The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools

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Abstract

Continuous Assessment (CA) is made up of assessment practices which take place within the natural setting of the classroom (Carlson et al., 2003). CA is aimed at moving away from summative assessment, toward formative assessment (William, 2011), where students are encouraged to become autonomous learners. However, Carless (2011) found that teachers rarely use the data they collect from CA tasks formatively, but rather use it for record-keeping purposes only. Therefore, the main aim of this research study was to explore the introduction and implementation of CA in Integrated Science in Maltese State schools to find out how teachers were implementing CA and the challenges that they were facing. This study involved seven science educators: two Education Officers, two Heads of Department and three science teachers. After receiving consent according to the ethical guidelines of the University of Malta, three focus group interviews were held with the participants using open-ended discussion and dialogue. The data collected was then analysed thematically by coding emergent themes and using participant quotations to develop a coherent narrative. A key point which emerged from this study is that the teachers navigated through the CA reform using adaptability. Initially, they were resistant to the removal of half-yearly examinations, however, they adapted to this change by incorporating summative tests into their school-based assessment. As a result of collaborating with the EOs, teachers were able to implement new assessment methods which include project-based learning, role play, and peer-assessment. The need for more dialogue between policy makers, EOs, and teachers also emerged, along with the need for more professional development sessions through which teachers can be trained on how to deal with CA better. This research study has brought some current issues regarding CA implementation to light, the teachers and EOs are

doing a great job at creating assessment tasks which engage the students and motivate them to become autonomous learners, however, there is still the need to focus on how CA can be a formative experience for both teachers and students.

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List of Abbreviations

BLO – Broad Learning Outcome

CA – Continuous Assessment

CCP – Core Curriculum Programme

EO – Education Officer

FREC – Faculty Research of Education Committee

HOD – Head of Department

LOF – Learning Outcomes Framework

NCF – National Curriculum Framework

PBL – Project-based Learning

PD – Professional Development

SBA – School-based Assessment

UREC – University Research Ethics Committee

Introduction

1.1 Rationale and Aim of the Research Study

Assessment has a variety of purposes, it can be formative where it is used to support student learning, and it can be summative where it is used for certifying student learning (Black & William, 2007). Within the Maltese context, the National Curriculum Framework (NCF) highlighted the importance of formative assessment since it improves teaching and learning and results in an increase in student achievement (MEDE, 2012). However, even though the NCF emphasised the importance of formative assessment, research studies (Grima & Chetcuti, 2003; Buhagiar & Murphy, 2008) suggest that assessment practices in Maltese classrooms still predominantly revolve around examinations. So as to shift the emphasis from summative assessment to more formative practices in Maltese classrooms, the Learning Outcomes Framework recommended a reform in assessment practices such that half-yearly examinations have been replaced by Continuous Assessment in Maltese State schools (Eurydice, 2021).

Continuous Assessment (CA) is defined as a formally planned programme which is implemented at a national-level and is aimed to guide curriculum-based assessment in classrooms for both formative and summative purposes (De Lisle, 2014). In Integrated Science, CA is described as a mode of assessment through which teachers collate CA marks throughout the scholastic year based on various tasks such as hands-on activities, practical work, projects, research, written and oral tasks, and other activities (DLAP, 2019). William (2011) states that the main aim of CA is to move towards formative assessment, however, international studies (Carless, 2011) found that teachers rarely use data from CA tasks formatively, but rather use the data for record-keeping purposes only.

As a science teacher who would eventually need to implement CA in my science classrooms, I was interested in finding out how teachers were using CA and whether the original intentions of moving towards more formative assessment in science classrooms were being reached. The implementation of assessment reforms evokes a range of emotions, particularly when teachers, who are responsible for carrying out these changes, are excluded from the decision-making process. Nunan (2003) states that whether a policy is successful or not depends on the way in which it is implemented in the classroom. Therefore, the main aim of this research study was to explore the introduction and implementation of CA in Integrated Science in Maltese State schools so as to find out how teachers were implementing CA and the challenges that they were facing. More specifically, the research study addresses the following research questions:

1. What are the views of science teachers regarding the introduction and implementation of CA in Integrated Science?
2. What kind of CA tasks are science teachers using?
3. What challenges are the teachers facing when implementing CA in their science classes?

1.2 The Structure of the Dissertation

Following this introduction, the second chapter of this dissertation presents a review of the literature on different types of assessment, particularly focusing on CA. A review of documents reviewing the introduction of CA within the Maltese context is also included. The methodology of this research study is described in Chapter Three, it outlines how the data was collected and analysed, and the rationale behind the choices made. In Chapter Four, the

results of the data collection are presented along with how the data was categorised into the main themes. These main themes are then discussed in Chapter Five which links the results with the literature. The concluding chapter presents the implications of this research study, its limitations, some recommendations for future research, and my final reflections. Throughout this dissertation, APA 7th edition formatting has been followed.

Literature Review

2.1 Defining Assessment

Elwood and Lundy (2010) define assessment as a "powerful umbrella term that incorporates a diverse range of actions and processes" (p. 335). These actions and processes can include examinations or tests which are formal evaluations of children's learning, and informal assessments that teachers routinely carry out in the classroom and are used to obtain information about students' learning and achievement (Elwood & Lundy, 2010). The information obtained from examinations and informal classroom assessments, can then be used for different purposes. Traditionally, the information obtained from assessment practices, is used to measure student learning and achievement (Gipps, 1994). This is in line with a psychometric theoretical framework, "in which the concepts of 'scientific measurement' are closely aligned with traditional curricula and beliefs about learning" (Shepard, 2000, p. 4). Within this framework, the main aim of assessment is to monitor educational progress against standards, at the end of a study unit, or school program, and can be used for selection and certification purposes (Klenowski & Wyatt-Smith, 2014). This is often referred to by teachers and educators as summative assessment (Bell & Cowie, 2002).

More recently, new information about the way in which students learn, has led educators and researchers to identify another purpose of assessment. While in the traditional model of assessment, assessment practices are used to evaluate the effectiveness of instruction at the end of a course of study or topic, and the processes that enabled learning were not considered as being a part of the assessment, new models of assessment have started to look at learning activities as being an integral part of the

assessment process (Wiliam, 2011). Within this new paradigm, rather than assessment of learning, the emphasis is on assessment for learning (Elwood & Klenowski, 2002). The focus is on assessment that is more student-centred, and teachers' assessments are being used to "mediate the development of intellectual abilities, construction of knowledge and formation of students' identities" (Shepard, 2000, p. 4). The information obtained from assessment is used to provide students with feedback in order to improve their learning (Black et al., 2003); and it is also formative in that the information can be used to adapt the teaching so that learning needs are met (Black & Wiliam, 2009). It is through assessment that teachers can find out whether the instructional activities used to engage students have resulted in the intended learning outcomes (Wiliam, 2013). Assessment therefore becomes the "bridge between teaching and learning" (Wiliam, 2013, p. 15).

2.2 Summative Assessment

Summative assessment occurs when information on students' achievement is collected at planned intervals; to provide a summary of the students' progress over time and information about what the students have achieved to date (Carlson et al., 2003; Klenowski & Wyatt-Smith, 2014). Summative assessment is used at the end of instruction such that after completing a unit or a school year, the students' level of attainment is determined (Wyatt-Smith et al., 2014). Wyatt-Smith et al. (2014) state that one purpose of summative assessment is to certify students' learning. Additionally, Chappuis et al. (2012) explain that the purposes of summative assessment are to: "provide evidence of student achievement for the purpose of making […] judgment about student competence or program effectiveness" (p. 6). This implies that summative assessment is used for making decisions on grading, promotion, graduation, and certification of student competence.

Moreover, information gathered using summative assessment is used for recording and accountability purposes. Such information is used by policy makers, curriculum planners, teachers, parents and students (Chappuis et al., 2012).

2.2.1 Formal Examinations

Formal examinations which students must sit for at the end of each school year and at the end of secondary schooling are an example of summative assessment. These examinations are summative because they occur at the end of a unit of study, and measure achievement at a specific period in time (Richardson, 2022). The achievement is also described using a summative grade, mark, or qualitative descriptors or criteria that are easily comprehensible and can be used by students for entry into further studies or future careers (Richardson, 2022). Examinations are considered by many educators to be the most fair and objective way of measuring student achievement of standards, since they provide a reliable and valid way of comparing standards, especially when linked to high stakes certification that is used for selection purposes (Klenowski & Wyatt-Smith, 2014).

The use of examinations as a form of summative assessment has been critiqued because of its effect on students (Madaus, 1988). Research suggests that summative assessment outcomes, especially outcomes of high-stakes examinations, may significantly impact students' lives. Richardson (2022) states that summative outcomes often signify a turning point in students' lives; for example, when students finish their secondary schooling and need to decide if they are going to opt for higher education or not. Additionally, getting good grades in high-stakes examinations results in qualification which is critically important to students; especially when seeking employment (Richardson, 2022). Grades tend to dominate many students' lives and such fixation on getting good grades has adverse effects

on classroom environment (Chappuis, 2012). Remesal (2011) states that students often perceive assessment used for summative purposes as being a stress factor. On the other hand, the importance of these high-stakes examinations might serve as motivation for some students to pay attention during lessons.

The importance given to examinations can also have an impact on teachers. Black et al. (2010), for example, suggest that teachers feel pressured by the system because of the priority given to examination and test results by parents, students and school management. In some cases, summative assessment results in teachers having low morale; due to the lack of autonomy and participation they have in decision-making on curriculum and assessment (Koh, 2014). Hargreaves and Fullan (2012) also state that high-stakes testing "restricts teachers' autonomy, subjects the teachers to endless intervention, [and] drives them to compete instead of collaborate" (p. 82). Looking at the impact of examinations on teachers from a positive aspect, Black and Wiliam (2018) suggest that teachers should collaborate and regularly meet such that they produce summative assessments which are dependable and comparable between schools giving teachers a sense of autonomy that could increase their morale.

2.3 Formative Assessment

Harlen and James (1997) state that formative assessment is feedback to both "the teachers and to the pupil about present understanding and skill development in order to determine the way forward" (p. 369). For Black and Wiliam (2009) assessment is formative:

> …to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in

> instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited (p.7).

The purpose of formative assessment is to gather evidence to improve instruction in a way that supports learning and improves achievement (Chappuis et al., 2012). This can be done by providing students with feedback on their work, that includes advice on how they can improve. Furthermore, Black and Wiliam (1998a) state that "we need to move towards an approach that values a continuous learning journey and a partnership between student and teacher" (p. 5). This can be achieved by changing our approach to assessment to encourage students to work both individually and with their peers and their teachers to understand the reasoning behind their learning and what they need to do to reach the standards expected of them, and hence help them to become metacognitive and life-long learners.

2.3.1 The Main Strategies of Formative Assessment

Wiliam and Leahy (2015) identify five key strategies of formative assessment. The first strategy, "clarifying, sharing, and understanding learning intentions and success criteria" (p. 11), emphasises the importance of the use of success criteria by teachers and learners. The second strategy "engineering effective discussions, tasks, and activities that elicit evidence of learning" (Wiliam & Leahy, 2015, p. 11) puts forward the teacher's role in eliciting information on students' learning through different tasks. The third strategy emphasises the teacher's role in "providing feedback that moves toward learning" (Wiliam & Leahy, 2015, p. 11) whereby students are not only told which level of learning they are in but also what they can do to learn and achieve more. The fourth strategy focuses on peer-assessment which "[activates] students as learning resources for one another" (Wiliam & Leahy, 2015, p. 11). The last strategy for formative assessment is "activating students as

owners of their own learning" (Wiliam & Leahy, 2015, p. 11) which highlights that the goal of formative assessment is to encourage students to become independent and life-long learners. Formative assessment can be used in the science classroom by making use of group work and think-pair-share activities; by asking students to make a prediction during scientific inquiry activities where students make use of their current understanding and share their ideas with their peers. Additionally, students can learn through argumentation during which there is student-student and student-teacher discussion (Hammerman, 2009).

2.3.2 Effect on Student Learning

Black and Wiliam (1998b) found that formative assessment tasks increased achievement in low-performing students to the point that they approached the level of achievement in high-performing students. The main reasons for this increase in achievement is that formative assessment allows students to develop the capacity to monitor and improve the quality of their work (Sadler, 1989). The strategies of formative assessment such as feedback from teachers and peers and helping students to become more aware of what is expected from them so that they can engage in self-assessment, have all been shown to increase student achievement (Chappuis et al., 2012; William & Leahy, 2015).

2.3.3 Teachers' Views

Implementing formative assessment is not a minor shift in practice as teachers need to think about how learners can achieve their goals and not simply to measure their achievement. Many teachers find it difficult to implement formative assessment as it requires a change in existing mental models and active episodes of accommodation, during

which new mental models need to be constructed (Earl & Timperley, 2014). For teachers to implement formative assessment, they require motivation and justification so that they become aware of the benefits and do not think it is just “this year’s new idea” (Black et al., 2003, p. 103). However, teachers are very often told the theory and practice behind formative assessment by a researcher or a facilitator without being examined on their existing conceptions of assessment. This leads to teachers incorporating some aspects of formative assessment into their current beliefs and they feel that they are implementing formative assessment, whereas it is not the case (Earl & Timperley, 2014).

Teachers’ views of formative assessment influence how they implement it. If a teacher does not believe that it will benefit their students and does not feel that students should be responsible for their learning, then implementation of formative assessment will be superficial and short-lived (Black et al., 2003). Black et al. (2003) state that when using formative assessment, both the teachers and students need to work harder, and there is an element of risk for both the teachers and students. When formative assessment is used in the classroom, students are given a voice which is a difficult task for teachers. Teachers feel that control becomes a big issue when implementing formative assessment and the changes that occur might make confident teachers feel that they are incompetent. Additionally, a new classroom culture is set up which teachers view as making both themselves and the students feel insecure at the beginning. However, teachers have noted that when they empower their students to learn for themselves, through questioning, feedback, self and peer assessment their job becomes more personally rewarding (Black et al., 2003).

2.4 Continuous Assessment

Continuous assessment (CA) can be described as assessment practices that take place in the natural setting of the classroom, where student performance across different learning modalities is observed and recorded by the teacher (Carlson et al., 2003). Continuous assessment can serve both a summative as well as a formative purpose.

2.4.1 Summative CA

When used for summative purposes by the teacher or the school, CA is usually fully structured and planned, taking place at predetermined time-intervals. The main purpose of having summative CA is usually for record keeping and providing students with a mark or a grade, or summative statements about learning outcomes achieved (Muskin, 2017). While end-of-year examinations, only provide a summative judgement on one occasion, continuous summative assessment provides snapshots of achievement at different time intervals, with an achievement profile being built over time. As pointed out by Carlson et al. (2003), documentation of how students' understanding, and skills have evolved can be accumulated and provide data for reporting students' progress over time.

2.4.2 Formative CA

Carlson et al. (2003) state that "continuous assessment is formative by nature" (p.4). In their view CA is formative because it is part of the everyday teaching and learning processes taking place in the classroom, and the information gathered from the CA is obtained when the students are engaged in learning and used to inform and form practice. The main purpose of formative CA is to determine the level of knowledge students have, diagnose any problems, make decisions on the next instructional steps, and evaluate

whether learning has taken place during the lesson (Greaney & Kellaghan, 2004). When CA is an integral part of assessment practices in the classroom, it strengthens students' learning, where through feedback students are guided and helped to engage purposefully with learning (Muskin, 2017).

As argued by Lumadi (2011), within the context of the classroom, CA should be more than just an examination at the end of instruction, it should be an integral part of instruction which informs the teacher on how to further student growth. Lumadi (2011) also argues that in CA, assessment should be done for students and not to students, this means that the purpose of assessment is to enhance student learning. Making use of CA in the classroom can also be a formative experience for teachers. Carlson et al. (2003) point out that through their continuous assessment of their students' work, teachers can better understand their students' thinking and they can develop better strategies to guide their students for further growth. By using their observations of students, they can reflect on their practice and refine their teaching and learning strategies (Mirza, 2021). Using the information from CA, teachers can also work with their colleagues and by sharing experiences, new perspectives on teaching, learning and assessment can be developed (Carlson et al., 2003). Mirza (2021) therefore argues that CA is a system which is formative in nature, however, also takes into consideration final grading and documentation. As Carlson et al. (2003) and Mirza (2021) point out, the data being collected on student learning is being used to improve instruction, which, as Lumadi (2011) states, enhances learning. However, CA is not only formative, CA, also has a summative component in which the data gathered is used for summative purposes at the end of the topic or scholastic year. In CA, data which are continuously collected serve two purposes, the first purpose is for guiding instruction, and the second purpose is for final grading.

2.4.3 Implementation of CA in the Science Classroom

In the science classroom, most science learning is inquiry-based where students: (1) learn about the concepts of scientific topics such as properties of matter, animal diversity and the earth and space; (2) engage in scientific processes such as observation, identification of a research problem, taking accurate measurements and arriving at conclusions from experimental data; and (3) develop scientific dispositions such as curiosity, perseverance and creativity (Carlson et al., 2003). There are several ways in which teachers can implement CA in the science classroom.

One technique suggested by Carlson et al. (2003) is for teachers to observe students while they are engaging in inquiry-based learning or conducting an experiment for example. Students can be asked to conduct an experiment, and write a report on what they have observed, the results they obtained and their conclusions. Following an initial assessment, the teachers can provide feedback to the students to help them reflect on their work, think about alternatives, and delve deeper into the investigation they were conducting. This according to Carlson et al. (2003) is a CA strategy that helps to improve student learning. Furthermore, the teacher can initiate a whole-class conversation in which learning occurs through inquiry and peer tuition, where different concepts are being discussed and students' knowledge is being unpacked. This is also combined with allowing students to self-assess so that they become more autonomous learners (Carlson et al., 2003; Llosa et al., 2023).

2.4.4 Teachers' Views Regarding CA

Many teachers perceive assessment as being an end of topic or end of year event due to their own educational experience. Carlson et al. (2003) worked with teachers whilst they implemented CA, and as they did so, teachers started realizing how assessment is not an end activity, but rather, a starting point for further learning. Teachers also became familiar with getting to know what the students had learned through activities and discussions rather than through tests (Carlson et al., 2003). The importance of reflecting on lessons also surfaced, teachers were trying to document everything students said to carry out CA, however this method was not effective as teachers felt that they were missing out on engaging with the students. When teachers started to take on the role of being facilitators and reflect on their practice, they felt that they became better listeners and could engage in various activities to implement CA (Carlson et al., 2003).

Muskin (2017) states that the goal of CA is to generate a detailed diagnosis on student knowledge, however, there are challenges which jeopardize this goal. The first is that some teachers might be confused with what CA entails in terms of purpose and strategy. Another challenge is that teachers need to carry out and use CA effectively, however, they might not be informed enough to do so (Muskin, 2017). Lumadi (2011) states that for CA to be done meticulously, there needs to be teacher training such that teachers are able to face any challenges that might surface. Moreover, apart from a one-time training event, there should be follow-ups to ensure that the teachers are given the necessary skills to carry out CA (Lumadi, 2011).

2.5 Continuous Assessment in the Local Context

Traditionally assessment practices in Maltese schools have focused on half yearly and annual examinations, as well as giving students class and homework tasks (Grima & Chetcuti, 2003). Heads of school interviewed by Grima and Chetcuti (2003), stated that examinations were the most objective and reliable form of assessment, which gave a clear indication of student achievement at the end of a year of study. However, the publication of the Framework for Education Strategy for Malta, with goals from 2014 to 2024 (MEDE, 2014) led to changes in this focus on examinations and in assessment practices in Maltese schools. The main aim of the Education Strategy was to have an educational system which ensured that all students had the opportunity to become active citizens and have the necessary skills to succeed in work and society (MEDE, 2014). The Strategy proposed the modernisation of teaching, learning and assessment and a move away from the traditional content-based approach of teaching and learning towards a learning outcomes approach. As a result, the Learning Outcomes Framework (LOF) was launched in 2015, with the aim to "free schools from centric syllabi while equipping them with guiding levels of achievement that the learners should achieve according to their personal level of development" (Said Pace, 2016, p. 3490).

The introduction of the LOF (2015), necessitated changes in assessment practices in schools, with the introduction of school-based assessment in schools to complement summative assessment at the end of the school year (Attard Tonna & Bugeja, 2018). Another change was the abolishment of the half yearly examinations to gain more time for teaching and learning (Spiteri, 2018). The introduction of school-based assessment, which started to be referred to as Continuous Assessment (CA), was intended to provide learners

with an opportunity to be assessed through different modes and activities to give value to the different ways in which students learn (Bugeja, 2019).

2.5.1 Introducing CA in Maltese Schools

The Education Agency for Special Needs and Inclusive Education report (2014) states that the Maltese educational system is highly centralised and that decisions are taken in a 'top-down' manner. This means that decisions are either taken at Ministry level or are guided by the Ministry. Attard Tonna and Bugeja (2016) state that this 'top-down' approach results in curriculum reforms which are centrally driven and cause a gap between policymakers and practitioners. In fact, in a study by Buhagiar and Chetcuti (2021), heads of school indicated that they felt that the introduction of CA was a top-down decision and that teachers and SLTs were not involved in the decision-making process, the teachers felt that they had no voice in the assessment reform but still, they were the ones who had to implement CA with their students. Heads of school indicated that they were informed by email of the changes in assessment practices and had very little training on how to carry out CA (Buhagiar & Chetcuti, 2021). This led to some teachers resisting the introduction of CA, mainly because they were not sufficiently aware of what was expected of them, and how to create appropriate CA tasks (Attard Tonna & Bugeja, 2016). The teachers saw the LOF and CA reforms as simply being another reform and not an opportunity for enhancing teaching and learning (Said Pace & Seguna, 2018).

Eventually, teachers were provided with some training regarding the LOFs and CA, through a 'Train the Trainer programme' which was intended to keep teachers in the loop of any changes and developments in assessment practices (Attard Tonna & Bugeja, 2018). Furthermore, professional learning sessions were carried out for teachers, that were subject

specific and helped the teachers with ideas, planning assessment tasks, and allowed them to voice their concerns about the challenges of using CA (Said Pace & Seguna, 2018). Teachers interviewed by Attard Tonna and Bugeja (2018) and Said Pace and Seguna (2018), stated that they were tired of the system constantly changing, that they were afraid that CA would take away valuable teaching time, and that students still needed to be prepared for the end of the year examinations. Teachers also expressed the need for more training in assessment practices. However, it was clear that teachers and administrative staff felt powerless and voiceless with regards to the introduction of CA, and that there was still a wide gap between policy and practice in the Maltese educational system (Chetcuti & Buhagiar, 2021).

2.5.2 The Format of CA in Maltese Science Classrooms

Since the focus of the current study is CA in Integrated Science in Years 7 and 8, reference will be made only to CA at this level, since CA in Years 9 to 11 is organised in a different manner. The initial idea for the introduction of CA was to have assessment tasks integrated as part of the teaching and learning process. The aim was for teachers to make use of different modes of assessment such as role play, quizzes, presentations, games, discussions and other innovative tasks in order to assess whether students had achieved specific learning outcomes (Cachia & Bugeja, 2020). The CA tasks in science (and in other subjects as well), are used summatively and students are given a mark based on the different tasks carried out. These marks are obtained at regular intervals and an average mark collated in the middle of the year and at the end of the year. As shown in Table 2.1, these marks then contribute to 30% of the global mark given to students at the end of the year.

Programme	Mid-yearly		Annual		
	Continuous	Summative	Continuous	Summative	Global*
Year 7 *(mainstream)*	Award a mark out of 100	*not applicable*	Award a mark out of 100	Award a mark out of 100	30% continuous + 70% summative
Year 8 *(mainstream)*	Award a mark out of 100	*not applicable*	Award a mark out of 100	Award a mark out of 100	30% continuous + 70% summative
Year 7 *(CCP)*	Award a mark out of 100	*not applicable*	Award a mark out of 100	*not applicable*	*not applicable*
Year 8 *(CCP)*	Award a mark out of 100	*not applicable*	Award a mark out of 100	*not applicable*	*not applicable*

** The marks in this column are calculated automatically by the online portal, based on the assessment weightings indicated.*

Table 2.1 Summary of marks to be entered into the online portal.

As outlined in a school circular issued by MEDE (2018), in both Years 7 and 8, the mid-yearly CA mark will be based on activities or tasks which are chosen at the discretion of the science teacher. Such tasks should be graded and can include various activities such as quizzes, online activities, presentations, journals, projects, classwork, games, tests, and any other valid activities. It is recommended that there is a variation in activities from one task to the next (MEDE, 2018). The mid-yearly CA mark can also include practical work, school-based assessment (SBA), project-based learning (PBL), and fieldwork, factored into it. The final mid-yearly CA mark shall be inputted on the online portal as a mark out of 100.

The annual CA mark for year 7 is based on three components: practical work, PBL and SBA. There are 15 marks allocated to practical work, 10 marks allocated to PBL, and 5 marks allocated to SBA. The final mark over 30 is then be converted to a percentage i.e., over 100, and this mark is to be inputted into the online portal. The 15 marks on practical work should be based on 7 practical reports which should include experiments from each science strand: Chemistry, Biology, and Physics. They should also include at least one fieldwork or site visit. The PBL is allotted 10 marks and should be done on the topic Energy across all schools, this topic will not feature in the annual exam and the project is moderated. The final 5 marks are allotted to SBA, the activities for this assessment are up to

the discretion of the teacher but shall not be awarded based on behaviour (MEDE, 2018). The annual CA mark for year 8 is divided in a similar manner to how it is divided for year 7. There are 15 marks allocated for practical work, these also include 7 practical reports, however, one should be related to Forensic Science, and a site visit is compulsory, since there are 10 marks allocated specifically for fieldwork. The 5 marks allocated for SBA have the same guidelines as those in year 7 (MEDE, 2018). Students in both year 7 and 8 who are following the Core Curriculum Programme (CCP) are assessed through tasks which are distributed throughout the whole scholastic year. During the annual exam period, students following the CCP are given a task. Once more, the choice of the tasks is up to the discretion of the teacher, both the mid-yearly and annual CA marks shall be converted to a final mark which is out of 100 (MEDE, 2018).

The assessment tasks are chosen by the teachers, who know their science students best and can make professional decisions on the number and kind of assessment tasks to be carried out in the science classroom (Cachia & Bugeja, 2020). Teachers are discouraged from doing tests during specific weeks during the scholastic year since this would defeat the purpose of removing the half-yearly examinations. While choice of assessment tasks is completely at their discretion, they have available examples of possible assessment tasks prepared by the science Education Officers (Cachia & Bugeja, 2020).

The format of CA in the Maltese science classroom is evidently mainly a way of obtaining a summative mark to assess whether students are achieving specific learning outcomes. The only difference is that rather than having a mark for the mid-yearly examination and the mark for the annual examination, students now have a mark based on the CA tasks and a mark on the annual examination. There is no indication, of any formative

feedback being provided for students on the assessment tasks and follow up being carried out by the teachers.

2.6 Conclusion

CA can be used for both formative and summative purposes but is naturally more formative in its nature. A summative approach to CA is used for record keeping and certification purposes, however, a formative approach to CA enables students to take ownership of their own learning and improves student achievement. Through this review of literature, it is evident that within the Maltese context, the teachers' views on CA have been given little to no importance prior to its introduction. Implementing CA requires a shift in teachers' practices and is not merely a new technique, but a fundamentally new approach to assessment. Hence, this research study explores the teachers' views on how CA was introduced, and how it is being implemented. The next chapter will delve into what methodology was used to explore how the participants feel about the CA reform.

Methodology

3.1 Introduction

This chapter looks at the methodology that was used to find out more about how Integrated Science teachers and EOs viewed the introduction of CA in Maltese State schools. It describes how the research was designed including the data collection process, along with necessary ethical considerations and data analysis. The approach taken was a qualitative one which enabled an in-depth focus into the views of Integrated Science teachers and EOs on CA and their ways of implementing it.

3.2 Objectives and Research Questions

Cohen et al. (2018) state that in research it is critically important to frame research questions. This because research questions focus, shape, and drive the research toward finding the answers to the questions that the researcher wishes to answer. Research questions also help make the research topic tractable (Cohen at al., 2018). The aim of the research study was to explore the introduction and implementation of CA in Integrated Science in Maltese State schools.

More specifically the research study tries to explore:

1. What are the views of science teachers regarding the introduction and implementation of CA in Integrated Science?
2. What kind of CA tasks are science teachers using?
3. What challenges are the teachers facing when implementing CA in their science classes?

Once the research questions were identified, it was then important to develop a research design which, as stated by Labaree (2013), should be coherent and logical.

3.3 Qualitative Research Methods

The main aim of this study was to explore the views of Integrated Science teachers and EOs regarding the introduction and implementation of CA in science classrooms across Maltese state schools. This involved the development of a research design, which as described by Merriam (1998), called for the development of a detailed plan that identified the way in which data and information would be collected, organised, and analysed to try and answer the research questions. This research design needed to be grounded within a theoretical framework which would as Denzin and Lincoln (2017) explain, lead to the identification of specific methods and ways of collecting and interpreting the data.

Since the current study was based on the views of teachers in their natural context, the science classroom, I decided that a qualitative research methodology would be the best approach. This decision was taken since the study focused mainly on the views of participants which corresponds to the characteristics of qualitative research which are described by Denzin and Lincoln (2017) as:

> Qualitative research is a situated activity that locates the observer in the world. Qualitative research consists of a set of interpretive, material practices that make the world visible…qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense or interpret phenomena in terms of the meanings people bring to them (p. 10).

Hammersley (2013) describes qualitative research as “a form of social inquiry that tends to adopt a flexible and data-driven research design” (p. 12). A qualitative approach was considered appropriate because as stated by Creswell (2018), “in the entire qualitative research process, the researchers keep a focus on learning the meaning that the participants hold about the problem or the issue” (p. 296). By choosing a qualitative research methodology I wanted to give what is described by Denscombe (2010) as an in-depth picture of a complex social situation and give voice to the participants of the study.

3.3.1 The Researcher in Qualitative Research

Qualitative research is “a set of complex interpretive practices” (Denzin & Lincoln, 2017, p.13). This means that as argued by Creswell (2016) the researcher is key in the collection and interpretation of data and information. In fact, one of the main critiques of qualitative research, is that the interpretation of the data by the researcher can be subjective and therefore cannot be generalised (Denscombe, 2010). However, for advocates of qualitative research this is a strength rather than a weakness (Denzin and Lincoln, 2017). In fact, as argued by Griffiths (1995), facts and values cannot be separated, and therefore, the researcher is out of necessity located within the research context itself. The researcher’s background, identity, and beliefs also come into play during interpretation of data, therefore it is very important for the researcher to be self-aware (Denscombe, 2010).

Therefore, to ensure that the research was conducted in a transparent way, qualitative researchers are encouraged to be reflective and reflexive about the research process. This means that all throughout the research process the researcher, needs to constantly reflect, and describe any decisions taken regarding the choice of methods,

themes, and coding, and eventually choice of quotations to include in the written text (Cohen et al., 2018). Tracy (2010) states that qualitative research should be credible, this can be reached by demonstrating clearly how the findings and conclusions were reached. In addition, "researchers need to examine situations through the eyes of the participants rather than the researcher" (Cohen et al., 2018, p. 19). This produces different sets of meanings which yield insights into the behaviour of participants, in this case, the science teachers.

3.4 Data Collection: Focus Group Interviews

Following the procedures outlined by Cohen et al. (2018), the next step in the research design involved deciding on which research instruments to use for the collection of the data. Since the research study involved looking at the views of teachers, it was decided that focus group interviews would best capture the insights of the teachers and provide what Kvale (1996) describes as an interchange of ideas between the interviewer and the participants. In fact, focus group interviews can be described as "a way of collecting qualitative data, which essentially involves engaging a small number of people in an informal group discussion (or discussions), focused around, a particular topic or set of issues" (Wilkinson, 2004, p. 177). Focus group interviews were thought to be the most suitable form of data collection since they allowed for discussion amongst the participants in a less threatening environment, thus allowing them to feel safe enough to share their views and opinions (Kruger & Casey, 2015).

In this research study, three focus group interviews were held. One focus group interview was held with the two EOs of Integrated Science. One other focus group interview was held with one Integrated Science HOD and the Integrated Science teachers

working with her. The last focus group interview was held with the other Integrated Science HOD and the Integrated Science teachers working with her. Through focus group interviews I gave the EOs and teachers the opportunity to freely discuss CA and its implementation with the possibility of agreeing or disagreeing with each other. My role during these interviews was to ensure that all the participants felt comfortable in voicing their opinions and that the discussion flowed smoothly. Throughout the focus group interviews carried out as part of the study, I tried to ensure that following Kvale (1996, p. 30) the interviews were designed in such a way that they:

- Were used to engage and interpret the teaching and learning context of the science teachers and Education Officers.
- Explored the real lived in context.
- Elicited in-depth descriptions of personal views and opinions.
- Were open and flexible.
- Were open to new ideas and insights that might not have been considered when designing the research.
- Were an interpersonal exchange with participants.
- Were an enriching and positive experience for all the participants.

3.4.1 Designing the Focus Group Interviews

Focus group interviews allow the researcher to explore the range of opinions and feelings people have regarding an issue, policy, or practice (Krueger & Casey, 2015). Therefore, the researcher needs to identify what are called information rich cases such as individuals "from which one can learn a great deal about the issues of central importance to the purpose of the research" (Patton, 2002, p. 46). When designing focus group

interviews, there are several procedures which should be followed (Ho, 2012). Firstly, one must ensure that the composition and size of the groups are well-thought. Groups can be either 'naturally occurring' or else 'pre-existing'. In a naturally occurring group, the participants would have been brought together solely for the purpose of the study, whereas in a pre-existing group, the participants would already know each other and might also work with each other (Kitzinger, 1995). In this research study, the participants of each focus group were a pre-existing group of people who work together on a daily basis. This was advantageous since as described by Kitzinger (1995) the participants interacted freely and were not hesitant to challenge each other.

Walden (2008) states that focus group interviews might have some limitations. Some participants could be either dominant or shy, meaning that ideas might either be overshadowed or might not emerge. However, focus group interviews were still the ideal approach for this study since they allowed the participants to discuss concepts and I could gather their opinions through these discussions (Krueger & Casey, 2015). So as to initiate such discussions, it was important to prepare for the interview. Following Cohen et al. (2018), I opted to use a semi-structed interview protocol. This meant that although the questions were developed prior to the interview, I allowed myself the flexibility and freedom as an interviewer, to move in the direction that the participants wanted. I therefore prepared a set of open-ended questions. Open-ended questions were chosen since according to Brown (2008) when questions are open-ended, they are more likely to allow the participants to elaborate on their experiences and give their opinions freely. When the questions used are open-ended, they put less restrictions on the way in which participants can respond and express themselves and can lead to answers that are not expected (Cohen et al., 2018).

3.4.2 Facilitating the Focus Groups

Within qualitative research, the interview is considered to be a social encounter and not simply a means of collecting data, therefore the role of the researcher as interviewer is of utmost importance (Cohen et al., 2018). Therefore, when facilitating a focus group interview, the researcher must follow certain protocols to ensure that all the participants feel safe and valued (Gill et al., 2008). As outlined by Gill et al. (2008), firstly, the researcher must react to the ideas of all the participants in a respectful manner, all their opinions should be valued and initiate further discussion. Secondly, it is important that the researcher does not engage in discussion with the participants as this might influence their answers and participants with opposing views might not voice their opinions. The interviewer is also responsible for maintaining the constant flow of conversation during the interview, ensuring that all the participants are motivated to express their opinions and that, in no way, should the interviewer impose themselves as being in a position of power over the participants (Cohen et al., 2018). It is also important to ensure that all participants are allowed to contribute to the discussion (Finch & Lewis, 2013).

Throughout the focus group interviews, I tried to adhere to the suggestions put forward by Gill et al. (2008) and Cohen et al. (2018), to ensure that I built a trusting relationship with the participants that allowed them to feel comfortable expressing their opinions. Furthermore, following Ho (2012), I ensured that the setup used during the focus group interviews was also one that encouraged interaction as the participants could all see each other, and everyone could feel that they were part of the group. The focus group interviews were also carried out face-to-face and at the workplace of the participants such that they were in their natural setting and thus felt comfortable (Krueger, 2002). The

ultimate aim of using focus group interviews was so that all the participants were able to contribute equally to the discussion.

3.4.3 The Focus Group Process

Setting up and conducting the focus group interviews involved the development of an interview protocol, that could be used in all the focus group interviews. Throughout, the focus group interviews conducted in this study I used the five-step model proposed by Finch and Lewis (2003):

Step 1: This involved setting the scene and ground rules. I began by re-introducing myself and reminded the participants about the aim of the research, and how the interview would be conducted. I explained that the interview was intended to be a conversation about their views regarding CA in science and that I was interested in their personal views and opinions. The participants were also asked to give their informed consent and sign a document indicating that they had agreed to participate in the interview without any form of coercion. The participants were also informed that they could opt out of the research interview at any point.

Step 2: Following my introduction, the next step suggested by Finch & Lewis (2003) was for the participants to introduce themselves and get to know one another. In my case, this was very simple to achieve since the participants worked in the same context and already knew one another. This was an advantage in the research since the participants already trusted one another.

Step 3: The third stage of the interview involved the asking of a few opening questions to set the ball rolling and to open the discussion. At first, the participants were a bit hesitant to express their personal views, as they seemed to be waiting for some kind of affirmation

or approval from my end. Eventually, as they became more engaged with the questions, they expressed themselves more freely.

Step 4: During this stage, the participants were engaged and focused on the discussion, and it was ensured that the topics being discussed were within the remit of the research study. At this point, the participants felt comfortable and were voicing their opinions whilst agreeing or disagreeing with each other in a respectful manner.

Step 5: This was the end of the interview, and as suggested by Finch & Lewis (2003), I tried to end the interview on a positive note, thanking the participants for their insightful comments and with the hope that their suggestions would be listened to by policy makers.

3.5 Ethical Considerations

Webster et al. (2014) state that an ethical researcher is one who considers the participants' well-being before, during, and after the research study. According to Webster et al. (2014), there are five principles which a research study should be based on, starting with the fact that the research should be one which is useful. The second principle is that the researcher should obtain informed consent from all the individuals involved in the study, and that participation is voluntary whereby no participants are pressured to participate. Another principle is that any risks of harm to the participants must be avoided. Finally, the participants' confidentiality and anonymity should be respected throughout the study. This research study is based on these principles. Before starting this study, since the participation of EOs and teachers was necessary, permissions were required, and ethical issues were dealt with early on in this research study. Ethical clearance from the Faculty Research of Education Committee (FREC) and the University Research Ethics

Committee (UREC) was obtained. Following this, permission to conduct research in state schools was obtained from the Ministry of Education, Malta.

3.5.1 Informed Consent

One very important ethical consideration of any research study is informed consent which can be defined as "those procedures for individuals to choose whether or not to participate in the research, once they have been told what it is about and what it requires" (Diener & Crandall, 1978, p. 57). Indeed, permission to conduct research was requested by means of a formal information letter which was sent to the following gatekeepers: the Director of the Directorate for Learning and Assessment Programmes, and the Heads of School of where the HODs and teachers work. This was followed by clearly informing the participants of what the study entailed and that they could opt out of this research study at any point. The participants were given information letters and consent forms which were then collected before the research study commenced. Webster et al. (2014) state that information letters should include the rationale and aims of the study, who is conducting the study, and within which institution this study is being conducted. It also needs to include what the participants are required to do, that they can withdraw whenever they want, and how the data will be stored and used. Webster et al. (2014) also emphasise the importance of seeking consent right before the data is collected, and this was done before the start of the focus group interview. The participants were also informed beforehand that the focus group interview would be audio recorded.

3.5.2 Confidentiality

Cohen et al. (2018) state that confidentiality is essential to protect the participants' right to privacy. Confidentiality is when information which can reveal the participants' identity is disclosed. The researcher knows the identity of the participants and their opinions, therefore, through confidentiality, this information must not be published (Cohen et al., 2018). With this in mind, personal information which could identify the participants, such as the school they worked at was deleted, and pseudonyms were used throughout the reporting of the results of the study. Some of the participants are highly identifiable individuals, therefore they were informed that the study would refer to their role in this case as Education Officers. Informed consent to use their job title was obtained before the focus group interviews. Even though the Education Officers are identifiable, they were still given pseudonyms to lessen the risk of immediate identifiability. The participants were also informed that the audio recordings of the focus group interviews would be stored securely and deleted in January 2025.

3.6 The Data Analysis Process

The focus group interviews were analysed using qualitative data analysis. This was done by analysing the data and interpreting it to elicit information from the data collected (Taylor & Gibbs, 2010). The main aim of qualitative data analysis is to make sense of the data collected by grouping the participants' opinions on a particular issue (Cohen et al., 2018). Cohen et al. (2018) state that in qualitative data analysis, data collection is done early in the research process such that a hypothesis or theory are derived from descriptive data. This was done by selecting and grouping the data collected.

3.6.1 Thematic Analysis

The data analysis which was carried out in this research study was a thematic analysis. The first step in data analysis was the transcription of the focus group interview audio recordings. Hycner (1985) states that transcription is an essential part of the data analysis process as it enables the researcher to familiarise themselves with the data collected and will thus make it easier to develop codes. Transcriptions were carried out right after the focus group interviews such that any non-verbal cues were easily recalled and included into the transcripts. The transcriptions were carried out using a word processor and then edited to ensure that there were no errors. Once the transcription process was completed, template analysis was carried out. Template analysis is "a type of thematic analysis where the aim is to create an analytic template in which the data can be categorized" (Cassell & Bishop, 2018, p. 4). The coding process was done manually by going through the transcriptions of the focus group interviews and assigning specific themes to different parts of the text. Guest et al. (2012) state that thematic analysis enables the researcher to capture in-depth meanings within the data collected. For a theme to emerge, it must be an issue or a concept which is repeatedly brought up by the participants (King & Horrocks, 2010). Once the themes were identified and analysed, an understanding of the issues discussed was formed (Taylor & Gibbs, 2010).

Even though thematic analysis is very time-consuming, it is advantageous as it enables the researcher to become well acquainted with the data during the coding process, and thus enables the identification of the main issues on the topic (Guest et al., 2012). Through this inductive research, insight was gained on how Integrated Science EOs and teachers perceive CA and how they are implementing it in the classroom.

3.7 My Role as a Researcher

One of the most important aspects of any research process, is that the data presented is authentic and trustworthy (Lincoln & Guba, 2011). To ensure that the views of the science teachers were presented in a transparent and realistic manner, I tried to be 'reflective' and 'reflexive' all throughout the research process. As argued by Denzin and Lincoln (2017), when the participants are prioritised during a research process, and the researcher stands back, and is critical of all that is going on, then the research data is more realistic and trustworthy. The important thing is for the researcher to be constantly self-aware and to acknowledge any personal ideas and views that might influence the collection and interpretation of the data.

In order to ensure this 'reflexivity', throughout the research process, I was constantly aware of my own views on the use of CA in science teaching. By reflecting on my own views and taking a step back, I tried to make sure that I was representing the views of the science teachers. This was done by using actual quotations from what the teachers were saying and making explicit, how these views were obtained and interpreted. I also kept reflective notes following the interviews with the science teachers to make sure that any factors that were relevant to the interpretation of the data were noted. This ensured that any representation of the data conformed to the criteria outlined by Lincoln and Guba (1985), such that the results were authentic, credible, and trustworthy.

Results

4.0 General Introduction: Setting the Scene.

The participants in the study (Table 4.1) were two Integrated Science Education Officers for State schools, two Heads of Department of Integrated Science, and three Integrated Science Teachers, also from the state school sector. The Integrated Science Education Officers (EOs) evaluate and report teachers' work. They also assess the progress of science education in schools. Matthew has been in this role for over fifteen years, whereas Owen has been in this role for the previous three years. The Heads of Department are responsible for coordinating the development of science education and to bridge the gap between the teachers and the education officers. Both Heads of Department and Tania, one of Integrated Science Teachers (T3), teach Integrated Science only. Tania has been teaching Integrated Science for ten years. The other two teachers, Sarah, and John (T1 and T2) both teach Integrated Science as well as Physics. Sarah has been teaching in her school for nine years, whereas John has been teaching Physics for thirty years in other schools but has started teaching Integrated Science and Physics in his school at the beginning of scholastic year 22/23. Amanda (HOD1), Sarah (T1), and John (T2) all teach at the same school, which is in the North of Malta. There are around 240 students in the school who are aged between 11-16 years. Julia (HOD2) and Tania (T3) both teach at the same school, which is also located in the North of Malta. There are around 300 students in the school.

Participants and Specialisation	Abbreviation	Pseudonym	Gender	Experience in current role
Education Officer of Integrated Science	EO1	Matthew	Male	Over 15 years
Education Officer of Integrated Science	EO2	Owen	Male	3 years
Head of Department of Integrated Science and Integrated Science Teacher	HOD1	Amanda	Female	6 years (20 years teaching in total)
Head of Department of Integrated Science and Integrated Science Teacher	HOD2	Julia	Female	7 years (21 years teaching in total)
Integrated Science and Physics Teacher	T1	Sarah	Female	9 years (12 years teaching in total)
Integrated Science and Physics Teacher	T2	John	Male	1 year (30 years teaching in total)
Integrated Science Teacher	T3	Tania	Female	10 years

Table 4.0.1 Information on Participants.

4.1 Introducing CA in State Schools

The endorsement by law of the National Curriculum Framework in 2012, led to the introduction of a Learning Outcomes Framework (LOF) that was intended to guide learning and assessment in all years of schooling. The main aim of the LOF was to shift the emphasis from teaching the subject to a greater focus on the learner and required changes in both

pedagogy and assessment practices in school subjects including Integrated Science (Directorate for Quality and Standards, 2015). According to Matthew, one of the Education Officers (EO1), this change in pedagogy and assessment practices was long over-due since "*the syllabi and textbooks had been there for 10 years plus and needed to be changed".* In addition, the teaching of science had become very theoretical, and content based, and as stated by Matthew (EO1), "*to revert back to practical work, we had to do something"*.

One of the consequences of the introduction of the LOF was in fact the resulting changes in assessment practices for Years 7 and 8 in Integrated Science. The main change which occurred was the removal of the mid-yearly examination and the introduction of Continuous Assessment (CA) tasks, that were to be carried out during the whole academic year and include a mix of different tasks. At the end of the year students would be awarded a mark based on 70% of the annual summative examination, and 30% of the annual CA mark. This decision reflected the aims of the NCF to move away from a more summative form of assessment to a more formative mode of assessment. Education Officers learned about this decision from a circular that was sent to them by the then Director General of Education (Learning and Assessment Programmes) (Bugeja, 2018). Shifting to CA was a decision which was taken by the Directorate, and neither the EOs nor the teachers could decide whether CA was to be implemented or not. Matthew (EO1) stated that *"…introducing CA in the final global mark and the removal of half-yearly exams was totally not in our hands. It was presented to us as a matter of fact"*. However, although the Education Officers were not involved in the decision-making process, the implementation of CA in schools needed to be carried out by educators and the EOs were expected to negotiate with the science teachers to ensure that the use of CA was successful (Directorate for Quality Standards, 2015).

4.1.1 Working with Teachers to Introduce CA

The science teachers in schools were first informed about the introduction of CA, in COPE sessions that were led by the EOs. These sessions included training for teachers on the LOFs and CA (Attard Tonna & Bugeja, 2018). Although the EOs and teachers were not involved in the decision regarding the introduction of CA, they were afforded some leeway about how the CA could be implemented in the Integrated Science syllabus. The EOs were involved in the assigning of "*the percentage mark and what will constitute the CA"* (Matthew, EO1). The EOs also wanted to involve the teachers in deciding the different tasks that would make up CA in Integrated Science in Years 7 and 8. In fact, it was the teachers who suggested that Project Based Learning (PBL), should be included as one of the CA tasks. Matthew (EO1) admitted that: *"…before we spoke to teachers, we hadn't thought of allocating 10% to PBL. Basically, when we went through all this process, we decided to allocate 15% towards practical work, 10% to PBL and 5% were left up to the teacher, in year 7".* The teachers were also consulted on the choice of topic for the PBL, and following discussion, "*we chose energy as the unit"* (Matthew, EO1).

For the EOs and HODs, working with the teachers was an important aspect for the successful implementation of CA in Integrated Science. This is important since as stated by Cerna (2013), the educators who need to implement the policy are more aware of the context and the strengths and challenges faced when introducing new ideas. In fact, as stated by Julia, one of the heads of department (HOD2), during the discussions regarding the introduction of CA, the EOs and HODs worked together with the teachers and *"communication was the key, that we involve the teachers throughout the different process, and we are always open to change. If something's not working, it will go, it will change"*.

4.1.2 Teachers' Views Regarding the Introduction of CA

The introduction of CA in Integrated Science is being described in the literature on the LOF (Directorate of Education, 2015), as an innovative assessment practice. However, for the teachers who participated in the study, this was something that they had been doing in science for some years, as they conducted practical work and other activities. What was different, was that now these tasks had become part of the formalised assessment process. John, one of the teachers (T2) expressed the views of the science teachers and argued:

> *It's becoming more structured through the LOs as you're saying, but I think I've tried to use it in the past and I've come across it in the past and in other schools, but not as emphasised as it's being done now.*

What the teachers were concerned about, was not the actual introduction of CA, but that CA replaced the half-yearly examinations that were previously held in Integrated Science. Spiteri (2018) states that the mid-yearly examinations were removed to gain more time for teaching and learning. This was also the view of two of the participants who argued that examinations take up instructional time. For Matthew (EO1), *"…before exams there is revision, and after there is class correction etc. One can easily say that because of the half-yearly we have removed a month from the scholastic year"*. The HODs however, suggested that this was really a time management issue and that alternatives could be found. For example, Amanda, one of the heads of department (HOD1), suggested that: *"We can do them in a shorter period, there is no need to have study days, and they can have 2 exams a day and not just one. It is a question of logistics".*

However, six out of seven of the participants in the study disagreed with the removal of the half-yearly examinations. The main reason that they would have liked the half-yearly examinations to be retained was that, in their view, the removal of the half-yearly

examinations led to students losing the skill of sitting for an exam, and some students lost the motivation to study. Amanda (HOD1) stated that:

> *… I still believe that CA on its own, without having tests or exams is not 100% efficient on students, because students need a target. And we still have to give them the skill of how to study or how to sit for an exam.*

Therefore, for the participants of the study although the introduction of CA was a move in the right direction, in order to refocus the teaching of science on the learner, it did not have to result in the removal of half-yearly examination. In the participants' views, the half-yearly examination could in fact be included as part of the CA.

4.2 Definitions of CA

In the traditional model of assessment, assessment was used to evaluate the effectiveness of instruction at the end of learning, whereas in new models of assessment, learning activities are being viewed as an integral part of the assessment process (Wiliam, 2011). Carlson et al. (2003) state that CA can be described as the assessment practices which take place in the classroom, in which the performance of students across different learning modalities is observed and recorded by the teacher. All the participants agreed that CA is an ongoing process in which students are assessed throughout the year using a variety of assessment modalities. Matthew (EO1) stated that for him CA is *"structured and unstructured, ongoing feedback"*.

4.2.1 CA as Formative

For the participants of the study, CA is more than just a test or examination at the end of instruction. Like what is described in the literature (Lumadi, 2011), they believed that

it is assessment, which is not done to students, but for students, since its purpose is to enhance student learning. As pointed out by Julia (HOD2) CA allows you to get *"an idea of where the student is, throughout the year, throughout the process of that particular student… and see that maybe that student didn't reach the LO there and then but managed to reach it further along the line".* Furthermore, Carlson et al. (2003) state that "continuous assessment is formative by nature" (p.4) and all the participants stated that they believe that CA has a formative aspect to it. As stated by Amanda (HOD1), CA *"is an ongoing process, where the students are aware where they are improving, where they need to improve, and what they have not understood"*.

CA is not only formative for students, but it can also be a formative experience for teachers. During their research, Carlson et al. (2003) found that through CA teachers were able to better understand how their students think and thus develop better resources which can guide their students further. Owen, one of the education officers (EO2) expressed how he thinks that the *"most important benefit of CA is for teachers to inform themselves on the teaching and learning process"* this is because he believes that *"unless you assess continuously, then you cannot possibly know how to plan your next lesson. You cannot possibly know whether you need to go back on certain activities or raise certain questions"* (Owen, EO2).

4.2.2 CA allows the use of Different Assessment Modes

CA in Maltese science classrooms is being used to assess whether students have successfully achieved the learning outcomes. The main intention behind CA was to encourage teachers to use different assessment modalities such as role play, quizzes, games, presentations, and so on (Cachia & Bugeja, 2020). This is confirmed by Owen (EO2),

who stated that *"CA gives us a way to actually assess in a different manner whether those outcomes have been achieved"*. The importance of using different assessment tasks is that different tasks can target different learning styles and intelligences and that can engage students such that they are more motivated to learn (Naylor et al., 2004; Saleem et al., 2022). Different assessment tasks can also assess other skills in addition to science content such as critical thinking, creativity, leadership skills, communication skills, and many more (Directorate for Learning and Assessment Programmes, 2019). Amanda (HOD1), sums up these two uses of CA:

> *Now we have introduced new activities apart from the practicals, so we are not always collecting marks based on tests but rather on projects and presentations. These are good as the students acquire skills which are not just science, but they learn how to speak in front of their peers and how to do research.*

There are different definitions in the literature of CA ranging from assessment over time, to different assessment tasks. Carlson et al. (2003) state that CA provides snapshots of students' achievement at different time intervals to create an achievement profile which is built over time. The Directorate for Learning and Assessment Programmes (2019) add that this can be done through different assessment forms. For the participants of the study, CA is ongoing assessment that can be used formatively to help the students reach the learning outcomes and acquire different skills. CA also aids teachers in adapting their teaching to fulfil their students' needs. Furthermore, the participants also think that CA also serves a summative purpose in which a final grade or mark is obtained as a result of the ongoing feedback and improvement which took place throughout the year.

4.2.3 CA as Summative Assessment

Mirza (2021) argues that CA is not only formative, however, it takes into consideration final grading. Sarah, one of the teachers (T2), agrees that CA is formative by nature, but has a summative component, she states that CA is *"an ongoing process and at the end you get the final of the ongoing process"*. The purpose of summative assessment is to certify students' learning and prove that students have understood the topics being taught. It is also used by policy makers, schools, students, teachers, and parents to judge students' competence and the effectiveness of their learning (Wyatt-Smith et al., 2014; Chappuis et al., 2012). CA is used for summative purposes since the marks the students obtain through CA tasks is summed up and contributes 30% to the global mark which is given to the students at the end of the year (MEDE, 2018). In fact, Matthew (EO1) states that they *"went through a process, as since this mark will be part of the global mark, there should be standardization"*.

4.3 Implementing CA in Science Classrooms

The decision to introduce CA in schools was a top-down decision which both the EOs and teachers had to follow. Said Pace and Seguna (2018) state that at first, teachers viewed the LOF and CA reforms as being just another reform. However, Attard Tonna and Bugeja (2018) carried out a 'Train the Trainer programme' which helped keep teachers in the loop of the changes and developments which were taking place with regards to assessment practices. Tania, one of the teachers (T3) confirms that they *"used to have in-service sessions"* during which they *"first heard about continuous assessment"*.

4.3.1 Positive Approach to Change

The introduction of CA was a top-down decision, and teachers needed to implement it without having a choice in their science classrooms. The teachers had mixed feelings about the introduction of CA. Four out of the five participants were positive about CA and John (T2) even describes the introduction of CA as being *"brilliant"*. The positive view of CA is outlined by Owen (EO2) who states:

> *It seems to be something that teachers are positive about, the fact that they can decide which practicals to include, the fact that they can decide which forms of continuous assessment to implement and use for the final grade. So, all in all, I think it's, it's a positive experience.*

The main reasons given by the participants of the study for their positive view of CA are that it provides science teachers with more flexibility, allows them greater autonomy in making decisions, and provides them with the opportunity to collaborate within a teaching community.

4.3.1.1 Flexibility

The introduction of CA in Integrated Science has allowed the science teachers to become more flexible. This flexibility is described by Julia (HOD2) who states that flexibility allows her and the other teachers to be open to change, *"If something's not working, it will go, it will change"*. This is important since as outlined in the literature (Ballegeer, 2021; Popirtac, 2022), when a teacher is flexible, he/she can support different learning styles by allowing for classroom discussions, group work, and individual work. Flexibility allows the teacher to adapt to the students' needs, interests, and abilities. Owen (EO2) explains why flexibility is important:

…sometimes teachers would be doing activity A and the main aim is to assess whether the students have reached LOs 1, 2, and 3, and in the process, they realize, that there were a lot of creative thinking skills in this activity. So, almost without knowing, the students reached LO 4. I mean, teachers have to realize that if that happened, then maybe we do not need to do tomorrow's activity that was intended to assess LO4. It is definitely a bit difficult for teachers to manage, because obviously, it requires a lot of flexibility…Obviously, teachers have to find the balance between having a plan and being able to adapt that plan.

4.3.1.2 Greater Autonomy

The introduction of CA allowed the science teachers to have a greater autonomy about what they wanted to assess, and the way in which they assessed their students. Sarah (T1) states that *"they tried to leave it in our hands as professionals"*. This was important for the participants of the study who all agreed that being able to choose their own methods of assessment enabled *them "to adapt the syllabus to the students they are teaching"* (Matthew, EO1). Since the science teachers were more autonomous and could make their own decisions, they were able to create activities that were more suited to the context they were teaching in. The importance of autonomy is also evident in other studies and Carlson et al. (2003), found that when teachers are free to develop their own assessment tasks, they are more successful in engaging students. Amanda (HOD1) spoke about how, *"There are various ways of how one can assess the students in a continuous way. So, then everyone chooses his/her own method, that they are comfortable with"*. This confirms that through allowing the teachers to make their own decisions, the teachers themselves could reflect on

their practice and make improvements such that they carry out CA, whilst adapting to the students' needs.

4.3.1.3 Collaboration

Teachers are constantly faced with students with mixed abilities and different learning styles, which is why they frequently need to adapt their teaching and provide their students with feedback (OECD, 2020). This results in teachers requiring professional support, which can be obtained when teachers collaborate such that they improve instruction and grow professionally to provide the necessary support for their students (OECD, 2020). The participants in this study strongly believe that one of the positive consequences of the introduction of CA was teacher collaboration. In fact, Amanda (HOD1) stated that she thinks that collaboration is an advantage of CA and, that in her school, they *"share resources"*. Amanda (HOD1) also shared an example of how they collaborate:

> *The role play task we do isn't just something I do by myself, or something Sarah does by herself, we do it as a group. We get all the year 8s and they can work with whoever they want, we shuffle the groups.*

Additionally, in Tania's (T3) school, the teachers also collaborate, she stated that they *"work as a group, and we do presentations to students so that we don't only assess the science behind the students"*.

Collaboration does not take place only between the teachers, but also with the EOs. Both the teachers and EOs stated that they have a good relationship from which the teachers get a lot of support. Matthew (EO1) stated that:

> *We are a good team, me and Owen and we have 2 HODs, the HODs, apart from doing the administrative part with us, they are also teachers in the school. So,*

sometimes we do get new ideas, and the first people we ask are them. And they tell us, no this won't work, or yes, we already do this, as ultimately, they are there, in the field.

This shows that the EOs and HODs work together to come up with different ideas on how to implement CA, where they take into consideration the different variables present in the classroom.

The introduction of CA has led to the development both within schools, as well as across colleges of communities of practice. These communities of practice are described by Wenger et al. (2002), as groups of people who share a concern, a set of problems and who deepen their area of expertise by interacting on an ongoing basis. Since science teachers need to meet to develop and implement CA in their subject area, they have had to form these teaching communities. Within these teaching communities, science teachers have found a safe space to meet, to discuss different pedagogies and assessment practices, and to make their voices heard with administration. All the participants of the study recognised the importance of collaboration, and the fostering of teacher learning communities for the successful implementation of CA in science. In fact, Julia (HOD2) states that that there is a need for *"more collaborative time"* and that science teachers should be provided with an "*extra additional slot, it has to be timetabled and it counts as a lesson not over and above the duties the teacher has, where it is collaborative meeting"*.

Overall, all the participants welcomed the introduction of CA. Some felt positive about this change since they felt that it will enable them to be more flexible, and others took it as an opportunity to reflect on their practice. One thing the teachers appreciated is that they were recognized as professionals and were given the freedom of developing their own philosophy on how to implement CA. Additionally, the teachers have also sought

professional support whereby they collaborated amongst themselves and with the EOs such that they ensured that their students' needs are being met.

4.3.2 Uncertainty about Change

Although the participants of the study were mostly positive about the introduction of CA, they still had some reservations. Like teachers in other studies carried out in the local context (Buhagiar & Chetcuti, 2021; Attard Tonna & Bugeja, 2016), this was mainly due to the fact that since the science teachers had no voice in the policy making, they were not sure about the implications of the changes, were uncertain of what it would mean for their work and classroom practice. Amanda (HOD1) expressed this overwhelming feeling of uncertainty and how she *"used to wonder how will I do this?"*. Sarah (T1) described that lack of information caused teachers to be concerned that CA *"would mean more hassle, more paperwork and it would be more bureaucratic"*. The participants of the study felt that the introduction of CA although positive would also be challenging in terms of time constraints; resources; the mixed ability of students and increased paperwork.

4.3.2.1 Time Constraints

Jones (2019) states that teachers work with demanding time constraints where they have to plan lessons, correct students' work, fill in necessary paperwork, attend meetings, participate in school activities, and cater for diverse students' needs. Said Pace and Seguna (2018) found that when teachers are tight on time, they tend to focus more on the methodological approach rather than the conceptual one and this results in students opting to regurgitate information rather than understand and apply it. Jones (2019) suggests that in order to keep up with all their duties, teachers need to plan and prepare resources and

manage their time well. John (T2) opened up about how due to the introduction of CA he is currently struggling with time management due to having been assigned many different year groups:

> *I have an issue with my time management. I've been challenged this year because I have what I'm not used to which is five different schemes of work. So that is really spread out. I mean, if you have fewer schemes of work with more classes of the same level, three you can handle, but five is a bit too much. Even in terms of preparation.*

For John, this meant having to prepare assessment tasks for students at five different levels, and that this was a bit too much for him.

The issue of time constraints also limited the choice of assessment tasks. Amanda (HOD2), argued that the main aim of introducing CA was to have different assessment formats such as using discussions to gauge student learning and understanding, but this was not happening as the vast syllabus needed to be covered. Amanda argued that:

> *We need to let the students discuss, as it means that they are interacting and that they are applying scientific concepts. But the fact that we are restricted by a syllabus limits our possibilities for discussions, but on the other hand, we need the syllabus as we need to know what we need to cover, so it's a tricky situation.*

Finding a balance between implementing CA, covering the syllabus, and allowing students to participate in activities such as school-outings, is challenging and Tania (T3) mentions being tight on time due to various school activities. In her view, *"if the school organises a lot of activities, it's difficult to implement this continuous assessment"*. The teachers therefore need to be trained "*to find ways to deal with CA in a better way"* (Owen, EO2).

4.3.2.2 Lack of Resources

Another challenge that science teachers were facing when trying to use CA with their students in their science classes, was the lack of resources. One of the aims of introducing CA in science was to encourage teachers to include more practical experiments and investigations and other learning activities (Musumeci and Farrugia, 2004). This, however, requires the availability of laboratories and laboratory equipment, laboratory technicians, 3D-models, opportunities to go out on fieldworks and site visits, and more (Kamba et al., 2019). Most of the participants were concerned about the lack of resources, Matthew (EO1) pointed out how:

> *…even though we have a lot of schools which have new labs, we also have 3 or 4 schools in which the labs leave much to be desired. It is either because there isn't enough money or that they have never been designed. So, in these schools there is a big issue in terms of resources.*

Julia (HOD2) agreed with Matthew's (EO1) concerns, in fact she stated that:

> *…we went to a school, and we saw a lab and I was disgusted, that you have students that have this type of lab, which is state of the art, and then you have others, which cannot even do a normal practicum. You know, that's where the problem is, when you have such disbalance in resources when it comes to science, and they're trying to implement something new, while you're presenting a new method, which is like fun and so on. But the teachers are angry because they cannot do the basic method, let alone the new method.*

Matthew (EO1) also stated an additional issue in terms of laboratories, he emphasised how *"support which is not present is the lab technicians, unfortunately the*

wage of technicians is what it is, and it doesn't attract many people. So, we have schools which have an issue because they don't have a technician". The lack of resources is not only present in terms of laboratories, but also in terms of opportunities to go out on fieldworks and site visits. Matthew (EO1) discussed how he thinks that:

> *… recently there are problems with fieldworks, as when students go out on a fieldwork, there is the issue of transport. And there are also places which require an entry fee to be paid, so we have schools that tell us, they cannot do certain outings, even though they would be valid.*

Apart from resources required for hands-on activities, such as experiments and fieldworks, digital resources were also mentioned by the participants. Owen (EO2) explained that in order to make CA tasks more engaging for students, science teachers try and include some work with digital resources such as preparing online presentations. He argues that:

> *…nowadays, many activities would require some sort of digital device, at least, many of the nicest do. And if you want to compete with what the students do after school hours, to make school as interesting, the important part is that we have these devices at school*.

4.3.2.3 Mixed Ability

Mixed ability classrooms are ones which accommodate students who have different learning styles, interests, strengths, knowledge, and skills (Webb, 1991). Webb et al. (1997) found that teachers deal with mixed ability classrooms by resorting to group activities which consist of heterogenous groups where the higher ability students serve as mentors to the lower ability students. Even though there are ways and means of how to tackle mixed ability

classrooms, the teachers in this study opened up about how it is difficult to manage mixed abilities whilst implementing CA. Tania (T3) expressed how she finds it difficult to deal with

> *…the difference in abilities in the same group, in the same class, because you can get a class where you have students who can do a certain thing, and then other students who cannot even fulfil this task you know, so, you have to think of something which involves the two of them.*

Therefore, even though mixed ability classrooms might be beneficial for students as peer tutoring is taking place, teachers find it hard to strike a balance between using high- and low-ability CA activities. Ideally, CA should enable all students to show what they know and can do. This is an issue of fairness and equity and recognising the experiences of different students, their diversity, and the way they respond to different assessment tasks (Stobart, 2005).

4.3.2.4 Too Much Ticking

Another aspect of CA is the process of record keeping. Keeping records of student achievement is important both to provide students and teachers with a summative assessment of what has been learned and for accountability (Naylor et al., 2004). While record keeping is important, the introduction of the LOF (2015) increased this record keeping and teachers must now tick the Broad Learning Outcomes (BLOs). BLOs are present to sum up the LOs in each Learning Programme such that the teachers tick whether the students have reached these LOs. The ticking process is one in which the teacher must tick criteria on a scale for each student. The criteria are divided as follows: started to be achieved, partially achieved, satisfactorily achieved, and fully achieved (Schembri, 2020).

The ticking of the LOs was actually intended to have both a formative and a summative purpose such that students could use the feedback from teachers on their CA tasks to continue to improve throughout the year (Attard Tonna and Bugeja, 2016). However, in reality the participants of the study were concerned that the CA was still mainly summative in nature, and that students were only concerned with the final mark and not with the feedback they were given. Sarah (T2) shared her concerns:

> *For us there is a lot of work in it, I'm not saying there isn't, but what concerns me is, when the students are receiving them, what are they taking from them? Are they looking at them? After all this work, does it still boil down to the mark only?*

Additionally, Amanda (HOD1) shared her experience on how students react to ticking and feedback:

> *…when students are given their corrected task or worksheet, they search for the mark. If you don't give them a mark, the students will ask you 'Miss, you didn't give us a mark? Didn't you correct it?'. They had told us not to give a mark, just write comments for the students. The comments are not given much importance by the students, if not zero. A mark and a comment on the other hand, leads the students to first look at the mark and then read the comment and sometimes they come for feedback on the comment. But students want the mark, they search for it.*

The question being raised by the teachers, is how the ticking of the LOs is actually having an impact on student learning. Matthew (EO1), states that *"I think that ticking is done so that we say that it is done, and only few people give it importance"*. This defeats the purpose since as argued by Wiliam (2011), marking alone is not enough, and any feedback if it is to be described as feedback should be used to help the students move forward in in their learning. The participants fear that their efforts at ticking the LOs are in vain, since neither

the students nor the parents understand them or give them importance. They highlighted the fact that importance is given to the mark obtained, since it is easily understood by everyone.

Overall, there are many factors which contributed to the teachers feeling uncertain about the introduction of CA. Firstly, teachers were already tight on time with juggling planning resources, correcting students' work, participating in school activities, catering for mixed abilities, and so on. Whilst doing so, some teachers were also faced with a lack of resources which adds insult to the injury. However, there seems to be some light at the end of the tunnel since one of the education officers hinted that more digital resources will be available soon.

4.4 Activities Used by the Teachers

When CA was introduced, it was left up to the teachers to decide which assessment tasks to use to implement CA. The reasoning behind this decision was that the teachers were viewed as professionals who know their students best (Cachia & Bugeja, 2020). Even though the tasks the teachers use is completely at their discretion, the Science EOs had prepared some assessment tasks which the teachers could make use of (Cachia & Bugeja, 2020). Matthew (EO1) stated that *"fulfilling an LO can be through various methods, either because the teacher saw them doing it, or because the students answered a question correctly, or they were given a revision test or a classwork, group work or presentation"*.

4.4.1 Different Types of Assessment Tasks

Presentations were a very popular assessment task amongst the participants, Julia (HOD2) stated that *"presentations are our preferred choice because we test many skills"*. In

their school they also carry out Science week in which the students *"have to present a question, a scientific question and they have to research about it and present it"* (Tania, T3). Presentations are a beneficial assessment task as they require the students to research and understand scientific concepts and apply previous knowledge. They also help the students develop presentation skills such as making use of good grammar and engaging in eye contact (Balagiu et al., 2019). The teachers also cater for lower ability students where they use tasks such as *"…charts and research in class"* (Tania, T3). Through researching in class, the students repeatedly read theories and concepts which helps them in becoming more familiar with the topics (Balagiu et al., 2019).

One of the ways in which the teachers at one of the schools are implementing CA is through the use of roleplay. Sarah (T1) stated that role playing *"is another way of how we will assess the students in a different manner"* whereby the teachers are using *"different approaches to actually getting the kids to do more than just the science but integrate science into other methodologies"* (John, T2). Rumore et al. (2016) state that through role play students become more engaged and learning is enhanced. The teachers are facilitating social learning from which the students are also gaining collaborative skills (Rumore et al., 2016). Additionally, through role playing, these teachers have also introduced self- and peer- assessment to the students, *"We also go into self-assessment and peer-assessment where the students themselves give marks to each other"* (Amanda, HOD1). Self- and peer-assessment are student-centered assessment processes which enable students to become autonomous learners and develop critical reflection skills (Wanner & Palmer, 2018). In fact, Amanda (HOD1) stated that "*the students come up with a lot of ideas and it amazes me that they are year 8 students who are judging each other in a constructive manner"*.

The teachers in this school make use of a variety of assessment tasks, Sarah (T1) listed the following ways through which students are assessed continuously:

> *We include practical work, skills of students during practicals, homework, classworks, tests, role plays and activities to see what the students are capable of. We are also giving them more opportunities to speak, for example in presentations for them to speak more in front of each other.*

This shows that the teachers are using various activities to implement CA. Amanda (HOD1) pointed out how they "*try to include experiments, even short ones whenever we can, we have over 20 experiments in the lab report book not just seven"*. She also stated that experiments allow the students to "*learn as they are doing, learn skills and working in a group"*. Shana and Abulibdeh (2020) found that when students engage in practical work, their interest in the subject increases, they develop communicative skills, and view science as something which is tangible and not just a theory or rule. Apart from the assessment modalities which the teachers are using, John (T2) shared an idea he has that he wishes to start implementing, he stated that *"there's a magazine I'm thinking about, I have set up for research, for the students to actually do research and then put this together in a magazine, that'll also work as CA"*.

4.4.2 Use of Summative Tests within CA

The teachers are doing their utmost to ensure that the students benefit from CA by using various activities and assessment tasks which they cater for all their students. However, there still seems to be some degree of resistance when it comes to tests. Tests in general can still be used, however, the use of tests in specific test weeks during the scholastic year was discouraged as otherwise the purpose of removing the half-yearly

examinations would be defeated (Cachia & Bugeja, 2020). The teachers are not using test weeks, however, they are still very much in favour of giving tests to students, *"I kept on giving students tests, as I think that they are important and beneficial for the students"* (Sarah, T1). Roediger III et al. (2011) state that testing is beneficial as it enables students to retain information and organize their knowledge. It also enables teachers to identify gaps in knowledge and provide feedback to the students. Furthermore, Roediger III et al. (2011) found that testing can motivate students to study.

The introduction of CA has led the participants to broaden their horizon regarding assessment practices they can use in class. It has exposed the teachers to many different activities through which they can assess their students, and the teachers seem to be doing a great job at ensuring that the students acquire different skills which complement their learning. Some teachers are still trying to stick to their roots and resist the change by using tests, however, others are embracing the challenge and coming up with innovative activities which will keep the students engaged.

4.5 Successful Implementation of CA through Teacher Professional Development

Professional development (PD) can be defined as all the "activities that develop an individual's skills, knowledge, expertise and other characteristics as a teacher" (OECD, 2009, p. 49). Kennedy (2016) states that PD fosters improvement in teaching, furthermore, Lumadi (2011) found that teacher training is required to ensure that CA is done meticulously. Through training, teachers become equipped with skills which enable them to face any challenges that might surface. Lumadi (2011) also states that training should not be a one-time event, but follow-ups are required. In studies by Attard Tonna and Bugeja (2018) and by Chetcuti and Buhagiar (2021), teachers expressed their need for more training when it

comes to assessment practices. Most of the participants agree that more training is required, Owen (EO2) thinks that *"one of the things that has to be done is to train teachers to find ways to deal with CA in a better way"*.

The participants think that the way forward for CA is to provide the teachers with continuous training and PD to help them in any challenges they might face. They also think that impact assessment is required to see how the students are benefitting from CA. John (T2) stated that *"this is something that has to be investigated, studied, and decided on, but the study has to happen. There should be impact assessment"*.

4.6 Conclusion

The introduction of CA brought about change which required Integrated Science EOs, HODs, and teachers to be collaborative, flexible, and reflective. This research study shows that, as confirmed by the participants' views of CA, the introduction of CA was welcomed in state schools but also raised some concerns due to the uncertainty it brought with it. The Integrated Science EOs, HODs, and teachers have adapted to this change, however, they still think that professional development is required to ensure that they keep improving their teaching and learning practices.

Discussion

5.1 Assessment Reform – from Policy to Practice

5.1.1 Reforming Assessment Practices in Integrated Science

Assessment reforms can be instigated by research and new ideas on pedagogy; however, they are mainly politically driven. In most cases governments drive these reforms which are then passed down to the teachers who are tasked with implementing the changes in schools (Baird & Hopfenbeck, 2016). The current study looked at a major assessment reform within the Maltese educational context. This reform involved the introduction of CA in secondary school subjects, including science. Similar to assessment reforms globally, the introduction of CA was part of an extensive educational reform that saw the Ministry of Education launch the Learning Outcomes Framework in 2015. The aim of the LOF was to move towards a learner-centred approach that allowed students to show what they knew through a variety of assessment tasks throughout the scholastic year (Attard Tonna & Bugeja, 2018). This reform in assessment practices in science reflects assessment reform globally, and as indicated by the EOs in the current study (see Chapter 4, Section 4.1), was long overdue.

What can be problematic in any assessment reform is the transition from policy to practice. This is because in most cases the policy is developed by one group of individuals such as government agencies, ministerial committees, or administrators, but influences the practices of other individuals such as teachers who need to put the policy into practice (Coburn & Stein, 2006). In a few cases, teachers in schools feel that some policies are out of touch with the realities of the classroom, and they tend to ignore these policies in their classroom practices (Brock-Utne & Holmarsdottir, 2004). In this study, I therefore wanted to

listen to the voices of the science teachers who were faced with having to implement CA in their science classrooms. I wanted to explore the views of the science teachers and EOs, because as argued by Nunan (2003), the success or failure of a policy can only be determined by the way in which it is implemented in the classroom. Although the participants of the study are only a small number, and no generalisations can be made, the views shared by the participants can lead to some insights and observations.

Like assessment reform in other countries (see Baird & Hopfenbeck, 2016), the teachers who participated in this study explained (see Chapter 4, Section 4.3.2) that the introduction of CA was a top-down decision which was taken externally, and they had no say in any of the decision-making process. This created a certain amount of uncertainty amongst the science teachers as they felt that this was something new, and they did not know initially how they were going to implement the required changes in their science classrooms. However, although other studies within the local context (see Attard Tonna & Bugeja, 2018; Said Pace & Seguna, 2018), indicated that Maltese teachers were in most cases tired of constant reforms and became resistant to new ideas (Chapter Two, Section 2.5.1), the science teachers and EOs who participated in the study seemed to be quite positive in general about the introduction of CA in science. In their view, they had been doing some form of CA for a few years, since science teaching involves practical work and investigation. Through the LOF and assessment reform, CA simply became something formal that needed to be recorded. For the participants, the main point of contention was the removal of the half-yearly summative examinations. This tension between the formative and summative purposes of assessment was evident all throughout the interviews carried out with the participants.

5.2 Implementing CA: The Formative – Summative Debate

The literature (Chapter Two, Section 2.4) defines CA as ongoing assessment which takes place in the natural setting of the classroom and can serve formative and summative purposes. As outlined in Chapter Four, Section 4.2, the participants had an understanding of CA similar to what is described in the literature. During the interviews they defined CA as being ongoing feedback which can be both structured and unstructured. For the participants, CA is more than just assessment at the end of instruction, but it is rather an opportunity to get to know what the students know, what the students struggle with, and how best to help them (see Chapter Four, Section 4.2.1).

The introduction of CA in science both internationally and locally is a result of what Klenowski & Wyatt-Smith (2014) describe as shifts in assessment practices from an emphasis on measurement through the use of high stakes examinations to a greater focus on using assessment for learning (see Chapter Two, Section 2.1). The main aim is to use assessment practices that are formative and as described by Black and William (1998a) used to help students improve their learning and teachers determine the next steps forward in the learning process. In science classrooms, this shift in assessment practices together with a greater emphasis on inquiry-based learning, has led to a greater focus on helping students to be more critical problem solvers, capable of assessing their own understanding (Postma, 2021). The teachers who participated in this study believe (Chapter Four, Section 4.4.1) that the introduction of CA in science classrooms has in fact fostered student-centred learning and enabled students to become more autonomous learners. For the participants of the study, CA shifted the emphasis of assessment at the end of a topic to assessment that enabled further learning. This realisation allowed the participants (Chapter Four, Section 4.3.1) to feel positive about this change in practice and shift to CA.

5.2.1 CA as Formative

When reviewing the literature (Chapter Two, Section 2.4.2), I found that CA is defined as a formative experience which is incorporated within the everyday teaching and learning that takes place in the classroom. CA is used to engage students and determine their level of knowledge which is then used to inform and form practice. The participants agreed that CA is formative (Chapter Four, Section 4.2.1), and that it gives them the opportunity to make use of different assessment modalities through which the students can acquire 21st century skills. The EOs stated that it is not only formative for the students, but it also helps the teachers reflect on their practice and helps them get to know about new methods of teaching and learning. The teachers who participated in the study agreed (Chapter Four, Section 4.2.2) with the EOs and stated that they are in fact embracing the flexibility and making use of different assessment tasks such as using role plays, peer-assessment, presentations, research, and practical work. The teachers shared their experience on using different activities and stated that the students are becoming motivated in the science classroom as they are always looking forward to activities such as role play and practical work. One teacher stated that CA has allowed her students to successfully peer-assess each other in a constructive manner (see Chapter Four, Section 4.4.1). The findings corroborate with research studies (Wanner & Palmer, 2018) which show that through student-centred assessments, the students become autonomous learners and critical thinkers.

What seems to be missing from the experiences described by the science teachers and Education Officers in the interviews is an emphasis on some of the key strategies of formative assessment. The literature (Chapter Two, Section 2.3.1) identifies five key strategies of formative assessment that involve clarifying learning outcomes, designing

effective assessment tasks, providing feedback, and encouraging self- and peer-assessment. As seen from the results of the study (Chapter Four, Section 4.2.1), although the participants state that they are using CA in a formative manner, in their descriptions they focus mainly on the type of assessment tasks being used, and that these are focusing more on student learning, which in their view makes the CA formative in nature. They give very few examples of how they give feedback to students, and how students use this feedback to improve their learning. Like the teaches in international studies (Chapter Two, Section 2.4.4), the participants who I interviewed talked about CA as improving student learning and helping them to reflect on their teaching. However, in my view the important aspect of feedback was very much downplayed by the teachers and is something that needs to be taken into consideration in any formal discussions regarding CA by practitioners and policy makers.

5.2.2 CA as Summative

As outlined in the literature, (Chapter Two, Section 2.4.1), CA also serves a summative purpose, whereby students are provided with snapshots of their achievement at different time intervals. The idea behind summative CA is to provide students with a record of the learning outcomes they have achieved. Traditionally, as has been described in Chapter Two, Section 2.2, summative assessment takes place at the end of a program of study and can be used for certification. The most common form of summative assessment is tests or examinations which are considered by teachers to be the most fair and objective way of assessing student learning. This reliance on formal examinations (see Chapter Two, Section 2.2.1), within the Maltese educational system is not allowing the teachers to fully embrace CA. The teachers who participated in this study believe that CA is beneficial for the teaching and learning process due to its formative nature, but, since the summative part of

CA imposes bureaucracy, ticking, and record keeping, some of the focus on learning is diminished (see Chapter Four, Section 4.3.2). Research studies show that teachers sometimes resist change due to the increased workload or because they are simply in denial (Zimmerman, 2006).

Although they were mostly positive about the introduction of CA, and they realised the benefits of using CA in a formative manner to encourage students learning, the teachers who participated in this study also believed that CA should be used in a summative manner. As argued by the teachers, (see Chapter Four, Section 4.4.2), students still need to sit for yearly examinations and eventually the SEC examinations at the end of secondary schooling, and that they needed to obtain the skill of sitting for exams. They therefore still made use of tests as CA tasks and lamented that the half-yearly examinations should not have been removed. This is a remnant of the summative examinations culture (Grima & Chetcuti, 2003) which is so predominant amongst Maltese educators.

5.2.3 Bridging the Gap between Formative and Summative CA

The LOF and CA reforms were put in place to move away from an exam-oriented educational system and move towards student-centred learning. The introduction of CA has increased the opportunity for teachers to carry out formative assessment in the classroom and the participants of this study tried their best to create their own pedagogy and implement this change. However, since the summative part of CA imposes bureaucracy and record keeping, the teachers are still opting for summative tests which are defeating the purpose of CA. Within the context of the current study, it is evident that teachers find it hard to shift from one assessment paradigm to another. However, they were trying to adapt

to the changes and were doing their best to try and bridge the gap between the formative and summative purposes of CA.

A key point that emerges from the study is that teachers navigated through the assessment reforms by using what I will describe as 'teacher adaptability'. This is "a teacher's ability to change, adjust and modify their practice in response to variability, novelty and uncertainty" (Loughland & Alonzo, 2019, p. 19). The teachers moved through what Collie and Martin (2016) describe as different cycles of adaptability – from adaptability as resistance and coping to adaptability as empowerment and growth. The science teachers described how at first, they were resistant to the removal of half-yearly examinations, since they believed that summative assessment was important within a context that eventually put great emphasis on high stakes examinations for entry into post-secondary schooling. They adapted to this change by using coping mechanisms and introducing summative tasks such as tests within the framework of the required school-based assessment tasks. However, although in their view school-based assessment was only a new name for old practices, they eventually adapted to the assessment reform by working together as a teacher community to develop new modes of assessment. This led them to engage with new assessment ideas such as project-based learning, role-play and oral assessment.

5.3 CA as a Positive Change Despite the Challenges

For the science teachers and EOs who participated in this study, the overall view was that the introduction of CA was a positive experience. The science teachers argued (see Chapter Four, Section 4.3.1) that the introduction of CA allowed them greater flexibility in that they could choose which assessment tasks they could use with their students. This was important for the teachers since they felt that with the increased student diversity in their

classrooms they could cater much better to the needs of specific students. The greater autonomy motivated the teachers and allowed them to better engage their students. It also allowed them to collaborate with colleagues and develop resources within a teaching community.

Therefore, as expressed by the science teachers and EOs the introduction of CA was meaningful because it enabled them to address issues of equity and support the different learning needs in their classroom. This emphasis on equity and diversity is also a reflection of assessment principles (see Chapter Two, Section 2.1) that draw on a sociocultural perspective and "a shift in the view of assessment as something being done to students to something that is being done with and for the students" (Klenowski, 2009, p. 15). The results of the current study suggest that CA is providing the teachers with enough flexibility and autonomy to use assessment to work with students.

Another interesting finding that emerged from the study was the creativity and innovative approaches that the teachers used in the development of CA tasks. Before the introduction of CA, the most common method of assessment used by teachers as shown in other studies (Grima & Chetcuti, 2003), were tests, the half-yearly examinations, and class and home-work activities which usually involved working out hand-outs. Following the introduction of CA, the teachers used different forms of assessment tasks (see Chapter Four, Section 4.4.1). These included presentations, role-play, practical work, investigations, self- and peer-assessment. Through using CA, the teachers felt free to move away from the rigidity of traditional tests, and use modes of assessment that would fulfil the purposes of assessment, and allow the students to become more autonomous learners and gain different skills in addition to knowledge about science. As indicated in international studies (see Chapter Two, Section 2.4.4), for the participants of the current study, the introduction

of CA in science led not only to an improvement in student learning, but also to changes in the teacher's pedagogy and skills.

Day et al. (2018) suggest that the main benefits of continuous assessment are: that it provides authentic information about student learning, improves the quality of learning by encouraging problem-solving, and motivates teachers to improve their teaching. The results of the current study seem to suggest that the introduction of CA in Maltese science classrooms is achieving these main aims, and as indicated in the Learning Outcomes Framework, has shifted assessment practices to focus on students and learning. In spite of the strong teacher belief that examinations and summative assessment still have a role to play in school science assessment, for the participants of the study, CA has become "a bridge between teaching and learning" (Wiliam, 2013, p. 15).

5.4 A Critique of CA

No assessment reform comes without its challenges, and although the science teachers and EOs who participated in this study had an overall positive attitude towards the introduction of CA in school science, they also discussed some of the challenges that they were facing. A study by Saleem et al. (2022) suggests that CA can be critiqued since it is too time consuming and may require more resources. This critique is also made by the participants of the study (Chapter Four, Section 4.3.2). For the participants, one of the main challenges they were encountering with the implementation of CA, was the lack of time to conduct CA in a meaningful manner. They argued that due to the bureaucratic nature of CA, they spent more time planning lessons, correcting work, and filling in the necessary paperwork. They were especially critical of the amount of ticking and record keeping that had been introduced with CA. This, they felt, was a bit unnecessary. The participants of the

study felt that the constant ticking defeated the purpose of CA as a formative assessment practice.

Another critique levelled by the participants was the lack of resources. In their view, to carry out CA in the appropriate manner, they required more laboratory resources to conduct experiments and investigations, and digital resources. These resources, they argued (see Chapter Four, Section 4.3.2.2), were a bit lacking in Maltese state schools. This critique reflects the problematic nature of top-down decision making, since policy is introduced without consultation with the teachers and EOs, who are the ones who know what is needed to make a policy successful. As pointed out by Attard Tonna and Bugeja (2016), involving teachers from the start of any change in assessment practices, and empowering them to share their own views, are important elements for successful change to take place.

Another aspect that the participants of this study were finding challenging was the implementation of CA in mixed ability science classrooms. One of the main aims behind the introduction of CA in Maltese schools (see Chapter Two, Section 2.5), was to cater for more student diversity. The idea was for teachers to focus on students as individuals and allow them to achieve according to their own personal development. However, in practice, the teachers argued that it was conceptually difficult and time consuming to find a balance between CA tasks that catered for both high- and low-ability students in the same classroom. The participants (Chapter Four, Section 4.3.2) felt that they needed more training and more practice that would help them develop the skills to carry out differentiated CA.

5.5 Professional Development

The introduction of CA in science in Maltese state schools was a top-down decision taken by policymakers who then expected the teachers to implement this decision in their classrooms. As described in the literature (see Chapter Two, Section 2.5.1), this created a gap between the actual principles that guided the introduction of CA and the classroom implementation, since teachers were not initially completely on board with, for example, the removal of the half-yearly examinations. The policymakers tried to bridge this gap by conducting various Professional Development (PD) sessions. PD is defined in the literature as being various activities which train teachers and enable them develop expertise, knowledge, and skills in the profession (OECD, 2009). According to Kennedy (2016), PD allows teachers to become more autonomous and it enables them to carry out successful implementation of CA.

The need for PD was also identified as being important for the implementation and success of CA both in the literature (Chapter Two , Section 2.4.4 and Section 2.5.1), as well as for the science teachers and EOs who participated in the study. In fact, for the participants (see Chapter Four, Section 4.3), the PD sessions were very valuable in helping them develop what has previously been described as 'teacher adaptability'. In their view, the PD enabled them to reflect on the main aims of CA, discuss with colleagues how they could overcome challenges, and eventually motivated them to implement CA in their science classrooms. However, as reported in other studies (see Chapter Two, Section 2.4.4), the participants all agreed that one-off PD sessions were not enough. They stated that more training was required for the teachers to build more confidence with overcoming the challenges of CA such as time-constraints, mixed ability classes, and developing innovative CA tasks. This, as argued by Bezzina (2002), points to the need for a shift in PD, from PD as

training to PD as a provision of opportunities for teachers to come together to reflect and to be empowered to be active participants in change, rather than simple recipients of instructions.

There is, in fact, a strong body of literature that strongly recommends the importance of teacher professional development when they work together in teaching communities. Wenger et al. (2002) suggests that in 'communities of practice' teachers can work together, learn from each other, and reflect on the challenges and successes of their classroom practice. This view of a teaching community emerged very strongly in the current study with the science teachers and EOs (see Chapter Four, Section 4.1.1) pointing out that the implementation of CA in science was successful only because the teachers, HODs and EOs collaborated, listened to each other, and were open to each other's point of view. They argued that the teaching communities that developed when science teachers got together to discuss the development of the CA tasks, provided a safe space that encouraged the teachers to share both concerns as well as successes, allowing them to grow professionally. This emphasis on PD as collaborative and ongoing is a key finding of the current study and reflects what Bezzina and Camilleri (2001) describe as "collegial reflective practice" (p.163), and is key in bridging the gap between policy and practice.

5.6 Conclusion

This study has brought teachers together to discuss their views on CA and shed light on how CA is being implemented in Maltese science classrooms. Some key ideas which emerged from this research study are that there is the need to bridge the gap between policy makers and EOs and teachers such that future changes in the educational system run smoothly. Another point which surfaced is the need for continuous professional

development whereby teachers are given the chance to express themselves on the challenges they are facing and are given the opportunity to collaborate and overcome such challenges.

Conclusions

6.1 Implications of the Findings

The main aim of this research study was to explore the views of Integrated Science teachers on the introduction and implementation of CA. A key point that emerged from this study is that the teachers navigated through the CA reform by what is called 'teacher adaptability'. This is the teachers' ability to modify their practice as a result of change and uncertainty (Loughland & Alonzo, 2019). At first, the teachers were resistant to change as they were not in favour of the removal of the half-yearly examinations. This is because of the emphasis that is put on high stakes examinations which lead to post-secondary education. However, the teachers adapted to this change by using coping mechanisms and the introduction of summative tests within the framework required of school-based assessment tasks. In their view, school-based assessment was only a new name for old practices, however, they eventually adapted to the CA reform collaborating with the EOs and developing new assessment modes. This approach led them to engage with new assessment practices which include project-based learning, role play, peer-assessment, and oral assessment. Even though the teachers are now successfully implementing CA, both the EOs and teachers believe that further training is required such that they learn to deal with CA better.

6.2 Limitations of the Study

One of the primary limitations of this study is that the sample size is small, this resulted due to a limited number of participants. Since the number of participants involved in this research study is restricted, the generalisability of the findings is limited and might

not accurately represent all the Integrated Science teachers. Another limitation of this study is that the choice of schools was constrained to those in which the HODs worked. This limitation prevented the research study from encompassing the full spectrum of Integrated Science teachers' views on the introduction and implementation of CA. Therefore, the results are specific only to the context of the schools in which the participants teach.

6.3 Recommendations

The first point that emerged from this research study is that in order for the implementation of CA to be successful, the teachers need to be willing to change their mindset from an emphasis on summative assessment to more emphasis on CA. After all, the initial aim of the LOF and CA reform was to encourage learning through formative assessment. The teachers need to be willing to make use of alternative approaches to assessment, however, first they need to be provided with enough resources to do so. Such resources include laboratories, laboratory equipment, 3d-models, opportunities to take students on fieldworks, and more.

From the insights obtained, it is evident that more dialogue is needed between policy makers, EOs, and teachers such that we move away from a bureaucratic system which uses a top-down approach, and include teachers more in decision-making, since they are ultimately the facilitators of change. On a similar note, teachers can also be kept in the loop through continuous professional development whereby they are given the chance to voice their concerns and also share positive experiences with each other.

Finally, it is recommended that future research takes students' views in consideration since they are ultimately the recipients of the change. By carrying out impact

assessment and exploring what students think, and how they have been affected by this change, we can gain insight on what is working, and on the way forward.

6.4 Final Reflections

This research study has enabled me to reflect deeply on the importance of CA, and how both teachers and students can benefit from it. It has also helped me develop a deep understanding on CA and how it is meant to be implemented. This is beneficial as it will enable me to use my acquired knowledge and apply it to my teaching. I will do so by reflecting on the good practices I have observed and how I can implement them in my classroom. Some examples which struck me, and I would like to implement, are the use of role play and the use of self- and peer-assessment. However, I would like to take these good practices a step further and focus more on making these tasks more formative for the students. I plan on doing so by giving students feedback and then follow up on this feedback by monitoring whether the students have improved or not, this will enable me to motivate the students and encourage them to become responsible for their own learning. One thing that inspired me during this dissertation is the good teamwork present amongst the participants of the study. This has motivated me to collaborate with my future colleagues such that we can develop CA tasks which will benefit the students. Furthermore, I also plan on developing my own CA tasks based on my students' needs, however, one task which came to mind whilst carrying out this research study is the use of a science debate through which students can discuss and argue about different scientific concepts. Apart from acquiring knowledge on CA, this research study has helped me communicate with other professionals and taught me to be both reflective and reflexive. It has also enabled me take different individuals' opinions in consideration, even when their ideas are conflicting, and

through critical analysis, I have learnt how to derive conclusions from various ideologies. Additionally, this research study has helped me grow as an individual, throughout this journey I have been challenged multiple times, and through determination and perseverance, I have managed to pull through. In the future, I would like to see this research and other related research be taken into consideration such that teachers and policy makers can work hand in hand to develop ways through which students and their achievements are kept at the heart and soul of education.

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Appendix 1: FREC Approval

L-Università ta' Malta

Faculty of Education
University of Malta
Msida MSD 2080, Malta

Tel: +356 2340 3058/2932
educ@um.edu.mt

www.um.edu.mt/educ

10th October 2022

RE: Application for Research Ethics Clearance EDUC-2022-00132 Ritienne Attard

Dear Ritienne Attard,

With reference to your application EDUC-2022-00132 Ritienne Attard for Research Ethics clearance, I am pleased to inform you that **FREC finds no ethical or data protection issues in terms of content and procedure**.

You may therefore proceed to approach potential informants to collect data using the tools/documents outlined in this application.

You are reminded that it is your responsibility - under the guidance of your supervisor - to distribute Information Letters and Consent/Assent Forms that are written in appropriate and correct English and Maltese.

Yours sincerely

Dr Joseph Gravina
Chairperson Faculty Research Ethics Committee
Faculty of Education

Appendix 2: Focus Group Interview Questions for EOs

To EOs :

- Further to the introduction of CA in Integrated Science in Years 7 and 8, I would like to get some insights into your experience of CA.
- How do you best define CA?
- Were you involved in the development of CA in Integrated Science and the decision making process?
- What was your role?
- What do you think triggered this change in assessment practices?
- Before taking the decision to implement CA did you get any feedback from HODs and teachers?
- In your view what are the benefits of CA?
- Do you think students are benefitting more from CA? How?
- What challenges do you think that teachers are facing in the implementation of CA in schools?
- If you had to re-introduce CA into schools, what would you have done differently?
- Are there any other issues you would like to talk about?

Appendix 3: Focus Group Interview Questions for Teachers

To HOD and teachers:

- When did you first hear about CA in Integrated Science? Were you involved in the decision- making process?
- How would you define CA?
- What were your first impressions when you were first introduced to the ideas of CA?
- Were you given any training on how to implement CA ?
- How are you implementing CA?
- Can you give me some examples of different tasks you are using for CA?
- Now that you have been implementing CA for quite a while, do you prefer it to how it was before with mid-yearly and half-yearly exams?
- If it were up to you, how would you have introduced CA to schools?
- What changes would you make with regards to implementation of CA?
- Are there any other issues you would like to talk about?

Appendix 4: Consent Form in English

Participant's Consent Form

The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools

I, the undersigned, give my consent to take part in the study conducted by Ritienne Attard. This consent form specifies the terms of my participation in this research study.

1. I have been given written and/or verbal information about the purpose of the study; I have had the opportunity to ask questions and any questions that I had were answered fully and to my satisfaction.
2. I also understand that I am free to accept to participate, or to refuse or stop participation at any time without giving any reason and without any penalty. Should I choose to participate, I may choose to decline to answer any questions asked. In the event that I choose to withdraw from the study, any data collected from me will be erased as long as this is technically possible (for example, before it is anonymised or published), unless erasure of data would render impossible or seriously impair achievement of the research objectives, in which case it shall be retained in an anonymised form.
3. I understand that I have been invited to participate in a focus group interview in which the researcher will ask open-ended questions to explore the introduction and implementation of CA in Integrated Science in Maltese State schools in order to find out how teachers are actually implementing CA and the challenges that they are facing. I am aware that the focus group interview will take approximately 45 minutes to one hour. I understand that the focus group interview is to be conducted in a place and at a time that is convenient for me.
4. I understand that my participation does not entail any known or anticipated risks.
5. I understand that there are no direct benefits to me from participating in this study. I also understand that this research may benefit others by: gaining insight on how teachers implement CA and the challenges they are facing.
6. I understand that, under the General Data Protection Regulation (GDPR) and national legislation, I have the right to access, rectify, and where applicable, ask for the data concerning me to be erased.
7. I understand that all data collected will be stored in an anonymised form on completion of the study and will be deleted in January 2025.
8. Although I am aware that pseudonyms will be used in the study, due to my position, I understand that I can easily be identified, and I am still willing to participate in the study.
9. I have been provided with a copy of the information letter and understand that I will also be given a copy of this consent form.

I have read and understood the above statements and agree to participate in this study.

Name of participant: _____

Signature: _____

Date: _____

Deborah Chetcuti

Ritienne Attard [redacted]

Prof Deborah Chetcuti [redacted]

Additional clauses:

10. I am aware that, by marking the first-tick box below, I am giving my consent for this focus group interview to be audio recorded and converted to text as it has been recorded (transcribed).

    MARK ONLY IF AND AS APPLICABLE

    - ☐ I agree to this focus group interview being audio recorded.
    - ☐ I do not agree to this focus group interview being audio recorded.

11. I am aware that extracts from my interview may be reproduced in these outputs, either in anonymous form, or using a pseudonym [a made-up name or code – e.g. respondent A].
12. I am aware that, by marking the first tick-box below, I am asking to review extracts from my interview transcript that the researcher would like to reproduce in research outputs, before these are published. I am also aware that I may ask for changes to be made, if I consider these to be necessary.

    MARK ONLY IF AND AS APPLICABLE

    - ☐ I would like to review extracts of my interview transcript that the researcher would like to reproduce in research outputs before these are published.
    - ☐ I would not like to review my interview transcript extracts that the researcher would like to reproduce in research outputs before these are published.

13. I am aware that focus group discussions should be considered confidential and that I should not disclose details of those participating and/or of the nature of discussions to others.

14. I am aware that my identity and personal information will not be revealed in any publications, reports or presentations arising from this research, however due to my position, I understand that I can easily be identified, and I am still willing to participate in the study.

Appendix 5: Consent Form in Maltese

Formola tal-Kunsens tal-Parteċipant/a

L-Implimentazzjoni tal-Valutazzjoni Kontinwa fix-Xjenza Integrata fl-Iskejjel tal-Istat Malti

Jiena, hawn taħt iffirmat/a, nagħti l-kunsens tiegħi li nieħu sehem fl-istudju ta' Ritienne Attard. Din il-formola tal-kunsens tispjega t-termini tas-sehem tiegħi f'din ir-riċerka.

1. Ingħatajt l-informazzjoni bil-miktub u/jew bil-fomm dwar l-iskop tar-riċerka; kelli l-opportunità nagħmel il-mistoqsijiet, u kull mistoqsija ngħatajt tweġiba għaliha b'mod sħiħ u sodisfaċenti.
2. Nifhem ukoll li jiena liberu/a li naċċetta li nieħu sehem, jew li nirrifjuta, jew li nwaqqaf il-parteċipazzjoni tiegħi meta nixtieq mingħajr ma nagħti spjegazzjoni jew mingħajr ma niġi penalizzat/a. Jekk nagħżel li nipparteċipa, jaf niddeċiedi li ma nweġibx kull mistoqsija li ssirli. F'każ li nagħżel li ma nkomplix nieħu sehem fl-istudju, l-informazzjoni li tkun laħqet inġabret mingħandi titħassar dment li jkun teknikament possibbli (ngħidu aħna, qabel ma tiġi anonimizzata jew ippubblikata), u sakemm l-għanijiet tar-riċerka jkunu jistgħu jintlaħqu u ma jintlaqtux serjament. F'dak il-każ, l-informazzjoni tiegħi tintuża u tinżamm anonima.
3. Nifhem li ġejt mistieden/mistiedna nipparteċipa f' intervista fi grupp fokali u l-persuna li qed tagħmel ir-riċerka se tistaqsi mistoqsijiet miftuħa biex tesplora l-introduzzjoni u l-implimentazzjoni tal – valutazzjoni kontinwa fix-xjenza integrata fl-iskejjel tal-Istat Malti sabiex isir magħruf kif l-għalliema qed jimplimentaw il-valutazzjoni kontinwa u l-isfidi li qed jiffaċċjaw. Jiena konxju/a li l- intervista fi grupp fokali se ddum bejn wieħed u ieħor 45 minuta sa siegħa. Nifhem li l- intervista fi grupp fokali se ssir f'post u f'ħin li huma komdi għalija.
4. Nifhem li l-parteċipazzjoni tiegħi ma fiha l-ebda riskju magħruf jew mistenni.
5. Nifhem li bil-parteċipazzjoni tiegħi f'dan l-istudju, m'hemm l-ebda benefiċċju dirett għalija. Nifhem ukoll li din ir-riċerka jaf tkun ta' benefiċċju għall-oħrajn għax jaf jiksbu għarfien dwar kif l-għalliema jimplimentaw il-valutazzjoni kontinwa u l-isfidi li qed jaffaċċjaw.
6. Nifhem li, skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali, għandi dritt naċċessa, nikkoreġi u, fejn hu applikabbli, nitlob li l-informazzjoni li tikkonċernani titħassar.
7. Nifhem li l-informazzjoni kollha miġbura se tinżamm b'mod anonimu meta jintemm l-istudju u ser titħassar f' Jannar 2025.
8. Għalkemm jiena konxju/a li se jintużaw psewdonimi fl-istudju, minħabba l-pożizzjoni tiegħi, nifhem li nista' faċilment niġi identifikat/a, u għadni lest/a li nipparteċipa fl-istudju.
9. Ingħatajt kopja tal-ittra ta' tagħrif biex inżommha u nifhem li se ningħata wkoll kopja ta' din il-formola tal-kunsens.

Qrajt u fhimt l-istqarrijiet t'hawn fuq, u naqbel li nipparteċipa f'dan l-istudju.

Isem il-parteċipant/a: _____

Firma: _____

Data: _____

Ritienne Attard

[redacted]

Prof Deborah Chetcuti

[redacted]

Klawżoli oħra:

10. Konxju/a li, jekk nimmarka l-ewwel kaxxa t'hawn taħt, inkun qed nagħti l-kunsens tiegħi biex l-intervista fi grupp fokali tiġi rrekordjata bl-awdjo u maqluba f'kitba fl-istess waqt (traskrizzjoni).

    IMMARKA BISS DAK LI JAPPLIKA
    - ☐ Naqbel li l- intervista fi grupp fokali tiġi rrekordjata bl-awdjo.
    - ☐ Ma naqbilx li l- intervista fi grupp fokali tiġi rrekordjata bl-awdjo.

11. Konxju/a li siltiet mill-intervista tiegħi jistgħu jiġu riprodotti b'mod anonimu jew bl-użu ta' psewdonimu [isem ivvintat jew kodiċi - eż. parteċipant A].

12. Konxju/a li, la qed nimmarka l-ewwel kaxxa t'hawn taħt, qed nitlob li nara siltiet mit-traskrizzjoni tal-intervista miegħi li r-riċerkatur/riċerkatriċi se j/tirriproduċi fir-riżultati tar-riċerka tiegħu/tagħha qabel ma jiġu ppubblikati. Jiena konxju/a wkoll li nista' nitlob li jsir xi tibdil fihom jekk ikun meħtieġ.

    IMMARKA BISS DAK LI JAPPLIKA
    - ☐ Nixtieq nara siltiet mit-traskrizzjoni tal-intervista miegħi li r-riċerkatur/riċerkatriċi se j/tirriproduċi fir-riżultati tar-riċerka qabel ma jiġu ppubblikati.
    - ☐ Ma nixtieqx nara siltiet mit-traskrizzjoni tal-intervista miegħi li r-riċerkatur/riċerkatriċi se j/tirriproduċi fir-riżultati tar-riċerka qabel ma jiġu ppubblikati.

13. Konxju/a li d-diskussjonijiet fil-focus groups għandhom jitqiesu kunfidenzjali u li m'għandix insemmi d-dettalji tal-parteċipanti u/jew in-natura tad-diskussjonijiet ma' ħaddieħor.

14. Konxju/a li l-identità tiegħi u d-dettalji personali tiegħi mhux se jiġu żvelati f'xi pubblikazzjoni, rapport jew preżentazzjoni li tista' toħroġ minn din ir-riċerka, madankollu, minħabba l-pożizzjoni tiegħi, nifhem li nista' faċilment niġi identifikat/a, u għadni lest/a li nipparteċipa fl-istudju.

Appendix 6: Information Letter in English

04/05/2022

Information letter

Dear Sir/Madam,

My name is Ritienne Attard and I am a student at the University of Malta, presently reading for a Master in Teaching and Learning in Science with Biology as a main area. I am presently conducting a research study for my dissertation titled The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools; this is being supervised by Prof Deborah Chetcuti. This letter is an invitation to participate in this study. Below you will find information about the study and about what your involvement would entail, should you decide to take part.

The aim of my study is to explore the introduction and implementation of CA in Integrated Science in Maltese State schools in order to find out how teachers are actually implementing CA and the challenges that they are facing. Your participation in this study would help contribute to a better understanding of Continuous Assessment in Integrated Science. Any data collected from this research will be used solely for purposes of this study.

Should you choose to participate, you will be asked to participate in a focus group interview which will take around 45 minutes to one hour.

Data collected will be anonymised and will only be accessible to myself (Ritienne Attard) and the Principal Supervisor (Prof Deborah Chetcuti). However, although all names used in the study will be anonymized, you need to be aware that due to your role as an Education Official/ Head of Department, you can be identified in the presentation of results. You will be asked to give explicit consent for data from the interviews to be reported in the study.

Participation in this study is entirely voluntary; in other words, you are free to accept or refuse to participate, without needing to give a reason. You are also free to withdraw from the study at any time, without needing to provide any explanation and without any negative repercussions for you. Should you choose to withdraw, any data collected from your interview will be erased as long as this is technically possible (for example, before it is anonymised or published), unless erasure of data would render impossible or seriously impair achievement of the research objectives, in which case it shall be retained in an anonymised form.

If you choose to participate, please note that there are no direct benefits to you. Your participation does not entail any known or anticipated risks.

Please note also that, as a participant, you have the right under the General Data Protection Regulation (GDPR) and national legislation to access, rectify and where applicable ask for the data concerning you to be erased. All data collected will be stored in an anonymised form on completion of the study and will be deleted in January 2025.

A copy of this information sheet is being provided for you to keep and for future reference.

Thank you for your time and consideration. Should you have any questions or concerns, please do not hesitate to contact me by e-mail [redacted]; you can also contact my supervisor over the phone: [redacted] or via email: [redacted]

Sincerely,

Deborah Chetcuti

Ritienne Attard
[redacted]

Prof Deborah Chetcuti
[redacted]

Appendix 7: Information Letter in Maltese

04/05/2022

Ittra ta' Tagħrif

Għażiż/a Sinjur/a,

Jiena Ritienne Attard, studenta fl-Università ta' Malta, u bħalissa qed insegwi Master fit-tgħalim xjentifiku. Ir-riċerka għad-dissertazzjoni tiegħi jisimha: L-Implimentazzjoni tal - Valutazzjoni Kontinwa fix-Xjenza Integrata fl-Iskejjel tal-Istat Malti; it-tutur tiegħi hi Prof Deborah Chetcuti. B'din l-ittra nixtieq nistiednek tipparteċipa fir-riċerka. Hawn taħt issib aktar informazzjoni fuq l-istudju li qed nagħmel u fuq xi jkun l-involviment tiegħek jekk tiddeċiedi li tieħu sehem.

L-għan tal-istudju hu li nesplora l-introduzzjoni u l-implimentazzjoni tal – valutazzjoni kontinwa fix-xjenza integrata fl-iskejjel tal-Istat Malti sabiex isir magħruf kif l-għalliema qed jimplimentaw il-valutazzjoni kontinwa u l-isfidi li qed jiffaċċjaw.Sehmek jgħin biex ikun hawn iżjed għarfien dwar il- valutazzjoni kontinwa fix- xjenza integrata. L-informazzjoni kollha li tinġabar fir-riċerka tintuża biss għall-fini ta' dan l-istudju.

Jekk taqbel li tipparteċipa, tintalab tieħu sehem f' intervista fi grupp fokali li se ddum bejn wieħed u ieħor 45 minuta sa siegħa.

L-informazzjoni miġbura se tiġi anonimizzata u ser tkun aċċessibbli biss għalija (Ritienne Attard) u għat- tutur ewlieni (Prof Deborah Chetcuti). Madankollu, għalkemm l-ismijiet kollha użati fl-istudju se jkunu anonimizzati, trid tkun konxju/a li minħabba r-rwol tiegħek bħala Uffiċjal tal-Edukazzjoni/Kap tad-Dipartiment, tista' tiġi identifikat/a fil-preżentazzjoni tar-riżultati. Inti tintalab tagħti kunsens espliċitu biex id-dejta mill-intervisti tiġi rrappurtata fl-istudju.

Il-parteċipazzjoni tiegħek f'dan l-istudju tkun għalkollox volontarja; fi kliem ieħor, inti liberu/a li taċċetta jew tirrifjuta li tieħu sehem, mingħajr ma tagħti raġuni. Inti wkoll liberu/a li twaqqaf il-parteċipazzjoni tiegħek fl-istudju meta tixtieq, mingħajr ma jkollok tagħti spjegazzjoni u mingħajr ebda riperkussjoni. Jekk tagħżel li tirtira mir-riċerka, l-informazzjoni li tkun laħqet ittieħdet fl-intervista miegħek titħassar dment li dan ikun teknikament possibbli (ngħidu aħna, qabel ma tiġi anonimizzata jew ippubblikata), u sakemm l-għanijiet tar-riċerka jkunu jistgħu jintlaħqu u ma jintlaqtux serjament. F'dak il-każ, l-informazzjoni tiegħek tintuża u tinżamm anonima.

Jekk tagħżel li tipparteċipa, jekk jogħġbok innota li m'hemm l-ebda benefiċċju dirett għalik. Il-parteċipazzjoni tiegħek ma fiha l-ebda riskju magħruf jew mistenni.

Bħala parteċipant/a, għandek id-dritt, skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali, li taċċessa, tikkoreġi u fejn hu applikabbli, titlob li l-informazzjoni li tikkonċernak titħassar. L-informazzjoni kollha li tinġabar fl-istudju se tinżamm b'mod anonimu meta jintemm l-istudju u ser titħassar f' Jannar 2025.

Qed ngħaddilek kopja ta' din l-ittra biex iżżommha bħala referenza.

Grazzi tal-ħin u l-kunsiderazzjoni tiegħek. Jekk ikollok xi mistoqsija, tiddejjaqx tikkuntattjani fuq [redacted]tista' tikkuntattja wkoll lit-tutur/i tiegħi fuq: [redacted] jew elettronikament fuq: [redacted]

Tislijiet,

Ritienne Attard
[redacted]

Deborah Chetcuti

Prof Deborah Chetcuti
[redacted]

Appendix 8: Information Sheet for Gatekeepers

Information Letter and Request for Permission to carry out Research

[redacted]

Name of the Researcher: Ritienne Attard

Title of Research: The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools

Part I: Information Sheet

My name is Ritienne Attard and I am a student at the University of Malta, presently reading for a Master in Teaching and Learning in Science with Biology as a main area. I am presently conducting a research study for my dissertation titled The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools; this is being supervised by Prof Deborah Chetcuti.

The aim of my study is to explore the introduction and implementation of CA in Integrated Science in Maltese State schools in order to find out how teachers are actually implementing CA and the challenges that they are facing.

The research study will involve a focus group interview in which semi-structured questions will be asked to explore teachers' views on CA and how they are implementing CA. The focus group interview will last between 45 minutes to one hour. The focus group interviews will be audio recorded, this will require the participants' consent. After the focus group, the interview will be transcribed verbatim and analysed using a thematic analysis.

This cohort of teachers has been chosen such that the focus group interview will be held with an Integrated Science HOD and the teachers working with him/her.

The prospective participants are free to choose whether they wish to participate or not. There are no anticipated risks for the participants. The benefits of this research project are that the participants might be provided with insight into the benefits of CA which will enrich their daily school experiences.

The collected data will be stored on a secure, password-protected computer. Should participants have any questions or concerns about how the collected information will be used or about the study in general, they can contact the researcher by email (ritienne.attard.18@um.edu.mt). Following the publication of aggregated anonymous results based on the collected data, all will be deleted in January of 2025.

The research participants will be informed about their rights, under the Data Protection Act Chapter 586 and the General Data Protection Regulation (GDPR) (EU2016/679), to access, rectify or erase the data concerning them.

The findings of this research study will be used solely for the dissertation.

Part II: Request for Permission to carry out Research

I would like to request for permission to carry out a focus group interview with the Integrated Science HOD and Integrated Science teachers. I intend to audio record the focus group interview. The research study will abide by the General Data Protection Regulations at all times.

Should you have any questions or concerns, please do not hesitate to contact me by e-mail [redacted] you can also contact my supervisor over the phone: [redacted] or via email: [redacted]

Thank you for your co-operation.

Ritienne Attard		6/06/2022
Name of Researcher	Signature of Researcher	Date

Appendix 9: Gatekeeper Permissions

GOVERNMENT OF MALTA
MINISTRY FOR EDUCATION, SPORT, YOUTH
RESEARCH AND INNOVATION
DIRECTORATE FOR RESEARCH, LIFELONG LEARNING AND EMPLOYABILITY

Tel: 25982743 **researchandinnovation@ilearn.edu.mt**

PERMISSION TO CONDUCT RESEARCH STUDY

Date: 22nd June 2022

Ref: R06-2022 1166

To: **Head of School –** [redacted]
From: **Director**

Title of Research Study: ***The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools.***

The Directorate for Research, Lifelong Learning and Employability would like to inform that approval is granted to **Ritienne Attard** to conduct the research in State Schools according to the official rules and regulations, subject to approval from the Ethics Committee of the respective Higher Educational Institution.

The researcher is committed to comply with the General Data Protection Regulation (GDPR) and will ensure that these requirements are followed in the conduct of this research. The researcher will be sending letters with clear information about the research, as well as consent forms to all data subjects and their parents/guardians when minors are involved. Consent forms should be signed in all cases particularly for the participation of minors in research.

For further details about our policy for research in schools, kindly visit www.research.gov.mt.

Thank you for your attention and cooperation.

Claire Mamo
MA Ed (Open)
Research Support Teacher
Directorate for Research, Lifelong Learning and Employability

f/ Alex Farrugia
Director
Directorate for Research, Lifelong Learning and Employability
Great Siege Road | Floriana | VLT 2000

t: +356 25982443 **e:** alex.farrugia@gov.mt | www.education.gov.mt

MINISTRY FOR EDUCATION, SPORT, YOUTH,
RESEARCH AND INNOVATION

GOVERNMENT OF MALTA
MINISTRY FOR EDUCATION, SPORT, YOUTH
RESEARCH AND INNOVATION
DIRECTORATE FOR RESEARCH, LIFELONG LEARNING AND EMPLOYABILITY

Tel: 25982743 **researchandinnovation@ilearn.edu.mt**

PERMISSION TO CONDUCT RESEARCH STUDY

Date: 22nd June 2022

Ref: R06-2022 1166

To: **Head of School –** [redacted]
From: **Director**

Title of Research Study: ***The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools.***

The Directorate for Research, Lifelong Learning and Employability would like to inform that approval is granted to **Ritienne Attard** to conduct the research in State Schools according to the official rules and regulations, subject to approval from the Ethics Committee of the respective Higher Educational Institution.

The researcher is committed to comply with the General Data Protection Regulation (GDPR) and will ensure that these requirements are followed in the conduct of this research. The researcher will be sending letters with clear information about the research, as well as consent forms to all data subjects and their parents/guardians when minors are involved. Consent forms should be signed in all cases particularly for the participation of minors in research.

For further details about our policy for research in schools, kindly visit www.research.gov.mt.

Thank you for your attention and cooperation.

Claire Mamo
MA Ed (Open)
Research Support Teacher
Directorate for Research, Lifelong Learning and Employability

f/ Alex Farrugia
Director
Directorate for Research, Lifelong Learning and Employability
Great Siege Road | Floriana | VLT 2000

t: +356 25982443 **e:** alex.farrugia@gov.mt | www.education.gov.mt

MINISTRY FOR EDUCATION, SPORT, YOUTH,
RESEARCH AND INNOVATION

GOVERNMENT OF MALTA
MINISTRY FOR EDUCATION, SPORT, YOUTH
RESEARCH AND INNOVATION
DIRECTORATE FOR RESEARCH, LIFELONG LEARNING AND EMPLOYABILITY

Tel: 25982743 **researchandinnovation@ilearn.edu.mt**

PERMISSION TO CONDUCT RESEARCH STUDY

Date: 2nd August 2022

Ref: R06-2022 1166

To: **Director –** [redacted]
From: **Director**

Title of Research Study: ***The Implementation of Continuous Assessment in Integrated Science in Maltese State Schools.***

The Directorate for Research, Lifelong Learning and Employability would like to inform that approval is granted to **Ritienne Attard** to conduct the research in State Schools according to the official rules and regulations, subject to approval from the Ethics Committee of the respective Higher Educational Institution.

The researcher is committed to comply with the General Data Protection Regulation (GDPR) and will ensure that these requirements are followed in the conduct of this research. The researcher will be sending letters with clear information about the research, as well as consent forms to all data subjects and their parents/guardians when minors are involved. Consent forms should be signed in all cases particularly for the participation of minors in research.

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Thank you for your attention and cooperation.

Claire Mamo
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MINISTRY FOR EDUCATION, SPORT, YOUTH, RESEARCH AND INNOVATION

L-Università ta' Malta

[redacted]

Permission to carry out research in school - RA

[redacted]

Dear Ms Attard,

Permission granted - keep us informed

[redacted] to follow you during the process.

cc - [redacted] to take note.

[redacted]

Sent: 07 October 2022 10:56

[redacted]

[Quoted text hidden]

L-Università ta' Malta

[redacted]

Permission to carry out research in school - RA

[redacted]

Dear Ms Attard,

[redacted] are interested in participating in your study. I am keeping them in copy so that you can communicate with them.

Wishing you all the best

[redacted]

L-Università ta' Malta

[redacted]

Permission to carry out research with Science EOs - RA

[redacted]

3 August 2022 at 14:26

Dear Ms Attard,

Good afternoon. You have my approval to conduct interviews with Science EOs.

Best wishes for your research study,

[redacted]

MINISTRY FOR EDUCATION, SPORT, YOUTH,
RESEARCH AND INNOVATION
Great Siege Road, Floriana, Malta