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Policy to Practice: Assessment Reform in Maltese Science Classrooms

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Abstract: New ideas about learning and assessment have led to assessment reforms in many countries, with governments and educators introducing new assessment policies that focus more on assessment for learning rather than measuring achievement. What is problematic about assessment reform is that new policies are written by one group of individuals, usually administrators, and passed down to teachers who need to implement them within the classroom context. The shift from policy to practice is not without its challenges and there is no guarantee that new assessment policies are successfully implemented by teachers.

This study explores how teachers in Maltese science classrooms implement assessment reform. More specifically it focuses on the introduction of School Based Assessment (SBA) to replace summative half-yearly examinations. Using a qualitative methodology, the study looks at the experiences of two Maltese Science Education Officers (EOs) and five Integrated Science teachers in two Maltese state schools as they navigated the shift from using assessment practices that involved traditional testing to school-based assessment practices that were more focused on student learning. The findings suggest that for the participants of the study the implementation of assessment reform was not a linear journey. The participants went through a process that involved: (i) an initial resistance to change, especially the removal of the half-yearly examinations; (ii) using coping mechanisms; and (iii) becoming empowered within a teacher community to embrace and implement new assessment practices. The study suggests that to implement

reform science teachers need to develop an 'assessment literacy' within professional learning communities that give them voice, provide them with support and empower them with the knowledge, skills, and resources that lead to successful assessment reform.

Keywords: Assessment reform; science assessment; school-based assessment; teacher assessment literacy.

Introduction

Assessment is an integral part of effective teaching and learning (Wiliam, 2011). It involves obtaining information about student achievement that can be used for multiple purposes (Berry, 2008). Historically, in many educational systems worldwide, the main purpose of assessment has been the selection and certification of students based on standardised tests and examinations (Stobart, 2021). However, in recent years, new ideas about learning and pedagogy have led to shifts in views about assessment with educators calling for assessment practices that support student learning (Black & Wiliam, 2009). The recognition within the educational community that assessment practices need to change from simply judging achievement to becoming an integral part of the learning process, has led to numerous assessment reforms in many countries (Berry, 2011; Masters, 2013).

While the desire by governments, researchers, academics, and teachers to continually improve assessment practices for the benefit of students is commendable, what may be problematic about assessment reform, is that it is based on policies that are written by a group of individuals usually administrators or ministerial appointees and passed down to teachers and practitioners in schools (Coburn & Stein, 2006). In this top-down model, policy makers who write new assessment policies are mainly focused on the theoretical aspects of reform and tend to ignore the context in which the policies need to be implemented (Adamson, 2011). Policy makers assume that teachers will be willing to take on proposed assessment reforms and make changes to their assessment practices in the classroom (Towndrow et al., 2010). However, research studies (Berry, 2011; Coburn & Stein, 2006) suggest that very often this is not the case and there is no guarantee that new assessment policies even if they are based on research evidence and sound conceptual frameworks will bring about change in teachers' classroom practice.

What is evident from research studies on assessment reforms (DeLuca et al., 2018; Stobart, 2021) is that their success depends on the co-operation of teachers. There is therefore a need for more research into how teachers understand assessment reforms and the challenges they face when trying to implement new theories about assessment and the intended outcomes of assessment reform in their classroom practices (DeLuca et al., 2018; Walland & Darlington, 2021). The study that is reported in this paper addresses this gap in the research and explores how science teachers implement assessment reform using the Maltese educational system as a case study. More specifically, the paper focuses on the changes in assessment policy that were a result of the introduction of the National Curriculum Framework in 2012 in Malta, and which led to the replacement as from the scholastic year 2020/2021 of summative half-yearly examinations with school-based continuous assessment (MEDE, 2018). Using a qualitative methodology, the study looks at the experiences of two Maltese science Education Officers (EOs) and five Integrated Science teachers in two Maltese state secondary schools as they navigated the shift from using assessment practices that involved traditional testing to assessment practices that were more focused on student learning.

Changing views on assessment

One of the main factors that leads to assessment reform is a shift in ideas about assessment and the theoretical re-conceptualisation of the role and purpose of assessment in teaching and learning (Baird & Hopfenbeck, 2016). This shift in views about assessment is "shaped by broader social and educational policies and structures" (Elwood & Murphy, 2015, p. 184) that influence the way in which policy makers, researchers and teachers understand the complex discourse around the development, use, and purposes of assessment (Richardson, 2022).

Within educational communities worldwide, the discourse surrounding assessment has mainly focused on testing and examinations (Richardson, 2022). Examinations are held at the end of a study-unit or programme, and they provide a summative assessment of student knowledge against pre-established curriculum standards (Gipps & Stobart, 2009). The use of examinations was based on the principles of 'psychometrics' that positioned human intelligence, knowledge, and learning as an innate ability that was fixed and could be measured (Elwood & Murphy, 2015). Having an accurate, reliable and scientific measure of student learning and achievement was considered important by policy makers and educators, since examination results provided

students with qualifications that could be used for entry into higher education and selection into future careers (Gipps & Stobart, 2009).

Examinations were also considered fair since they treated all students in a similar manner, could be replicated, and consisted of learning outcomes which could be measured quantitatively using a mark or a grade (Nisbet & Shaw, 2020). In more recent years, this psychometric view of assessment based on measurement of student learning has been critiqued by educators who argue that tests and examinations: (1) do not take the social and cultural context of students into consideration (Elwood & Murphy, 2015); (2) can have an adverse effect on the lives of students since they determine future life chances (Richardson, 2022); and may influence the work of teachers who feel restricted and teach to the test rather than for learning (Black et al., 2003).

This critique of testing and examinations led to a call by educators for assessment practices that were more authentic, practical, and related to real life situations that looked at a broader range of skills rather than just knowledge such as the ability to problem solve, work in teams, and being critical and reflective (Masters, 2013). Furthermore, new ideas about learning such as sociocultural learning theories shifted the focus of assessment practices from one of measurement to one of 'assessment for learning' (Black & Wiliam, 1998). From a sociocultural perspective, "learning and assessment are situated and the agency of both teacher and student are recognised" (Klenowski & Wyatt-Smith, 2014, p. 31). Assessment rather than simply being a summative judgement of what students have learned becomes a formative process which establishes where students are in their learning, what progress they have made over time and provides feedback about this progress (Wiliam, 2011; Masters, 2013). Within this framework, the main aim of assessment is that of helping students to improve by "supporting and encouraging the learning" (Richardson, 2022, p. 29) and providing teachers with information that allows them "to make decisions about the next steps in instruction" (Black & Wiliam, 2009, p. 9).

This shift in thinking about learning and assessment has also led to efforts being made by policy makers, researchers and teachers to develop and broaden assessment practices that go beyond traditional paper and pen examinations, to ensure that current assessment practices are more aligned with views of assessment for learning (Masters, 2013). This has led to the introduction in some countries of school-based or classroom-based assessment practices

(Stobart, 2021). School-based assessment (SBA) is usually carried out by the teacher in the classroom context, is continuous, and takes place over time, can be designed to assess a broad range of skills, and is usually formative because it provides students with feedback about their progress (Carlson et al., 2003). According to Stobart (2021), school-based classroom assessment is encouraged because it focuses on the learning and can assess skills such as problem-solving, thinking, and creativity. Most of all formative school-based assessment can help to "improve the outcomes for all students" (Klenowski, 2011, p. 68). In addition to providing evidence about student learning and achievement, formative school-based assessment can also be used by teachers to reflect on their teaching, discuss with colleagues and enable them to develop new perspectives on learning and assessment (Wiliam, 2011). School-based assessment positions assessment as being "an integral part of the learning and teaching cycle" (Berry, 2011, p. 56).

Implementing new assessment practices

This emphasis on assessment as an integral part of teaching and learning that involves a partnership between student and teacher (Black & Wiliam, 1998) has led to assessment reforms in many countries. However, even though policy makers and researchers agreed about the greater emphasis on learning, research (Berry, 2011) suggests that teachers were not necessarily prepared for these new ideas in assessment. For teachers to change their views and enact assessment reform, they need to develop an understanding of the assessment practices they were being asked to engage in, what Willis et al. (2013) describe as 'assessment literacy'. This involves, "teachers articulating and negotiating classroom cultural knowledges with one another and with learners, in the initiation, development and practice of assessment to achieve the learning goals of students" (Willis et al., 2013, p. 242). Secondly, they need to be able to adapt and "change, adjust and modify their practice in response to variability, novelty and uncertainty" (Loughland & Alonzo, 2016, p. 19). This capacity to respond to change and uncertainty has been described by Martin et al. (2012) as teacher 'adaptability'. Teacher 'adaptability' is quite challenging as teachers need to have the capacity to adjust: (1) their cognitive understanding of the new assessment practices; (2) their behaviour and the way in which they work with colleagues and students; and (3) their emotions to counteract any anxiety and uncertainty created by having to change their practices (Martin et al., 2012). As argued by Willis et al. (2013), teachers need to constantly articulate and re-negotiate their assessment knowledge so that they can implement classroom practices that are in line with new assessment policies.

While some teachers can adapt to changes in assessment practices individually, research suggests that science teachers need to be supported and provided with professional training so that they can implement new assessment practices (Lumadi, 2011). Other research (Collie et al., 2020) indicates that science teachers can be helped to achieve assessment literacy and adaptability by the establishment in schools of "professional learning communities in which science teachers reflect on an instance in which they adjusted their thoughts, behaviours, and emotions to manage a novel or uncertain situation" (p. 10). The reflections and thoughts can be shared with colleagues and used to discuss strategies that can help science teachers implement new practices in their science classrooms. Assessment policies on their own are not enough to bring about change and innovation, teachers need to be provided with professional learning opportunities that enables them to take ownership of change rather than being simply told what to do.

The study

Assessment Reform in the Maltese Context

Within the Maltese educational context, assessment practices have for many years been dominated by summative examinations: half-yearly and yearly examinations during each scholastic year and the more high-stakes SEC examinations at the end of secondary schooling. The use of examinations as the main mode of assessment was based on the belief of many educators that examinations were the most reliable, objective, and fair way of measuring student achievement (Grima & Chetcuti, 2003). Reliability and objectivity were considered important in a small state country, like Malta, where examinations were used for the selection and channeling of students based on their ability (Sultana, 1999).

This examination-oriented culture had repercussions on curriculum, teaching and learning in Maltese schools where teaching is mainly traditional, and content based focusing on recall and memorisation of factual knowledge (Attard Tonna & Bugeja, 2016). Following, international trends in assessment, Maltese education policy makers recognised the need for curriculum and assessment reforms, and this led to the publication of the Framework for Education Strategy for Malta, with goals from 2014 to 2024 (MEDE, 2014). The main aim of the Education Strategy was to have an education 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 (SBA) 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 (SBA) 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). For example, in Integrated Science (Year 7 and Year 8), students are given tasks that are chosen by the science teacher and can include various activities such as quizzes, presentations, journals, projects, classwork, games, tests, practical work, and investigations. These tasks are given a mark which contributes to 30% of the global mark given to students at the end of the academic year with the other 70% of the mark being based on the end of year examination. The 30% assigned to SBA tasks replaces the mark previously assigned to the half-yearly examination. 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).

Within the Maltese context, the introduction of SBA was a top-down decision and teachers, and school administrators were not involved in the decision-making process. Teachers were informed by email about the changes in assessment practices and were initially given very little training (Buhagiar & Chetcuti, 2021). This led to some teachers resisting the introduction of SBA, mainly because they were not sufficiently aware of what was expected of them, and how to create appropriate SBA tasks (Attard Tonna & Bugeja, 2018). The teachers saw the LOF and SBA reforms as simply being another reform and not an opportunity for enhancing teaching and learning (Said Pace & Seguna, 2018). They viewed the new policies as simply being a new name for old

practices. To overcome this resistance, teachers were eventually, provided with some training regarding the LOFs and SBA, 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 SBA (Said Pace & Seguna, 2018). However, research carried out by Buhagiar and Chetcuti (2021) suggests that teachers and administrative staff felt powerless and voiceless with regards to the introduction of SBA, and that there was still a wide gap between policy and the implementation of new assessment practices in Maltese schools.

The research methodology

This study therefore explores the views of two science Education Officers (EOs) and five science teachers teaching Integrated Science (Years 7 and 8) in two Maltese state secondary schools, to obtain a first-hand narrative of an assessment reform from the point of view of science teachers. We opted for a qualitative case study methodology (Yin, 2018) and used focus group interviews to give voice to the teachers' views and hear what they thought of the introduction of SBA in Maltese secondary schools, how they implemented the intended outcomes of the new policy, and the challenges which they faced. Although the number of science teachers is too small for any generalisations to be made, we believed that listening to the views of these teachers could provide us with insights into how assessment reform is enacted in practice.

We opted for focus-group interviews rather than individual interviews since following Kruger and Casey (2015), we thought that they would allow for discussion amongst the teachers in an environment that was safe enough for them to share their views and opinions. Three focus group interviews were held, one with the EOs and one in each of the schools of the study. Ethical clearance was obtained from the Research Ethics Committee of the University of Malta (UREC), and all ethical considerations as outlined by Webster et al. (2014) were adhered to. Informed consent was obtained from the participants of the study who were assured that all information that they shared would be treated with strict confidentiality. Pseudonyms were used when reporting results to ensure anonymity and participants were also informed that participation in the study was completely voluntary and that they could opt out of the study if they so wished.

To facilitate discussion amongst the teachers, an interview protocol was prepared by the researchers, and the focus group interviews carried out by one of the researchers. Following Cohen et al. (2018), a semi-structured interview protocol was developed. Open-ended questions were chosen since according to Cohen et al. (2018) when questions are open-ended, they are more likely to allow the participants to elaborate on their experiences and give their opinions freely. The interviews which lasted approximately one hour, were audio recorded and later transcribed verbatim. During the interviews "the teachers were positioned as experts of their own experiences. They were probed and encouraged to elaborate on the different factors that influenced their decision-making" (Walland & Darlington, 2021, p. 84).

The interview transcripts were then reviewed by the researchers. Following Braun and Clarke (2006), both Attard and Chetcuti 'familiarised themselves with the data', and searched for common themes related to the teachers' views regarding assessment reform. These themes were coded and reviewed for multiple interpretations to arrive at a comprehensive narrative of the teachers' point of view. Attard and Chetcuti discussed the emergent themes, which led to what Darbyshire et al. (2005) describe as complementary insights when writing the results of the study. This analysis of the data led to the identification of three well-defined themes that led to the results that are presented in the next section.

The participants of the study

The participants of the study were two Integrated Science Education Officers (EOs) for secondary state schools. The EOs, Matthew and Owen are responsible for the development and implementation of the Integrated Science curriculum and assessment protocols in secondary state schools. They also work with science teachers and conduct professional development sessions for them. The other participants were five teachers who all teach Integrated Science to Year 7 and 8 students in two Maltese state secondary schools. Two of the teachers, Amanda and Julia also act as Head of the science department in their respective schools. Amanda teaches Integrated Science together with Sarah and John, in a secondary school that caters for around 240 students aged between 11 and 16 years. All of them have more than 5 years of experience teaching Integrated Science. Julia and Tania teach in a different school, catering for around 300 students of the same age, and both also have more than 5 years of experience teaching Integrated Science. Sarah and John also teach physics in addition to Integrated Science.

Research findings

The main aim of the study was to explore how the EOs and Integrated Science teachers navigated through the introduction of SBA in Maltese secondary schools. As we analysed the narratives of their experiences to find out more about how the science teachers were implementing changes in their assessment practices, three main themes emerged. The participants of the study went through a process of adaptation that involved: (i) an initial resistance to change, especially to the removal of the half-yearly examinations; (ii) using coping mechanisms to mitigate the move from summative examinations to SBA; and (iii) becoming empowered within a teacher community to embrace and implement new assessment practices.

Resistance to change

Following the launch of the Learning Outcomes Framework (LOF) in 2014, science assessment practices in Maltese schools went through a reform that involved the removal of the half-yearly examinations and the introduction of SBA tasks (MEDE, 2014). Science teachers would be responsible for the development of the SBA tasks that were meant to assess skills that could not be tested using traditional paper and pencil examinations such as problem-solving skills, creativity and critical thinking (Attard Tonna & Bugeja, 2018). For the participants of the study this reform in pedagogy and assessment practices was long overdue, since as pointed out by Matthew (an EO) "the syllabi and textbooks had been there for 10 years plus and needed to be changed."

However, although the participants of the study recognised the need for assessment reform, they were not happy with how the new assessment policies were introduced. The removal of the half-year examinations and introduction of SBA was a top-down decision taken by policy makers (officials at the Education Directorate and Ministry of Education) and neither the EOs nor science teachers were involved in the discussions. Matthew explained how:

> Introducing SBA in the final global mark and the removal of half-yearly examinations was totally not in our hands. It was presented to us as a matter of fact.

This lack of consultation with teachers, generated a great deal of uncertainty and ambiguity and as reported in other studies (Attard Tonna & Bugeja, 2018; Zahra & Farrugia, 2022), the science educators who participated in the study were initially resistant to the assessment reform.

The main reason for the initial resistance to the new assessment policies was that six out of the seven participants in the study did not agree with "the removal of the half-yearly examinations" (John, science teacher). The participants of the study, both the EOs and science teachers, were still very much ingrained in what Grima and Chetcuti (2003) describe as an examinations-culture. For the science teachers, the end goal of secondary education was the SEC examination, a traditional pen-and paper test. They believed that their role was to prepare students for this examination. They were therefore initially resistant to the removal of the half-yearly examinations for two main reasons. First, they feared that the removal of the half-yearly examinations would lead to students losing the skill of sitting for an examination and students would be less motivated to study. As argued by Amanda:

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

Secondly, they were not convinced that the assessment reform would achieve its intended aim, that is shifting towards assessment practices that were more learner centred. In the view of the participants of the study, students only wanted to receive a mark, and they were only concerned with the final summative judgement, and not with feedback to improve their learning. Sarah voiced her concerns and stated that:

> What concerns me is, when the students are receiving the SBA feedback, what are they taking from it? Are they looking at the feedback? After all this work, does it still boil down to the mark?

Overall, the EOs and science teachers felt that they did not have enough information about the assessment reform to convince them of its merits. They had many unanswered questions which raised a great deal of uncertainty. Sarah echoed the concerns of her colleagues: "how am I going to do this, will it involve more paperwork and more hassle…is this going to involve more work?" The lived experience of the participants of the current study, suggests that within in the Maltese context, the science teachers were unprepared for the assessment reform, and they did not have the necessary knowledge and skills, or 'assessment literacy' to implement the new policies in their science classrooms. This initial resistance to assessment reform is also reported in international studies carried out in Hong Kong (Berry, 2011), Australia (Klenowski, 2011) and the United Kingdom (Richardson, 2022).

Coping with change

The assessment reform introduced in Maltese secondary schools (MEDE, 2014) was placing considerable demands on science teachers, who were finding it extremely challenging to implement the assessment changes that were expected of them. In principle they understood the benefits of the introduction of SBA as a formative experience for students, "an ongoing process where the students are aware where they are improving, where they need to improve, and what they have not understood" (Amanda). They also accepted the fact, that SBA helped the teachers "to inform themselves on the teaching and learning process" (Owen, EO). At the same time, they were finding it hard to translate these new principles into their science lessons. As pointed out by two of the teachers:

> It is definitely a bit difficult for teachers to manage because obviously it requires a lot of flexibility…we need to find a balance between having a plan and being able to adapt that plan (Tania).
>
> I have an issue with my time management. I've been challenged this year because I am very spread out with the introduction of SBA…It's a bit too much…even in terms of preparation (John).

To cope with these challenges and while they took the time to cognitively engage with the benefits of using SBA formatively to help students improve their learning, the science teachers adapted to the new policies by trying to fit the change into their existing schema or practices.

In fact, the science teachers who participated in the study, admitted that although the new assessment initiatives required them to use a variety of assessment tasks throughout the scholastic year, they were still using 'tests' as the assessment task of their choice. Sarah explained that "I kept on giving students tests since I think that they are important and beneficial for the students". For the teachers, tests are an easier and familiar option. They coped with the assessment reform by retaining the summative aspect of assessment (tests) within the new framework that advocated the use of assessment for learning rather than for judging achievement. The teachers also continued to give marks for the tests, rather than formative feedback, because in their view the students were only familiar with marks, and they would not give any attention to feedback. As argued by Amanda:

> I prefer to give students a mark because comments on their own are not looked at by the students…If the students have a mark for a test, when I put comments, they first see the mark and then sometimes they come for

> feedback on the comments. But without a mark they don't give the comments any importance.

The continued use of tests and numerical marks by the science teachers suggests that as pointed out by Berry and Adamson (2011), there is no guarantee that the intentions of policy makers are actualised, and that they "will be faithfully implemented in every classroom" (p. 9). As shown by the experiences of the teachers in the current study, teachers respond to new policy initiatives by transforming them to meet what they believed to be the realistic and practical needs of their classrooms.

Becoming empowered by change

After the initial resistance to the removal of the half-yearly examinations and their continued use of tests throughout the year to assess student learning, the EOs and science teachers started slowly to engage with the principles of the assessment reform. As narrated by the science teachers themselves, they eventually started: (1) to understand the principles of Assessment for Learning which instigated the assessment reform, (2) to develop the skills that they needed into order to implement SBA in their science classrooms; and (3) to gain a sense of ownership which empowered them to successfully implement assessment changes. As pointed out by Klenowski (2011) the science teachers needed to be "informed, prepared and resourced to implement this level of change" (p. 68).

Cognitively engaging with the principles of the reform

A key factor that contributed to the changing mindset about SBA of the EOs and science teachers who participated in the study, was the professional development and training provided for the science teachers together with the Education Officers. These PD sessions, as reported in other studies (Attard Tonna & Bugeja, 2018; Said Pace & Seguna, 2018), helped the teachers and EOs to understand the main principles of formative assessment and come up with new ideas and plan assessment tasks. As pointed out by Owen (an EO), the science teachers started to understand that through SBA they could "inform themselves on the teaching and learning process". This first, enabled the science teachers "to introduce new activities apart from tests, so we are not always collecting marks based on tests" (Amanda). Second, as pointed out by Owen, "unless you assess continuously, then you cannot possibly know how to plan your next lesson. You cannot know whether you need to go back on certain activities or raise certain questions". The

participants of the study started to think of assessment as part of the learning process and they re-conceptualised their views of assessment from what Black and Wiliam (2009) describe as summative measurement of achievement to a view of assessment as formative and leading to improvement of learning.

The participants of the study were in fact excited about the new and different ways in which they were using assessment in their science classrooms. The teachers described some of the different tasks they were making use of:

> 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 inn presentations for them to speak more in front of each other (Sarah).

> We try to include experiments, even short ones whenever we can, we have over 20 experiments in the lab report book not just seven… the students learn as they are doing, learn skills and working in a group (Amanda).

> 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 will also work as CA (John).

These tasks allowed the teachers to assess many skills such as critical thinking, creativity, leadership skills, and communication skills in addition to science content and was in line with the aims of the assessment reform.

Working collaboratively with colleagues in a community of practice

The change in mindset about assessment practices, did not happen automatically and the EOs and science teachers described how they developed ownership of the new assessment policies as they worked together with colleagues in their respective schools and during professional development training. Julia points out that developing new assessment tasks allowed for "more collaborative time", while Amanda explained how in her school, they introduced role play as one of the assessment tasks, and how this involved collaboration amongst different teachers:

> 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 assess the students together and

we also do presentations for them.

Since the science teachers needed to meet to develop and implement SBA, they had to form teaching communities, what Wenger et al. (2022) describe as 'communities of practice'. These professional communities according to Julia, "fostered and enabled collaboration and led to growth". Within these teaching communities, science teachers found a safe space to meet, to discuss different pedagogies and assessment practices, and to make their voices heard with the administration. The teachers however, also acknowledged the need for structures to enable them to meet as a teaching community. As pointed out by Julia:

> …we need to be provided with an extra additional slot, it has to be time-tabled and it counts as a lesson not over and above the duties the teacher has and where it is a collaborative meeting.

Overall, the science teachers who participated in the study eventually reached a stage where they recognised the importance of SBA. Although they admitted that half-yearly examinations and tests were easier to administer and marks were better understood by the students, the introduction of SBA also provided them with the opportunity to grow as professionals, to be more creative, to have a voice in science assessment practices and to develop relationships with colleagues in collaborative learning communities. The 'teacher adaptability' (Martin et al., 2012) evident in this study enabled the participants to develop an 'assessment literacy' that allowed them to engage more effectively with the assessment reform.

Discussion and Conclusions

The climate of assessment reform is a shared international experience (Darling-Hammond, 2011) and provides teachers with opportunities to rethink their assessment practices. Realistically, however, the shift from policy to practice is not straight forward and policy intentions need to be understood and accepted by teachers before they can be successfully implemented in practice (Berry, 2011). This study tries to shed some light on the assessment reform journey within the Maltese context and to provide some insights into the assessment reform journey of science teachers. Although, the context in which the study was carried out is very specific and involves only a small number of participants, the study tells the story of how science teachers managed to navigate through changes in assessment practices.

The findings of the study suggest that the assessment reform journey is not linear, and teachers need to develop 'assessment literacy' or an understanding of the philosophy and principles of new assessment practices before they can implement assessment reform (Willis et al., 2013). Davison (2013), in fact, argues that the development of teacher 'assessment literacy' is necessary for the success of any assessment reform. The development of this 'assessment literacy' does not take place in a vacuum, but as pointed out by DeLuca et al. (2018), the knowledge, beliefs and assessment practices of teachers are influenced by multiple factors such as the learning environment, policy requirements, and professional development. Within the Maltese context, teachers' views of assessment were historically shaped by different paradigms which continued to influence their current assessment practices. Similar to what was happening on an international level (DeLuca et al., 2018; Shepard, 2017), science teachers in the study needed to shift their mind-set about assessment, from a view of assessment as a measurement of student achievement based on examinations (summative assessment) to view of assessment based on the principles of assessment for learning with a greater emphasis on the improvement of learning (formative assessment). This was no easy task and did not happen automatically. The teacher narratives show that before the science teachers developed 'assessment literacy' they went through a process of 'teacher adaptability' (Martin et al., 2012) so that they could "adjust their thoughts, feelings and behaviours in response to new, changing or uncertain situations" (Granziera et al., 2019, p. 60).

This process of 'teacher adaptability' is clear in the teacher narratives presented in this paper. The EOs and science teachers went through the three dimensions of adaptability described by Martin et al. (2012) since they responded to the change on a cognitive, behavioural, and emotional level. Alonzo et al. (2021) argue that the effectiveness of any assessment reform starts with teachers understanding the basic assessment principles and re-aligning their practices with these principles. In fact, the EOs and science teachers who participated in this study had to first cognitively understand what they were being asked to do – and realign their focus from a heavy emphasis on summative examinations to a diversification of their assessment tasks, providing feedback and involving their students in the assessment process. Their behavioural response to the change was mainly a coping strategy, where they continued to use tests over an extended period rather than as a one-off examination. This made the reform more manageable for them in practical terms and helped to reduce the emotional anxiety of not being prepared to carry out assessment in a continuous and formative manner. The science teachers needed to "construct their own understanding in the context of their practice" (Shepard, 2017, p. XXII).

The science teachers adapted to the assessment reform on an individual level, but it was only when they started to work with the EOs and other science teachers that they managed to develop 'assessment literacy'. Through dialogue, collaboration, and within teacher communities of practice they were able to develop a greater sense of autonomy and felt empowered to move on in their thinking and practices. However, the teachers acknowledged that the setting up of teacher communities needed to be structured so that teachers would have the opportunity to engage in their own personal and professional development. As argued by Bezzina (2002), such professional teacher communities can provide opportunities for teachers to come together to reflect and be active participants in change rather than simple recipients of instructions. This "collegial reflective practice" (Bezzina and Camilleri, 2001, p. 163) is key in bridging the gap between policy and practice. Within professional learning communities, science teachers are more capable of adapting and reflecting on how to develop the necessary skills that enable them to engage in effective assessment to support student learning (Wilsey et al., 2020). As argued by DeLuca (2018), professional development and continued teacher support are instrumental in enabling teachers to "shift their approaches to assessment from traditional to contemporary conceptions" (p. 358).

We would therefore argue that the success of any assessment reform depends on teachers developing 'assessment literacy' and a "shared discourse" (Willis et al., 2013, p. 252) of assessment practices. Following Pastore (2023) we would argue that assessment literacy does not simply involve teachers developing the knowledge and skills to make sound assessment decisions, but that the views, beliefs and dispositions of teachers play an important role in how teachers respond to and enact assessment reform. For teachers to effectively take on assessment reform, make it their own, and implement it in their classrooms, they need to first, be involved in the decision-making process to ensure that any new policies reflect classroom realities. This will make them more likely to engage with assessment reform. Second, this dialogue should not stop once the assessment reform is introduced but it should continue throughout the school year to open conversations about assessment and continuously evaluate the impact of the reform. This conversation can be continued within professional learning communities. When science teachers are given voice, provided with the support to work collaboratively in a safe space, and empowered with knowledge, skills and resources, the tensions between policy and practice can be overcome leading to successful assessment reform.

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