltese Elements	5	14

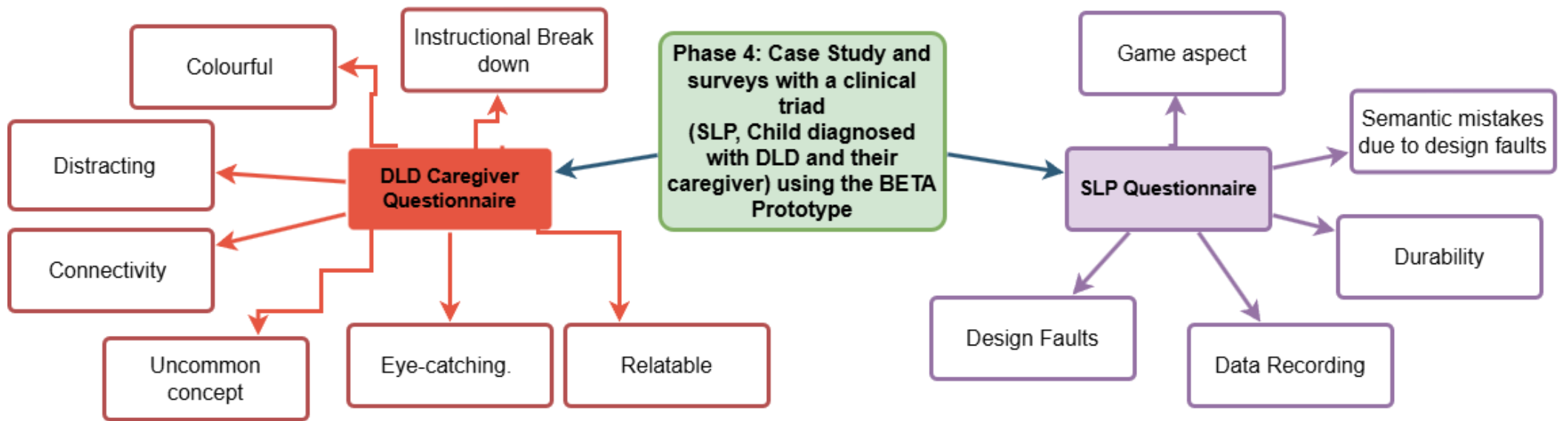
Code	Theme	Subtheme
Verbal Prompting	4	12
Modelling	4	12
In/adequate levels	5	13
Lack of Processing time	5	13
Code Switching	4	12
Bored Children	1	5
Spontaneous Translation	4	12
Helping each other	4	12
Fixation	5	13
Fleeting Attention	1	5
Redirection Required	1	5
Creative Narration	4	12
Self-Correction	4	12
Receptive and Expressive Answers	4	12

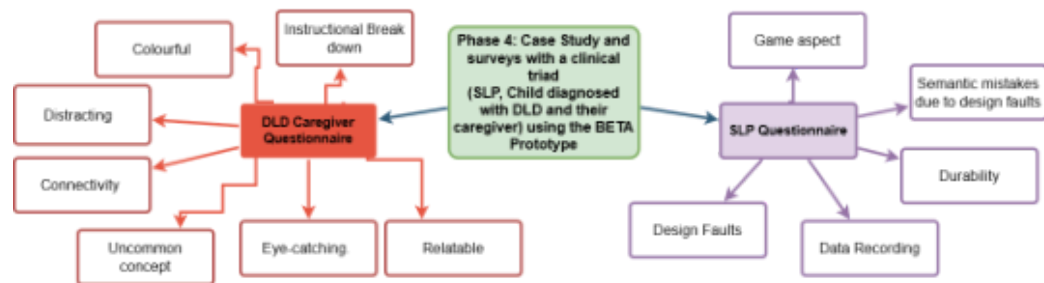
Code	Theme	Subtheme
Competitive	1	5
Inattentive Parents	1	5
Disconnected Design	1	1
Children helping parents	1	5
Interest in technology	2	7
Positive reaction to bonuses	3	9
Visual Aids helpful	1	1
Lack of cooperation	1	5
Helpful for SLT carryover	3	10
Foreign Language Teaching	3	8
Disconnected name	5	13
Useful Guide	3	9
Attractive Mascot	1	4





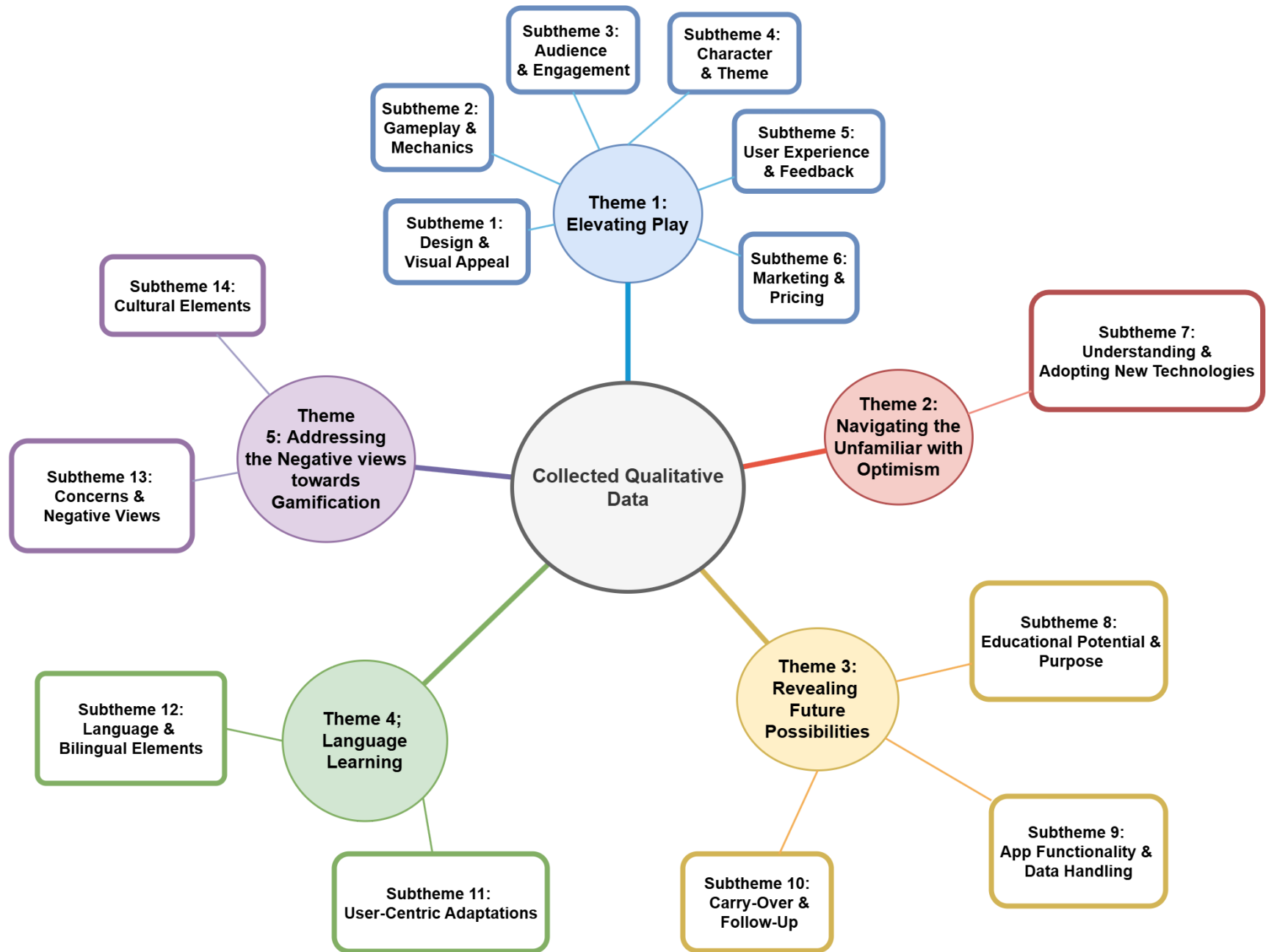
Code	Theme	Subtheme
Instructions and Visuals in App Preference	4	12
Responsiveness of App	3	9
Maltese Element	5	14
Design Changes	1	1
Inclusion of further activities	3	10
Reference to previous research	1	4
Unfamiliarity with the concept of connected technologies	2	7





Code	Theme	Subtheme
Colourful	1	1
Instructional Break down	3	9
Distracting	5	13
Connectivity	2	7
Uncommon Concept	2	7
Eye-catching	1	1
Relatable	1	1

Code	Theme	Subtheme
Game Aspect	1	2
Semantic Mistakes de to design faults	1	5
Durability	1	2
Data Recording	3	9
Design Faults	1	1



Appendix G: Sample Transcriptions

List of Sample Transcriptions:

1. Sample from the Audio Transcription of the Interview held in Phase 1
2. Sample from the Audio Transcription of the Clinical Session observed in Phase 4

Sample from the Audio Transcription of the Interview held in Phase 1	
RESEARCHER	First question, just to break the ice about the topic, did the board game itself catch your eye?
SLP 1	Definitely! The colours, the characters they're really interesting and I liked that it wasn't like the normal sorting or labelling. There's a bit of a more interesting element to it.
RESEARCHER	It was thought out to serve as a sort of language intervention toolkit. Basically, you'd have it in your clinic, and you can easily personalise it and adapt it to your client's abilities with a little bit of everything from the language basics. Obviously, we couldn't include everything that's used in the clinic for language sessions, but we tried to include a variety of activities into one tool. Anything from your end SLP 2?
SLP 2	It's very attractive in terms of the design and all of that it's very appealing. Even in the questionnaire that we filled in before. I know one of the things I

	<p>mentioned was the flexibility sort of and having an app that allows for those different activities to be not only targeted but even at different levels. It yields more flexibility plus you have the board, and you can target a number of skills.</p>
<p>RESEARCHER</p>	<p>Therefore, keeping on the same train of thought, what benefits do you see with having a product like this in your clinic?</p>
<p>SLP 1</p>	<p>To me it would be additional. I don't believe that it will replace anything, but I do believe it could augment therapy in terms of variety and interest. I think something it definitely adds is the element of a game. What I use games for is I use a game which is used for everyone like guess who or snakes and ladders and adapt it to my language goals. But this I think it will add this element of there is a game specifically for speech therapy that can't well no it can be played outside.</p>

RESEARCHER	Yes, no, it is in fact targeted for both therapeutic uses and the general typically developing population too.
SLP 1	Exactly but it's specifically a language game so no matter what language goals are being targeted.
RESEARCHER	That was a main point during the creation of this. Whatever you're doing with the game and the app, even if you're not sticking to the standard set of provided instructions you can still find a way to target goals. At a later point even just looking at the board and using the different themes for description or receptive drills.
SLP 2	My mind kind of veered off and I was thinking. One of the advantages is definitely the facilitation of carry-over but at the same time it's one thing to ask the parents to download an app and continuing something at home but I'm wondering if the board is required or if the games on the app can be played

	<p>separately without the board? Or say if certain pieces were missing?</p>
<p>RESEARCHER</p>	<p>So, the board would technically always be needed due to the physical pieces because you need to interact with the physical pieces to complete the tasks that the app gives you. However, I can see your point and a few ideas were tossed around about what would happen if a piece of the game was lost. We all know that it's quite common to lose or damage materials in the clinic so we're trying to include a way in the app that would make the tasks playable with the missing pieces being eliminated from the stimuli.</p>
<p>SLP 2</p>	<p>Okay, I see.</p>
<p>RESEARCHER</p>	<p>But with that being said the project is working on connected technologies. So, the aim is to have both the digital and the physical working together. As time passes, it's getting harder to get a child to sit down and play without having some form of a digital medium present.</p>

SLP 1	Definitely!
RESEARCHER	<p>Having talked about a slight limitation there, I'll ask my next question. Do you see any negative repercussions to introducing this in the clinic? Perhaps it would help if you pictured a particular client who you certainly wouldn't use it with and then explain why.</p>
SLP 1	<p>I think more opinions will come out when we see the actual physical pieces, like how small the pieces are. How much as in, is there a lot of placements for things to put on? I don't really think there is a negative side to including this in the clinic, it looks sound, but you will need to be careful with choosing your clients.</p>
RESEARCHER	<p>So, in terms of the physical pieces, we tried to scale them to have relational sizes to each other. For example, I can show you a few here. As you can see, the shirt is smaller than the bus but then the bird is smaller than the shirt.</p>

SLP 1	Okay, but they're quite big still. That was more of a safety concern but seeing them they don't look like they would be choking hazards.
SLP 1	I have another question.
RESEARCHER	Yes, sure.
SLP 1	Let's say I only wanted to target categories with my client. Would he still be able to get to the city centre? Because I know I'd have clients who would want to win no matter what.
RESEARCHER	You would basically just remove the other game cards and keep scanning the category ones. The app itself would then sort of generate different drills each time you scan it. In that way you'd still be able to keep playing but only using that task.
SLP 1	Cause I wouldn't want to have to play through the whole set of cards and all the different games with clients who would only really benefit from say two of them. In the end it would have you

	<p>know been not a waste of time but the game aspect of it in the clinic is not the main thing. At the end of the day, I would need it to target goals.</p>
RESEARCHER	<p>Taking it back to what you were saying SLP 2, would you guys prefer that the game starts and ends in one session? Or would you also consider spending only a portion of the session on the game and continuing from where you left in the next session?</p>
SLP 2	<p>Personally, I wouldn't want to push it and make them stop playing and then risking a tantrum because we didn't win, or we didn't get to the city centre.</p>
SLP 1	<p>I agree for sure. I also have another question. Can you play it board game only or do you definitely need a device?</p>
RESEARCHER	<p>You do need the device to access the app. Otherwise without scanning the QR codes you won't be able to get the task.</p>
SLP 1	<p>And the task is played solely on the device?</p>

RESEARCHER	No, you play it with both the physical and the app. So, the device tells you which pieces you need to use and phrases the question for you then you use the physical pieces to complete the instruction. Instead of doing it on the tablet.
SLP 1	That is for me as in I would enjoy it but I'm imagining some speech therapists that may find this a bit complicated.

Sample from the Audio Transcription of the Clinical Session observed in Phase 4	
Jane	It's Ms Jane's turn, okay? I'm going to get a card and I'm going to scan it.
Jane	Let's see what game we have. Alright, we have categories.
Researcher	So that's our penguin and he helps you play Mason. You have to listen to him.
Jane	Let's see what I need to do. I think I need to find all of these pieces and put them into different categories. Let's see if I can find them.
Jane	I have a teddy bear.
Mason	Look mummy!
Researcher	Mason, if you help Ms Jane you can move your penguin one step.
Jane	Will you help me find them? Look I found the teddy bear, can you find the table?
Mason	The car!
Jane	Very good, the car. Let's put it here, what else is there?
Mason	The bus.
Jane	The bus good. What else? What's this? Do you know what it's called?
Mason	Yes! So we can sit down
Jane	Mhm, it's called an ah-
Mason	Arm?

Jane	Armchair
Mason	Armchair
Jane	Who's that?
Mason	A chef!
Jane	A chef good job
Mason	To cook
Jane	Exactly, he cooks
Jane	Yes, she's there. Who's this?
Mason	Erm when you do me like that
Jane	Mhm she's doing like that. You know she's the one who teaches us. Do you know what she's called?
Jane	She's a tea-
Mason	Hmm
Jane	She's a teacher
Mason	A teacher. That special teacher
Jane	Exactly! What's this?
Mason	A t-shirt
Jane	This one is?
Mason	I have them

Jane	Yes, you have them. What are they called?
Mason	Pants
Jane	Pants, bravu pants. And this one? Do you know what it's called?
Mason	A kite!
Jane	A kite, good job. And the table, very good.
Mason	Cleaner!
Jane	Good job! Cleaner, yes. What else is there?
Mason	A chair!
Jane	A chair, bravu.
Mason	A chair!
Jane	This one is?
Mason	A flokk
Jane	Flokk. Do you know in English, what it's called?
Veronica	A sh-
Mason	A shirt
Jane	A shirt, good job.
Mason	Football....Basketball
Jane	Exactly, basketball.
Researcher	I think we have one more, or two more Ms Jane?

Jane	Let's see. And this one?
Mason	A dress!
Jane	And one more, which one's left? Vroom vroom. Bravu, what's this?
Mason	A motorbike
Jane	Now look, we need to split them up in different categories. Can you help me split them up? Let's see which ones.
Mason	Here
Jane	Let's put them here so we can see them.
Mason	Teddy bear
Jane	Now how do we split them up?
Mason	<i>*incoherent*</i> We put it right there. First, the chair it will be right here.
Mason	Will be a bus and right here
Jane	And which one goes with the bus?
Mason	The school?
Researcher	Look Mason, we have to split them up into five. So we have five groups of things look.
Researcher	We have the bus, and what goes with the bus?
Researcher	The chair or the motorcycle?
Researcher	There we go good job, alright.

Jane	Now what else goes with the bus and motorcycle?
Mason	The car!
Jane	Wow! Now what else?
Researcher	Good job, so that's done
Jane	Now we have five, sorry, four more groups.
Mason	Kite
Jane	Which one goes with the kite?
Mason	The
Researcher	So these are all transport Mason, with the kite, what do you think, should we put the teddy bear or the t-shirt?
Mason	The t-shirt
Veronica	What is a kite?
Mason	This one
Veronica	And what do you do with it?
Mason	I play with it
Veronica	And what do you do with the teddy?
Mason	He sleeps with it
Jane	We can also p-
Mason	Play!

Jane	So they go together and what are these?
Jane	T-T-T
Mason	Teddy....Toys
Jane	So, look these are transport. These are toys. Now let's find another group.
Researcher	Find another toy maybe?
Mason	No, those are the toys