

INVESTIGATING THE IMPACT/ROLE OF THE INTERACTIVE WHITEBOARD ON TEACHING PRACTICES IN MALTESE KINDERGARTEN CLASSROOMS THROUGH AN ACTIVITY THEORY APPROACH.

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This thesis is submitted in partial fulfilment of the requirements for the degree
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This thesis results entirely from my own work and has not been offered previously for any other degree or diploma.

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A handwritten signature in blue ink, appearing to read 'R. Camilleri', written in a cursive style.

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Abstract

Technology in the 21st century is changing the face of society as much as it is transforming learning and teaching practices. At kindergarten level children are already immersed in technology, challenging teachers into re-thinking their pedagogies to be able to effectively integrate digital tools into their classrooms, a change which is a complex process. This research investigates if and how the Interactive Whiteboard (IWB), as a technology-enabled tool, supports/challenges teachers into transforming their pedagogical practices from the teachers' perspectives in Maltese kindergarten classrooms.

Activity theory (AT) as the main theoretical framework was adopted to examine and analyse the pedagogical activity within this specific sociocultural context, enabling the capture of the whole dynamics of the activities taking place, underlining how the IWB acts as a multimodal tool enabling teaching and learning. The teacher as the facilitator plays a crucial role in the dynamics of this activity system.

The findings result from participative observations within ten Maltese kindergarten classes and interviews with the kindergarten educators. They perceive the IWB as an important mediating tool which stimulates and motivates learning while in the process supports and transforms their teaching practices. The tensions which emerged were mainly due to the lack of support both in technical and pedagogical aspects as well as that by school leaders. Lack of training and professional development was predominantly hindering the full potential of the IWB tools. These

challenges in some instances acted as the driving forces behind change in pedagogy.

The major recommendations arising from this study suggest a clear strategy for a whole school policy for technology uptake, emphasis on continuous professional development, opportunities for sharing of practice, and a shared leadership approach. These factors are influential and determine whether a shift can transpire in how far teachers exploit this curricular integration or use the IWB merely as a substitution, as technology for its own sake.

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Module 1 ED.S821: Research Methods in Education and Social Science

Settings: What are the initial perspectives and preconceptions of teachers about the use of tablets in the primary classroom?

Module 2 ED.S822: The Development of Professional Practice: Why is technological integration limited in Maltese primary classrooms?

Module 3 ED.S823: Researching Technology Enhanced/Networked Learning, Teaching and Assessment: The role of technology within teaching practices in a Maltese kindergarten classroom.

Module 4 ED.S824: Groups and Communities: Integrating the IWB in a Maltese kindergarten classroom – a case study using activity theory to analyse teaching practices.

Module 5 ED.S825: Interculturality and Globalisation in Technology Enhanced Learning: Global education and intercultural awareness in eTwinning.

The research paper for Module 5 was presented and published as follows:

- Published in the academic journal **Cogent Education** - Taylor & Francis online – Teacher Education and Development. July 2016
- Presented at the **Teacher Education Policy in Europe (TEPE)** international conference in Malta. May 2016
- Presented my research work at the **Global Education Conference** – an online international conference. November 2015
- Moderated and presented a **European webinar** on the eTwinning platform about the theme of Global education and interculturality in eTwinning. April 2015
- Recently I have been invited to present my published work and contribute as a member of the conference committee in **World Education Day - 2018** in Jinan, China. September 28-30, 2018.

List of abbreviations

VLE virtual learning environment

eLST eLearning Support Teacher

KGE Kindergarten Educator

LSE Learning Support Educator

NCT Noticing, Collecting, Thinking

ECE Early Childhood Educators

ZPD Zone of proximal development

SAMR Substitution Augmentation Modification Redefinition

CoP Community of Practice

MCAST Malta College of Arts, Science & Technology

CPD Continuing professional development

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Chapter 1 Introduction

“Technology is just a tool. In terms of getting the kids working together and motivating them, the teacher is most important.” - Bill Gates

1.1 Technology in education

Technology in the 21st century has become diffused in all aspects of our lives, transforming the face of society. In education this is no different, learners come to school already immersed in a society and culture which uses technology extensively, affecting the way they interact with the world, necessitating that educators provide teaching and learning experiences which are meaningful and relevant to them. It is no longer debatable whether we should be integrating technology in the classroom, but rather how we should be doing this. Through technology, educators can create a visually rich and interactive learning environment within their classrooms (Moos & Marroquin, 2010).

Although technological innovations are not limited in schools, few radical transformations are exceptionally evident. This means that a shift must transpire from simply using technology as another teaching tool or another resource, to technology as an essential element for successful performance outcomes (Ertmer & Ottenbreit-Leftwich, 2010). Technology integration in education is part of a complex change process and thus educators are being challenged into re-thinking their pedagogical practices to effectively enable learning through technology. Straub (2009) sustains that unlike curricular changes in subject matters, which happen every so often, technology innovations and tools are constantly changing. This hinders teachers' adoption of

technology, as they fear they lack the knowledge or do not have the time available to learn to use and integrate a new tool in the classroom.

Some teachers may lack the pedagogical knowledge and fail to realise what the potential of these “new technological tools mean for instruction in early learning environments” (Kaumbulu, 2011, p. 3). Such challenges may serve as barriers to curricular integration and yet, at the same time, could be catalysts into bringing about transformation in teaching practices.

Empirical research from various sources indicates that the resistance to the integration of technology in the classroom is widespread (Cuban, Kirkpatrick, & Peck, 2001; Goktas, Gedik, & Baydas, 2013; Howard, 2013; Kaumbulu, 2011; Levin & Wadmany, 2008; Papaioannou & Charalambous, 2011; Sweeney, 2009; Turbill, 2001; Winzenried, Dalgarno, & Tinkler, 2010). These sources identify inadequate technical and administrative support, lack of training, and the lack of time for preparation amongst other factors. When we talk about teachers resisting technology it is *change* which is being resisted more than the technology itself. Fullan, 2007, argues that educators need to understand the meaning of the change being implemented, the "what" and "how", for them to conform to the idea of transforming their pedagogy. This lack of knowledge and understanding then brings about resistance to any change. "Neglect of the phenomenology of change - that is, how people actually experience change as distinct from how it might be intended - is at the heart of the spectacular lack of success of most social reforms" (p. 8). This is further corroborated by Mumtaz (2000), who states that resistance is based on unclear understanding of why the change is taking place, leading to “confusion and misunderstanding” (p. 336). Educators are familiar with their “tried and tested ways of teaching” and thus do not feel the need to adapt to new technologies. On the other hand, educators who

understand the gains for teaching and learning take risks and integrate new technology practices in their teaching methods. They are effectively enacting this change in their classroom practices by bringing about transformation.

1.1.1 Technology in the early years

Children in kindergarten are at the very beginning of the educational spectrum. Research conducted on children up to age six has shown that they are already very actively engaged with interactive technologies and media before they start attending formal schooling (Rideout, Vandewater, & Wartella, 2003). It is also crucial to understand that certain skills need to be presented to the children at this very early stage. The OECD, 2017 report establishes the fact that the brain's sensitivity to developmental areas is at its peak during these early years and thus lays the foundations for future skills development and learning. "Investments in high-quality early childhood education and care...are key for children's long-term learning and development" (OECD, 2017, p. 17). The social and intellectual development of children at this age is more malleable, and thus exposure to technology could have a much more significant impact (Rideout et al., 2003, p. 3). The next chapter will discuss this in more detail.

As evidenced, technology may be the stimulating factor in motivating and exposing children at the right time, strengthening their ability to learn and retain that learning. Yet the most determining element is the teacher, who is central to enabling and facilitating this learning. It is hence the role of the kindergarten educators (KGEs) to expose young children to technologies as learning tools in their classrooms. Therefore, if teachers are not given adequate professional development opportunities as well as training, they will fail to seize the potential of technology in their pedagogy at this critical time.

The educational system and policies in Malta do not deny the importance of exposing children of kindergarten age to the use and integration of educational technologies within classrooms, yet how much of this is actually put into practice is another matter and will be discussed further on. A more detailed account of the local scenario, the Maltese educational system, and my role in this field will follow.

1.2 My role and the local context

1.2.1 The Maltese educational system

In Malta children enter kindergarten at the age of three where they spend two years of pre-primary education before beginning their formal schooling. The first year of primary education is referred to as year one. The early years extend up to year two with children aged five to six. Primary schooling is up to year six when children are aged nine to ten. In year seven they begin their secondary school journey up to year eleven.

Schools in Malta are either state or non-state schools, the latter comprising church and independent schools starting from pre-primary to upper secondary education. State schools offer free education to all students and are found in all the main towns and villages in Malta. The current study focuses on kindergarten classes in state schools because my work situates me in primary schools and thus I am most familiar with them.

State schools in Malta are clustered into ten colleges. Each college consists of several primary and secondary schools geographically located within the vicinity of each other. The primary schools of one college act as feeders for the secondary school or schools of that same college. Kindergarten classes are an integral part of Maltese primary state schools. There are usually two distinct classes, kinder one and

kinder two, with children aged around 3 and 4 years respectively. At 5 years of age children then progress to the first year of their primary compulsory schooling.

1.2.2 My role in schools

At the time I embarked on this research my role was that of an eLearning Support Teacher (eLST) for primary schools, now more commonly known as Digital Literacy Support Teacher, but for the scope of this study will be referred to as eLST. Initially my career as an educator began as a primary class teacher in which I spent eight years. At the time, technology in schools was limited to three desktop computers in specific classes. Later on, as the technology increased I found myself captivated with learning how to integrate this tool in my classroom. I hence enrolled in a two-year diploma course at the University of Malta, in Information Technology in Primary Education (2002). After successfully completing the course I then applied to become an eLST. As an eLST, my role was predominantly supporting and training educators in their use and integration of technology in the classroom, both on a one-to-one basis as well as on a group basis. I also provided whole school training during professional development sessions. My support extended moreover to the school administration (head teacher and assistant head teachers), which I will be referring to in this study as school leaders, who regularly asked for advice and suggestions as to strategies for further training of their staff and for the deployment of innovative technology, which the education department would implement from time to time. Maltese state schools are equipped with a multitude of digital resources, especially in primary schools. One of the main interactive resources is the Interactive Whiteboard (IWB). Its potential in enabling active participation and in effect change in pedagogy allows for a more interactive teaching style (Verenikina, Wrona, Jones, & Kervin, 2010). The IWB also supports whole class teaching, acting as a mediating tool

between teacher and students (Lewin, Somekh, & Steadman, 2008). As a tool the IWB is essentially a large whiteboard display with a touch-sensitive surface. It is connected physically to a computer and projector to display computer images or can be a standalone touchscreen used independently. Users manipulate and activate items on the board either by directly using fingers as a mouse or with the use of a special pen. Although it may appear that the physical IWB is changing teaching and learning, it is the resources educators use with the IWB that have a “significant impact on educational outcomes” (Maher, Phelps, Urane, & Lee, 2012, p. 139).

In 2011 the IWB was initially installed in all Maltese state schools and thus primary schools including kindergarten were furnished with one IWB in each classroom. An IWB together with a projector were installed to work together. This happened very quickly with barely any consultation between policy-makers and educators (the practitioners) to enable a smooth implementation. Training was hurried and limited to an initial three-hour training session by representatives of the respective IWB company. This training happened during one session with no opportunity for hands-on training. The only hands-on training was delivered, later on, by eLSTs such as myself during professional development sessions. These sessions were not carried out by all schools but only by schools requesting such support and who envisaged the need to provide more training to their staff. Although as eLSTs we provided pedagogical support, especially on a one-to-one basis, we were and still are very limited in number to cater for all state schools in Malta. It is important to note here that prior to the IWB installation, the virtual learning environment (VLE) as the main learning platform for state schools had also just been introduced into schools in a very short time, consequently overwhelming teachers and firing up much resistance and frustration.

I was constantly realising that the resistance to these technologies was not merely cosmetic, which could be solved easily. It implied a more complicated context with a multitude of underlying factors each playing a distinct role. The most evident reasons were that teachers lacked the pedagogical knowledge and failed to realise what the potential of these “new technological tools mean for instruction in early learning environments” (Kaumbulu, 2011, p. 3). The lack of both pedagogical and technical support, which has consequently brought about minimal change in pedagogy suggested the urgent need for continuing professional development, training, as well as sharing of best practice (Al-Faki & Khamis, 2014; Goktas et al., 2013; Winzenried et al., 2010).

1.3 Purpose and scope of study

The more I came across teachers who either resisted using technology or on the other hand were enthusiastic in learning how to integrate it yet lacked the support, the more I became intrigued to delve further into this issue. I decided to conduct empirical research together with a theoretical and academic framework to take this up professionally.

Initially upon embarking on this study, I discovered that despite these technological developments in the classroom, local research to inform policies and practice was very limited, especially in the kindergarten classes. What engrossed me most during my work as an eLST was the realisation that these kindergarten classes were being equipped with the exact same technologies as in the primary classes and yet whenever training, professional development, research or surveys were being planned and effected in this regard, this was offered primarily to the primary-class educators. KGEs are expected to use the technologies available professionally, even though they are given less support and less priority, as pointed out by Sollars, (2013) from the local

scenario and which will be discussed later on. This is notwithstanding the acknowledgement from various stakeholders of the importance of introducing digital technologies in early childhood education as already alluded to earlier on and again re-affirmed by Hansen (2008) “Clearly, technology within literacy instruction has the potential to benefit young learners” (p. 110).

This realisation prompted me into looking specifically to find any research and literature supporting the use of technology in the early years of schooling. As a result, I found a host of literature from foreign countries but very limited literature to do with technology in Maltese kindergarten classes. “Early years services (in Malta) have developed in a rather ad-hoc and staccato manner over the years. There has never been a well-thought out, all-encompassing strategic policy for the early years, particularly for the under-fives” (Sollars, 2013, p. 37). KGEs, formally known in Malta as kindergarten assistants, were recruited with a minimum of entry requirements and training was provided on the job in the first few weeks. Regular monitoring was also lacking, as was any guidance on working with young children. Consequently, this led to a perception of KGEs as “akin to baby-sitting and being a mother was a sufficient qualification to be employed in early years settings” (Sollars, 2002). These could be some of the reasons why KGEs were not treated as professionals and neglected. Today certain perceptions still persist and are difficult to erase even though the Education Department is offering more dedicated and professional courses specifically for the early years. More informed awareness from all stakeholders would bring about the necessary change in policies and practices in this field.

Drawing upon foreign sources I have found that the issue of lack of consideration for early year educators is not only a local phenomenon. In Australia the quality and professionalism of early childhood educators (ECE) is also lacking (Fenech &

Sumsion, 2010). The authors acknowledge the discriminatory factor in accrediting teachers in New South Wales for teacher preparation courses yet excludes ECEs. They also refer to the “lack of pay parity with teachers working in the primary school sector” (p. 90). Jayne Osgood has a plethora of work which discusses the ongoing debates of the ‘professionalism’ of ECEs and their status in the UK. “Early years practitioners increasingly have to wrestle with demands for accountability, performativity and standardised approaches to their practice” (Osgood, 2006, p. 6). Sheridan, Edwards, Marvin, & Knoche (2009) reaffirm the lack of empirical research that “has been dedicated to the process by which early childhood practitioners acquire new knowledge, skills, and dispositions” (p. 387). The authors emphasize the need for empirical research to focus on *how* to conduct supportive professional development for these practitioners to bring about meaningful change rather than target and underline *what* professional development is in terms of structure and form. Oberhuemer (2005) maintains that although there is an increase in the awareness of the early years’ service as regards quality and visibility, yet “conceptualisations of early childhood professionals remain distinctly variegated across Europe and beyond” (p. 6). Oberhuemer suggests policies which endorse the professionalism of early childhood educators and which value them as “of social, cultural, educational and political significance” (p. 14).

Despite such challenges, I must note that today governments and educational institutions overall are demonstrating signs of growing bodies of scholarship in policies, practice and awareness of the importance of the early years. My preoccupation is that there is still much to be desired as to subsequently acknowledge the important role of the KGE and shift from policy to practice, from discourse to reality,

and hence equip these educators with the support and resources needed “to provide richer educational experiences” (Sheridan et al., 2009, p.378).

My work as an eLST has situated me into the actual classroom realities enabling me to empathise with such teachers as well as providing me with insights of the actual contexts these teachers are facing. Notwithstanding the radical changes and challenges brought along with the innovative technologies, I have noticed not only resistance, but also instances into very good practice of technology integration which unfortunately remains enclosed within the four walls of the classroom. This is the main reason I became so inspired and felt the need to give these educators a voice. Through this research my main purpose is to make known the practices of KGEs, including challenges they face in their particular context, appreciate these, and act accordingly. As already mentioned, the nature of my role has motivated me into identifying this gap in the literature as well as in practice; moreover, I have concentrated on the impact of the main technology used inside classrooms, the IWB, and investigated KGE’s teaching practices to determine if any radical shifts have transpired in their pedagogy. As in any initiative, there were teachers willing to move forward, take the challenge and integrate these tools and resources effectively in the classroom while others were more reluctant and resisted the change. This research studies the barriers and motivating forces in the implementation of technology while suggesting recommendations for the local context.

A model which is used for establishing the level of technology integration and the approximate level of change within teaching practices, is the Substitution-Augmentation-Modification-Redefinition (SAMR) model developed by Puentedura (2010) (see figure 1.1). This will be occasionally referred to later on in other chapters. The SAMR framework shows the progression developed in technology

adoption in the classroom. It establishes the shift in activities from the basic enhancement level, which are substitution and augmentation. Here the teacher uses technology to accomplish traditional tasks only by substitution, for example from writing on paper to writing on a word processor. The next level is the transformation level, where we have modification and redefinition. At this level technology changes and redefines the teaching and learning processes, enabling the user to create, collaborate, and interact in tasks which were previously inconceivable.

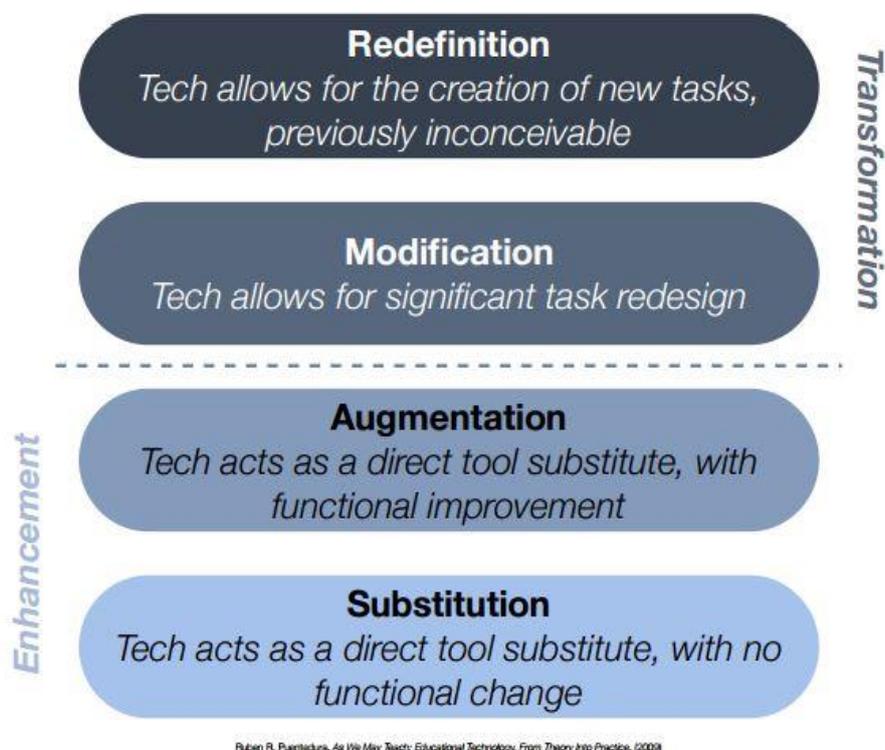


Figure 1.1 The SAMR model.

1.3.1 Defining the research questions

The research questions emerging from this context focus on examining teachers' perceptions of how technology, specifically the IWB as a multimodal tool, is supporting or challenging them into reshaping their pedagogical practices to achieve their objectives.

The main overarching research question driving this study is:

- How does the tool (IWB) impact teacher's pedagogical practices and activity within the classroom context?

This has been further broken down into three more specific questions:

1. How does the IWB, as the mediating tool, within the activity system, hinder, enhance or transform pedagogy from the teachers' perspective? (A more detailed explanation of the activity system will be discussed in section 1.4 below).
2. What role does the teacher play in this dynamic system when integrating the IWB in the classroom?
3. What are the tensions and contradictions encountered, if any, when using technology? How are they resolved?

1.4 Conceptual framework for analysis

In exploring conceptual frameworks, I found Activity Theory (AT) provides the appropriate framework to holistically encapsulate teachers' activity when using the IWB within the classroom context. It helped reveal teachers' perceptions of how technology, particularly the IWB as a multimodal digital tool, mediating social action, is supporting/challenging teachers into reaching and reshaping their pedagogical practices and objectives. AT also exposes the tensions created and if and how they are resolved. "Activity theory is a practical framework which can be used to underpin the complex and dynamic problems of human research and practice" (Hashim & Jones, 2007). Using the AT lens provided me with an analytical tool to study the "complex pedagogical activity embedded in, and affected by a combination of multiple layers of personal, social and institutional contexts, which closely interact with each other as they affect the activity outcomes" (Kervin, Verenikina, Jones, & Beath, 2013,

p. 135). This effectively contributed to systematically exploring and understanding the context of why KGEs resist or adopt use of the IWB in the classroom. Although the literature review reveals a multitude of studies where the AT framework has been adopted to study technology in primary classrooms (Lin, 2012; Yong, 2010), in the Maltese context this will be an innovative approach. AT, as a framework, has not been so widely used locally in educational studies and neither has it been used as a tool to study and conduct research with KGEs in the classroom.

AT is an ideal framework to study innovation and change as it happens within a system because it takes into consideration the multitude of variables such as the context, the system rules, the community, and looks at how these interact together, between themselves and through the mediating tools. AT looks at contradictions in the system which could work either against the targets to be achieved or if solutions are found, bringing about systemic change. AT also looks at the crucial role of the teacher in the system who determines the processes and uses the tools appropriately to achieve pre-identified goals. The complexity of the system which incorporates technical and pedagogical issues are exposed and then analysed within this lens.

Consequently, AT will be framing evidence to address the gap in the local literature throwing light on the practices and day-to-day realities of KGEs within classrooms, exposing their challenges, how and if these are resolved, and recommendations based on the findings of this study. Central to this approach is the comprehension that learning and teaching is a culturally based social undertaking as it highlights the communicative aspects of teaching and learning where knowledge is shared and co-constructed (Hardman, 2008, p. 67).

The AT conceptual framework will be thoroughly discussed in the next chapter - the Literature Review.

1.5 Definition of key terms

1.5.1 Educators

This whole study specifically investigates kindergarten teachers who are referred to interchangeably as either *Kindergarten educators (KGEs)* or simply *teachers* all through my work. The term *educators*, which is used frequently in this research, has a wider meaning including all kindergarten and primary teachers, support teachers, learning support educators, and school leaders. Learning support educators (LSEs) are educators assigned to children with special educational needs. In the Maltese context they support and collaborate with the class teacher and other colleagues during class activities. The term school leaders (school administration) will also be used very often and includes the head of school and the assistant heads who form part of the school administration team.

1.5.2 Technology integration

My understanding of the term *technology integration* will not simply refer to the implementation and superficial use of a technology, the hardware and software, but specifically the curricular integration, which is the embedding of technology within the curriculum making it more meaningful (Hutchison, Beschorner, & Schmidt-Crawford, 2012). The term will thus be used interchangeably.

1.5.3 The 21st century skills

The 21st century skills encompass skills such as problem-solving, communication, collaboration, global education, creativity, and critical thinking. The importance of these skills in our society dictate that educational systems must adopt them as an essential framework for preparing students for life and work environments. These learning and innovation skills “focus on creativity, critical thinking, communication and

collaboration is essential to prepare students for the future” (Partnership for 21st Century Skills, 2004).

1.6 Structure of the thesis

This introductory chapter has looked at the importance of technology in educational settings to foster 21st century skills. I then discussed the need to acknowledge its importance and potential in stimulating children’s learning experiences especially during the early years and consequently how teachers need to be supported and trained through professional development. The local context was then explained along with my role in schools as supporting teachers in the integration of technology. Here I delineated how my role provided the motivation and inspiration for further research and consideration of these crucial early years to address the gap in local literature. Once I established the whole context of the study, the purpose, scope and conceptual framework of this research followed.

Ensuing this introduction, I then look at the existing literature in this particular field. The *Literature Review* earmarks empirical research, studies, and other relevant work about the use of technology in the classroom. Initially I give an overview of the process in locating existing research and studies. The existing local strategies and policies follow to give an understanding of the local scenario and existing documents focusing on the use of technology in the Maltese educational system. Subsequently a detailed description is given about AT and its many facets through leading literature, its purpose in this study and how it supports such research. As its name suggests the literature review explores existing literature. Accordingly, I research the fields of technology integration, change, pedagogy, technology in kindergarten, teachers as change agents, and the technology itself – the IWB. The focus has been on literature and empirical studies carried out in primary schools to be able to provide a robust

supportive framework for my arguments and any recommendations. The literature review divulges more closely the limited research which exists locally in this field, hence the need to contribute to this sector and provide empirical research.

Moving on to the *Methodology* chapter I primarily discuss my personal beliefs and the underlying philosophies of how I understand and view the world; knowledge and reality, as this is constantly being reflected in my interpretations. The methods and research instruments chosen and used are described and examined reflecting the qualitative nature of this study. I again refer to the crucial importance of my role in this section to be able to capture the realities only an insider can decipher. The ethical considerations and procedures I adopt are all defined and described ensuring conformity with data protection policies. I explain how this was carried out and then present a detailed account of the data analysis signposting the methods and software used. A limitations section concludes this chapter.

The *Findings and Analysis* chapter describes, through an in-depth narrative, the observations and interviews conducted in each classroom with each KGE. I then move on to analyse these descriptions using the AT framework adhering to the research questions stated in this introductory chapter. To conclude, a summary of the key findings is listed and the emergent themes discussed.

Subsequently, the *Discussion* chapter takes on a more argumentative approach wherein readers are reminded of the main themes driving this study and what the findings reveal. Assumptions in correlation with the literature are made and each research question discussed in light of the findings analysed.

The final and concluding chapter sums up this research holistically, bringing together the literature, theory, findings, analyses as the supporting evidence for

recommendations made and at the same time contributing to the local literature as indicated at the beginning of this work. Through this study I hope to draw the spotlight specifically on kindergarten teachers in Malta, exposing their challenges and resistance to technology, exemplary and innovative practices, as well as demonstrating how technological tools, particularly the IWB, are dynamically changing their teaching practices. This would confirm the need for more support and training highlighting the crucial role of the teacher in this transformation.

The next chapter is an overview of the pertinent literature starting from any existing local policies to looking into foreign relevant studies in this field. This review pinpoints where the need for more research exists and how this study will contribute to the gap in the literature.

Chapter 2 Literature Review

2.1 Introduction

In view of technology as a tool which is transforming pedagogical practices, that is, the way teachers teach, this literature review sets out to explore and research how teachers capitalise upon technology as a mediating tool between themselves and students, within a classroom environment, to enhance and transform their teaching practices. It is by studying this impact of technology that we can better understand its dynamics. Price & Oliver (2007) proposed a framework to conceptualise this technology impact through a three-part model. The *anticipatory* which includes the design, attitudes and discourses, the *ongoing* which is the actual process of integration including support and professional development and finally the *achieved*, the summative outcomes of the technology. Executing such a framework could eliminate inflated unrealistic talk surrounding innovative technology, subsequently proving to be more realistic by “knowing the limitations as well as the potentials of particular technologies in relation to teaching and learning” (p.24).

This literature review will first look at relevant literature of local policies then move on to provide a definition of activity theory (AT), the theoretical framework within which this whole research is embodied. Reference is made to empirical studies where AT has been applied within an educational context. Then I explore technology integration in the classroom and how or whether this is bringing about change in pedagogy. I will then reflect upon the teacher, the fulcrum of all classroom activities and his/her role in this shift as change agent. Studies demonstrating specifically the integration of the interactive whiteboard (IWB) are cited as it is the technological tool under focus in my research. This will uncover the challenges, tensions as well as benefits brought about by technology integration, along with the need for more

support. I will then examine sources that refer to technology in kindergarten.

Literature and empirical research dealing with technology in the classroom has been drawn predominantly from foreign sources. This is due to the gap in local research in this area, especially at kindergarten level, and is effectively the scope for presenting this study. Although the review is structured into specific themes as indicated it will be impossible not to have overlapping of basic concepts and merging of ideas in different sections as they all relate to each other and are interdependent in some way or other. The teacher as the fulcrum in management and transformation of classroom practices, training, professional development, and the application of AT are all issues which will emerge throughout the review, as they could be key in the process of change. First, I will explain how the relevant literature was identified and how the searches were conducted.

2.1.1 The literature review process

In structuring this literature review I was influenced to a certain extent by the systematic approach proposed by Levy & Ellis (2006) for conducting and writing a literature review. This model consists of three main sequential steps – see figure 2.1.

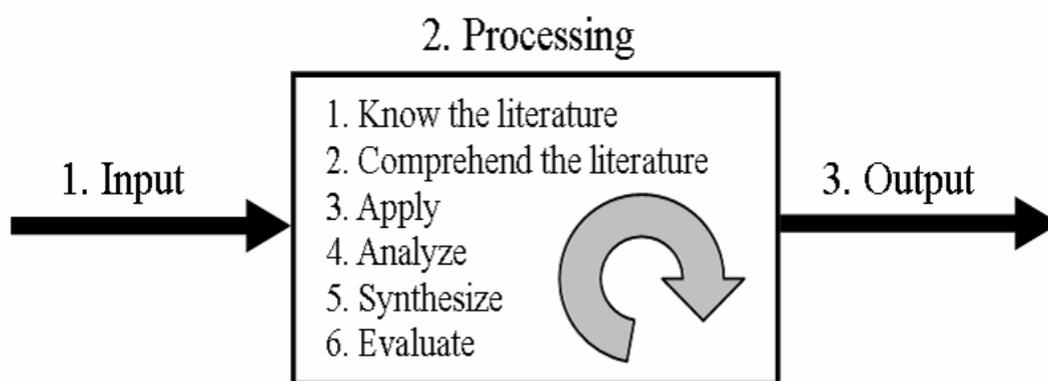


Figure 2.1 – The three stages of effective literature review process

The first stage: *Input*. This refers to all the relevant research articles which were found and the gathering of data from the literature. Internet searches were carried out by identifying key-words and phrases such as: technological innovation, technology in primary schools, reluctance/resistance of teachers' use of technology, the early years, barriers in technology integration, factors supporting integration, communities of practice to support change, interactive whiteboard, transformation. These were inputted into various online databases using Lancaster University's electronic facility from the library section: OneSearch. Other databases and search engines accessed were mainly: Eric, Web of Science, ScienceDirect, Google Scholar and British Education Index. Various journals from across the globe were examined such as Early Childhood Education Journal, International Journal of Technology and Design Education, Journal of Social Sciences, Computers & Education, etc. Websites and blogs also provided up to date current information. Local policy documents were consulted along with numerous books and reviews. This input phase was an important stage in the process of collecting data from the literature as according to Levy & Ellis it determines the quality and effectiveness of the resulting output (p. 185).

The second stage: *Processing*. Data and information from the sources were investigated by taking into account Bloom's Taxonomy of Educational Objectives (Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation), as suggested, for a thorough review. This process determined factors such as whether the publications provided findings focusing on primary schools, if they were relevant to the study, or shed light on any theoretical concepts whilst others stood out as they alerted me to issues not yet explored. Empirical studies using qualitative mixed methods characterised most of the literature covered in this research, including

studies from Turkey, Cyprus, Finland, Germany, Australia, and the United Kingdom. Very limited literature on the Maltese context with special emphasis on kindergarten use of technology could be found, confirming a gap in the literature.

The third stage: *Output*. This final stage refers to the argumentation of the research.

2.2 Local strategies and policies

In recent years Malta embarked on the implementation of the National eLearning strategy (Government of Malta, 2008), which emphasized three particular directions: skills, infrastructure and content (see figure 2.2).

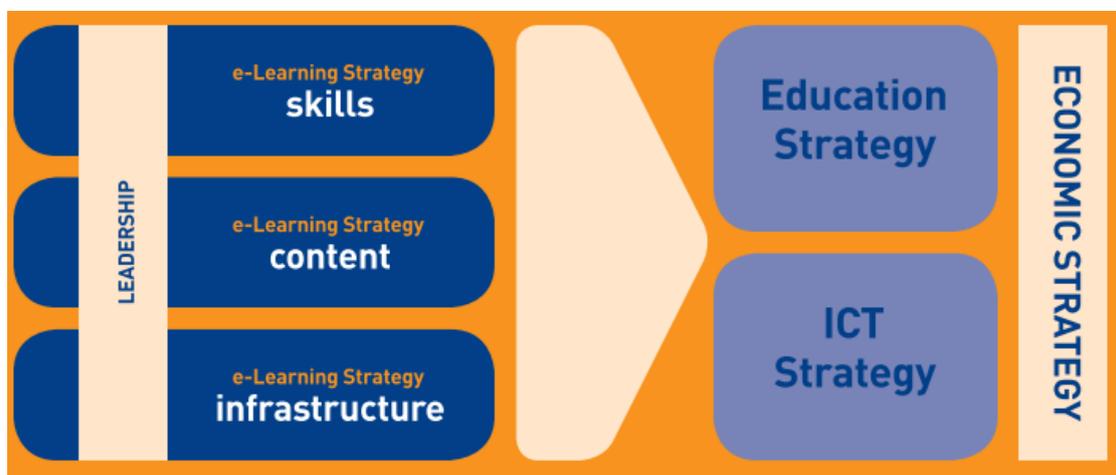


Figure 2.2 The National e-Learning Strategy

This strategy marked the beginning of equipping all state schools with the necessary ICT infrastructure, providing training to all educators in using ICT in the classroom, and furnishing teachers with the necessary tools to make students' learning more motivating and engaging. The *Smart vision*, as it was referred to, recognised the importance of technology as a tool.

Technology will lubricate this new industrialisation. But technology has no value in and of itself: it is a tool for people to use to realise their vision, their aspirations, and indeed their full potential which has no value in and of itself but

a tool for people to use to realise their vision, their aspirations, and their full potential (Government of Malta, 2008, p. 4).

The potential of technology in education as a game changer was thus realised and set into motion a number of initiatives which targeted the infrastructure and hardware in schools. All state schools today are equipped with infrastructure which enables a virtual learning environment (VLE) and hardware such as desktop computers, IWBs, laptops for all educators and an array of digital resources such as Bee Bots, Lego Story Starters and Pro Bots amongst others. Initially all state primary school classes were furnished with four desktop computers. These were not put into a lab as is the practice in some church and independent schools. This set-up with computers readily available in the classroom was implemented strategically to emphasize the concept of technology as a tool to be used when necessary rather than another subject compartmentalised into a laboratory.

Maintaining this vision the 2012 document, *A National Curriculum Framework for All* – NCF (Ministry for Education and Employment, 2012), recognised the important role of digital literacy in education in Malta. “We regard Maltese, English, Mathematics, Science and Technology as key skills backed by a robust acquisition of digital literacy skills” (p. ix). The document proposed universal education entitlement built around the eight EU Key Competences Framework, namely, digital competence. The NCF is the first national curriculum since Malta joined the EU in 2004 and in effect has adopted several policy-related documents issued by the European Commission. Following the NCF was a development of this proposed framework translated into learning outcomes which could be implemented and followed by schools. The *Learning Outcomes Framework* – LOF (Ministry for Education and Employment, 2015) built upon the NCF as a guide to pedagogy and assessment, with the

intention 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 LOF emphasizes digital literacy as a cross-curricular theme and essential for learning and life, carrying on from the NCF to propose specific learning outcomes for educators to follow.

Digital literacy education seeks to equip learners with the competencies (knowledge, skills and attitudes) in the use of digital technology needed to access learning opportunities, to pursue their chosen careers and leisure interests and to contribute to society as active citizens. It also aims to provide them with knowledge of the principles underpinning these technologies and a critical understanding of the implications of digital technology for individuals and societies (Ministry for Education and Employment, 2015, Digital Literacy section, para. 1).

The NCF is one of the few documents presented by the Ministry of Education and Employment, identifying the Early Years “as the most crucial phase in each individual’s life - a child’s learning and education in the Early Years are inextricably linked to the holistic development” (p. 45). It also acknowledges the importance of engaging with digital literacy at this very early age stressing that practitioners should adapt and capitalize upon effective pedagogies and resources to develop motivation in these young learners (p. 46). The Framework for the Education Strategy for Malta 2014-2024 (Ministry for Education and Employment, 2014), identifies the importance of charting its action by providing children at kindergarten level with a “stimulating and rich learning experience” (p. 6). The LOF document also provides a specific guide for pedagogy and assessment for the Early Years.

A very topical document addresses digital literacy and how it could progress from enhancement to transformation within the Maltese educational system (Department of eLearning, 2015). This paper also recognizes that the provision of opportunities to enhance digital competences should commence at kindergarten level.

Although several documents allude to and include the importance of acquiring digital literacy skills at an early age, there is no extensive literature or empirical studies focusing on the early years and pedagogical practices. There is also a misalignment between the vision of policies which seem idealistic, but which are not realistically reflected in teacher/school practices.

These limitations have necessitated the following review of foreign literature as essential in formulating and drawing conclusions or recommendations for the local context.

2.3 Theoretical Framework

Activity Theory (AT), as a theoretical framework, was considered as the most appropriate to underpin this study in the light that it can encapsulate activities within the classroom from a sociocultural perspective to study educators and children in their natural setting. AT is also known as cultural historical activity theory (CHAT) and studies “the intertwining of human thought and action with practices and institutional affordances for action” (Edwards, 2011, p. 1). AT presents ways of understanding the role of the technological tools which are available in kindergarten classrooms, and in what ways they affect teaching practices.

The AT framework was chosen to embody this research owing to its focus on ongoing interactive processes as it “allows one to situate developmental processes in context” (Hardman, 2007, p. 53). The model is so dynamic it allows for insights into continuous constructions and re-constructions of the elements making up the

whole system. Pedagogical activity, which is the main focal area of this study, is multifaceted as much as it is complex (Hardman, 2008), necessitating such an approach that is situating interactions in time and place. In this case we have KGEs who were observed in their classroom environments to study how the technology is changing pedagogy.

Teachers introducing new digital tools may be driven to find modifications to overcome contradictions encountered, and if they succeed continue to develop upon those teaching strategies. The rules or the tools may have to be modified to suit the activity more appropriately in the process. This continuous adjustment by the KGE and the children to meet the objectives of the activity is not a static and linear process and as such allows for development, re-thinking and re-constructing. The classroom is a live community and the teacher seeks to find the most effective tools to bring about learning. Thus, in this context AT is applied to study the IWB, as a mediating multimodal tool, for interactions between teacher, learners, and goals.

2.3.1 Activity Theory – A definition

Technology, change, pedagogy, beliefs, and challenges are not detached isolated concepts but interrelated, and are investigated as they work together within a system. AT provides the framework to study classroom activity within a situated sociocultural context by understanding human behaviour and social interactions “...in their natural everyday life circumstances, through an analysis of the genesis, structure, and processes of their activities.”(Kaptelinin & Nardi, 2006, p. 31)

In essence the mediated action triangle in AT (see Figure 2.3), proposed by Engeström (1987), explains how activity enables humans to develop through interaction with tools and social others to find new meanings. This visual model triangle (figure 2.3) was originally conceptualised by Vygostky (1978). The main

concept basically revolved around the understanding of the interactions between the 3 nodes; the subject, tool, and object. The subjects are the individuals under study, who act upon the object, which is the desired outcome/objective of the activity, to transform it through mediating artefacts, which are the tools (Hardman, 2007). This model triangle was further developed by Leontiev (1974) morphing then into Engeström's (1987) concept of activity as expanded learning. Engeström added the components of rules, which constitute the rules within the classroom setting or community - the participants of the activity system, and he also added the division of labour - the dividing of tasks and roles among the members of the community which could include support staff and school leaders. These additions by Engeström offer a more dynamic overview of the teaching and learning processes.

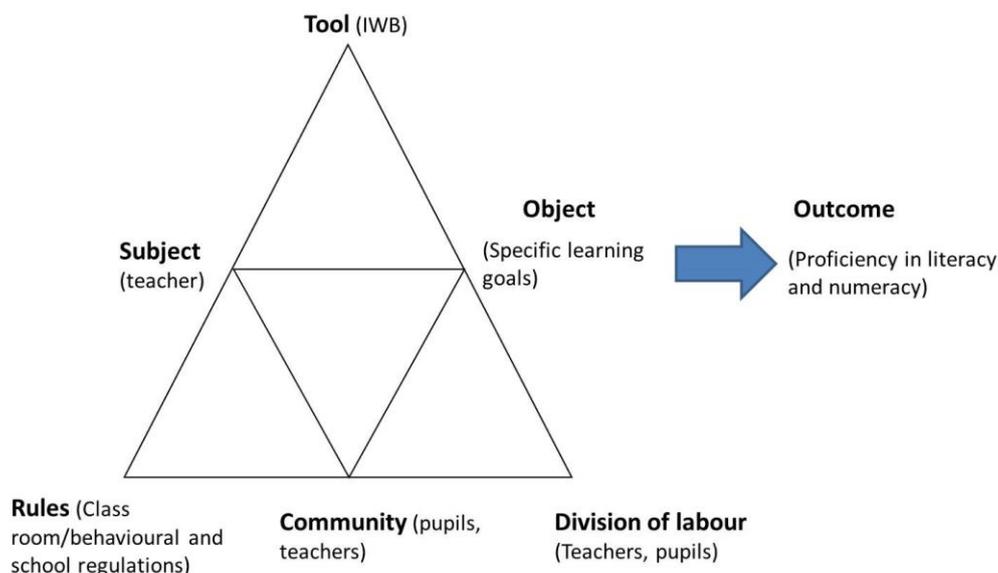


Figure 2.3 The proposed activity system based on the model formulated by Engeström (1987).

AT also encompasses the complexities within a classroom environment by disclosing any pertinent contradictions by momentarily freezing activities to view the integration of technology in its entirety. It reveals how the teacher 'orchestrates' activity within a

situated environment to enhance and scaffold teaching and learning with the IWB, as a multimodal tool (Dillenbourg, 2011). Waycott, Jones, and Scanlon (2005) report that there is an interchange between the tools and the learner where:

the user adapts the tools they use according to their everyday practice and preferences in order to carry out their activities; and how, in turn, the tools themselves also modify the activities that the user is engaged in (p.107).

In this study the user is the teacher who is constantly adapting the technology, the mediating tool, to best suit the learning needs of the children, the activities and teaching practices to achieve learning outcomes, the object. The challenges and contradictions presented by the technology can result in change and development (Engeström, 2001) rendering contradictions as catalysts for transformation.

2.3.2 Activity Theory Application

“Nowadays, a common application of Activity Theory is for the study, analysis and interpretation of the changes required for the transformation of collective practices” (Karasavvidis, 2009, p. 438). Pedagogy is an ongoing social construct (Price & Oliver, 2007), so what better way to analyse this impact than through AT, which is a social constructivist approach?

As a conceptual lens it allows for a visualisation of the “context of the educational processes under investigation” (Gedera & Williams, 2016, p. vii). Gedera & Williams have managed to compile a not-so-common collection of works using activity theory in educational research, interwoven with transformations in education. This collection presents theoretical and empirical studies from various aspects of contemporary educational contexts as well as diverse continents. Engeström in his opening comments to the book states that “the model of an activity system makes visible the context of the educational processes under investigation” (p. vii), indicating how this

approach exposes insights to pedagogical practices immersed in a socio-cultural environment.

One of the studies in this collection of empirical research findings applies sociocultural historical AT in an elementary Singapore school to analyse how distributed leadership can facilitate the uptake of one-to-one computing (Yong & Lim, 2016). The four levels of contradictions and tensions defined in AT and arising during the implementation are examined. The discussions and actions which take place address the disturbances demonstrating that social mediators can be key in bringing about a successful integration of technology. The authors argue that shared leadership is central to success because it is extended to the school's teaching community. This community is inclusive of the school principal, ICT co-ordinator, curriculum co-ordinators, and teachers. In Malta this can be taken up as an example wherein the school community – school leaders, eLSTs and other teaching staff – can come together to discuss contradictions and tensions, find solutions and be able to integrate the IWB in their pedagogy in their specific context, rather than left to tackle problems individually.

The complex activity system taking place in the classroom includes interdependent elements which can come from outside the classroom. These can influence, contradict and mediate the activities. AT allows researchers to explore these elements and the transformative processes, expose barriers, and provide recommendations. Verenikina, Wrona, Jones, & Kervin (2010) use AT to investigate the implementation of the IWB in literacy teaching in an Australian primary school. This enables them to view the IWB as a mediating tool which enhances pedagogical practices with emphasis on the tool as needed to achieve an outcome. "Technology alone is not the remedy to a quality education system rather that technology is useful

relative to its need in achieving a learning outcome” (p. 2613). Through AT the authors expose the influencing role of the rules underlying the curriculum, which may hinder or encourage technology use as does the division of labour between the students and the teacher. My research will shed light on how the IWB fits into the activity system and how I will be investigating the role it plays in Maltese kindergarten classrooms. The literature is also exposing the issue of curricular demands which determine much of why Maltese teachers resist or limit the use of technology.

Lin (2012) proposes eight model kits to support kindergarten teachers’ integration of technology. Lin demonstrates the importance of having practical models based on real classroom situations. In Malta KGEs also need to have the opportunity of learning how to practically apply features of the IWB in their everyday activities. Instead of models, eLSTs could provide that support on an individual basis or through showcasing best practice, from KGEs themselves, in professional development sessions.

AT is also used to investigate pedagogical practices in mathematics in a primary school through object-oriented activity. The findings indicate that pedagogical moments could be captured and thus studied. By approaching technology integration from a sociocultural dimension, it can be viewed in its entirety, primarily as this would be including the context wherein ICT is being situated. AT was also used to investigate the implementation and use of the IWB in an Australian primary school. This case study reveals how the “IWB mediates literacy teaching from the perspective of an Activity System” (Verenikina, Wrona, Jones, & Kervin, 2010, p. 2613).

AT is increasingly used as an analytical tool in educational research (Hashim & Jones, 2007) because it explores the mediating role of tools without depending on the participant's perspective (Scanlon & Issroff, 2005).

2.3.3 Relevance to Proposed Study

This research studies the technology impact of the IWB, in a sociocultural context, which in this case is the classroom and school environment, and its impact on pedagogical practices. Yong (2010) highlights this importance of the sociocultural aspect of situating ICT in the classroom and looks for elements which impact teaching and learning. Furthermore AT is applied to highlight the barriers and challenges KGEs face bearing in mind the important factor that the KGEs are dealing with very young children, which in itself is very challenging.

2.3.4 Tensions and contradictions in activity theory

In activity theory the principle of contradictions helps to identify conflicts and tensions which emerge in a system. Engeström (1987) not only identifies such contradictions but also denotes four distinct levels which analyse the process of transformation (Bonneau, 2013, p.2). The first level is the primary contradictions that occur within the same element of an activity system such as within the community. The secondary contradiction occurs between nodes of the same activity system such as the subject and the community. The tertiary contradiction arises upon the introduction of a more advanced object to the system such as new technology or practices. The quaternary contradictions "arise between the central activity and its neighbouring activity systems" (Foot & Groleau, 2011, p. 6).

The term contradiction in activity theory can thus be considered as the source of development and change (Gedera & Williams, 2013, p. 34) because when

confronting tensions in practice, teachers may adopt ways and means of overcoming obstacles and consequently develop such contexts into opportunities for innovative and effective solutions to tensions encountered. Engeström & Sannino (2011) argue that contradictions are not easily distinguished and “must therefore be approached through their manifestations” (p. 371).

The contradictions and tensions exposed and manifested when “practitioners articulate and construct them in words and actions” (Engeström & Sannino, 2011, p. 371), will be analysed to determine whether they lead to change and transformation or hinder innovation. Yong (2010) studied the elements which would impact the integration of ICT in teaching and learning when introducing an innovation. Yong found that the sociocultural approach – the rules, division of labour and “strong leadership together with a high level of technical and pedagogical knowledge and skills” (p. 6) – facilitates curricular integration of ICT. Emerging contradictions identified could then lead to an expansive form of learning (Engeström, 1987). The tensions between subject and tools, resolved through commitment and perseverance in Yong’s study, are shown to lead to an expansive form of learning in the teacher’s own pedagogy and hence transformation. This current study seeks to investigate the tensions between KGEs, the IWB, and other elements such as the school environment, and if or how they are resolved.

Activity Theory is particularly relevant in situations similar to those of the local scenario that have a significant historical and cultural context where the participants, their purposes, and their tools are in a process of rapid and constant change. (Hashim & Jones, 2007).

2.3.5 Activity theory and phenomenology

My research investigates teachers' perspectives of the impact of the technology on their practices, in other words it adopts a phenomenological approach to research. Both AT and phenomenology are concerned with examining the structure of a particular phenomenon, in this case the impact of technology on pedagogy. In AT this is carried out through observations and field notes and with phenomenology through interviews and informal discussions. Both AT and phenomenology assume an actor (the teacher, subject) engaging in meaningful activity, mediated by tools (Kaptelinin & Nardi, 2006; Kosaka, 2013). Subsequently they complement each other in that AT provides a more diagrammatic, illustrative expression of the processes and theoretical framing of the research, while phenomenology mainly influences the methodology of this study.

2.4 Technology integration, change, and pedagogy

The literature presents several empirical works that study technology integration from varied perspectives and facets. This has given me a greater insight to the complexity of the barriers, incentives, enhancements, and change which technology integration in the classroom implies and the impact it has on pedagogy for teachers. Jonassen (1996) had envisioned technology as mindtools, wherein learners learn *with* technology rather than *from* it. "Cognitive tools are essential components of a learning environment in which learners are required to think harder about the subject-matter domain being studied or the task being undertaken and to generate thoughts that would be impossible without these tools" (Jonassen & Reeves, 1996, p. 697). Here Jonassen demonstrates insights into shifting focus from the technology as the end, to a tool enabling the construction of learning. "When students work with computer technology, instead of being controlled by it, they enhance the capabilities

of the computer, and the computer enhances their thinking and learning” (Jonassen, 1995, p. 44).

With technological tools readily available in the classroom, and having children who are familiar with the digital interface, teachers are challenged into re-thinking their teaching methods to be able to effectively integrate technology into their classrooms, a change that implies a complex process. At times teachers lack the pedagogical knowledge and fail to realise what the potential of these “new technological tools mean for instruction in early learning environments” (Kaumbulu, 2011, p. 3). This points to the need for a supportive environment within the school where teachers are given advice and support through a progressive development in their pedagogical content knowledge of use of the IWB. School leaders who support teachers in their development and who encourage sharing of practices to enhance pedagogy between teachers are facilitating transformation in practices (Sweeney, 2009). In a study focusing on major tensions in the uptake and use of IWBs in Australian primary schools, Sweeney notes that when school leaders provide these supportive learning environments “the focus shifts away from the teacher and the technology towards the use of the IWB as a shared tool to enhance learning” (p. 32). Cranmer & Lewin (2017) in their research project: Innovative Technologies for an Engaging Classroom (iTEC), underline the importance of having a supportive system for educators to sustain any innovative technology introduced in the classroom. In this four-year European project which mainly addressed the concept of innovation, the authors also emphasize the complexity of defining innovation which depends on how individual teachers perceive it – highlighting its subjectivity – the project has shown that transformation is brought about not by radical change but rather progressive adoption of technology.

Technology integration at face value may appear simply as a question of implementing new hardware and software in the classroom and upskilling teachers' knowledge of particular technologies. Yet it is evident that technology integration is a much more complex issue which impacts upon pedagogy and practices and in effect challenges teacher's pedagogical beliefs leading to change in practices (Fullan, 2007, 2013; Luckin et al., 2012). I must also note here that although the literature suggests that change will inevitably follow implementation, this may not always be the case. Two paradigms may be present, "the one based on the idea that new technology will 'transform' pedagogy (sometime in the future) and the other based on the assumption that it can 'enrich' what is already taking place" (Burnett, Dickinson, Myers, & Merchant, 2006, p. 12). Thus, on the one hand, it could simply be substituting or enhancing what is already practiced, reflecting no functional change, or on the other hand, it could be transforming practices completely through redesigning tasks. In a study, set in the UK (Burnett et al., 2006), which happens to have a very similar educational structure to the local scenario, two main paradigms seem to dominate the educational landscape. Technology is seen by teachers, either as a means of transformation and change, or that of 'enrichment' wherein technology simply acts as a substitute and enriches what is already there. Most opt to adopt the latter as it requires no major changes and is thus less daunting. In their research project Burnett et al. study how two primary schools take on this transformation through a technology plan, demonstrating how technology not only introduces new literacy practices but, in the process, also changes perceptions of the teacher's role. It demonstrates the "possible avenues towards what may sometimes seem an unrealisable goal of transformation of the curriculum" (p.27). In Maltese primary and kindergarten classes, the interactive whiteboard (IWB) most times is merely used as

a glorified projector, simply an 'enrichment' of what was already in practice, a white board, and in essence no real change to pedagogy is implemented. Commitment to technology plans could help initiate the step forward towards change. This suggests that technology needs to be embedded in pedagogical practices for change to come about.

The connecting forces of technology, pedagogy, and change knowledge in technology integration are elements which make up the metaphor of the stratosphere described by Fullan (2013). Fullan, a leading advocate of change and educational reform, discusses the relationship and connectivity between technology, pedagogy and change knowledge by comparing them to the stratosphere in one of his books with the same name (2013). The stratosphere constitutes internet resources, which do not have a physical location, and are present everywhere giving it a mystical aura. We cannot understand everything in it, yet it is readily available.

It includes technology with its huge, ever expanding storehouses of information, but also opportunities to learn differently, what I call pedagogy; and it incorporates change knowledge – what we should do with all this information to change things, presumably for the better (Fullan, 2013, p. 1).

Fullan argues that change can be easy even in whole system reforms by addressing small factors which bring about innovating learning experiences: the technology should be engaging, not too complicated to use, available anytime anywhere and meaningful by being steeped in real-life problem solving. Undeniably, these factors contribute highly to a successful integration, yet I believe Fullan (2013) is being too prescriptive here. In my experience, the varying school cultures, with their particular contexts and situations that differ from school to school and from place to place do not always make this possible.

The 'new' meaning to educational change is echoed repeatedly in all Fullan's five editions of the book *The New Meaning of Educational Change* (2016), implying that this 'new' meaning has not yet been fully understood. "Neglect of the phenomenology of change – that is how people actually experience change as distinct from how it might have been intended – is at the heart of the spectacular lack of success of most social reforms" (Fullan, 2007, p.8).

Educational change is being widely discussed, especially in recent times, where technology in education is transforming teaching and learning practices. Emphasis in professional development, for example, is more on pedagogy rather than skills as it used to be (Beetham & Sharpe, 2013; Ertmer & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007; Kervin et al., 2013; Levin & Wadmany, 2008; Papaioannou & Charalambous, 2011; Ravenscroft, Lindstaedt, Delgado Kloos, & Hernandez-Leo, 2012; Zhao, Pugh, Sheldon, & Byers, 2002). Despite this awareness there seems to be a dichotomy. Teachers are said to be changing and adapting to become more technologically oriented, more student-centred in their pedagogy and discourse. Yet my personal observations and experiences in classrooms when supporting teachers reveal a different reality, one where despite the enhancements and support in pedagogy and professional development not so much has in fact changed in the classroom, and teaching practices remain barely changed. This observation surfaces also in the literature (Cuban et al., 2001; Tondeur, Van Braak, & Valcke, 2007). Having technology readily available within the classroom does not necessarily mean teachers will definitely make abundant use of it or change, as many other factors come into play, such as technical problems: "then confidence in the technology's worth erodes and contributes to sustaining current teaching practices" (Cuban et al., 2001, p. 829).

Imposing a curriculum is another important factor which contributes to reverting to traditional practices. One way of solving this would be by allowing teachers to devise their own ICT competencies and technology plan for the school. This could be worked out by the school staff, school leaders, and teachers coming together to adapt the national ICT-related curriculum (digital literacy) for the school's particular needs. This would commit teachers with the responsibility of executing their own decisions into their own practice, decisions with more realistic goals. This bottom-up approach would be more successful as educators will have ownership, responsibilities in decision-making, and a sense of shared leadership. Subsequently this will at the same time encourage reflection and empower teachers, leading to change in practice and more dialogue between all stakeholders (Tondeur et al., 2007).

With Maltese schools becoming more and more autonomous, decision-making on not so major issues can effectively take place at school level and implement more strategic and attainable proposals. This concept of autonomy for schools was proposed in the document "All Children to Succeed" (Ministry of Education Youth and Employment, 2005) wherein all state schools are decentralized into ten colleges as already defined in chapter 1. "State schools will acquire greater autonomy and will be in a position to nurture their own identities. In this way, each school will adapt the national curriculum to its own needs" (p. v) Change would as a consequence not be an issue of power or imposition if it comes from amongst the school staff itself, and is thus more likely to happen (Wasley, 1992). "Planning should precede purchasing, and training should precede implementation" (Czubaj, 2002, p. 16). Change, hence, needs to be meaningful, in contrast with the main focus of most policy makers whose intentions and personal agendas are to acquire and impose technology rather than

to use it effectively, reducing technology to an 'end' in itself instead of a 'means' (Czubaj, 2002). Both tensions and opportunities in the integration of technology are effectively enacting change in classroom practices.

2.5 Teachers as change agents

For technology integration and eventually change to ensue one fundamental element must be at the fulcrum of any transformation: teachers as change agents themselves. Some of the literature covered so far put much weight on the external factors, however few papers look into the most critical element: teachers' technological and pedagogical beliefs. Teachers, the facilitators of the change process, need to believe in the importance of technological integration. To enable this change process in teachers Ertmer and Ottenbreit-leftwich (2010) identify four variables in teacher change: knowledge, self-efficacy, pedagogical beliefs, and subject and school culture. Fullan (2013) too, in his vision, emphasizes the importance of pedagogy: essentially the teacher. "The teacher as change agent is crucial, or we will get aimless multi-tasking" (p.67), indicating that the teacher is facilitating and guiding this process by bringing everything together through specific skills. Fullan quotes Hattie (2009), who not only acknowledges the teacher as a leader of change but someone very skilled who is continuously evaluating the effect of their teaching on students' learning.

The question of whether technology in itself brings about improved learning is debatable. I firmly believe that technologies in themselves do not have any direct impact on learning. It is the practice that brings about learning and that practice is enabled by using tools. The tools may be the technology which in this case is the IWB. This is why practice manifested as teaching methods or pedagogy is so important. Consequently, the positive attitude and perspective of teachers towards

use of technology is crucial. “Thus, understanding users’ attitudes toward learning technology, including instructors’ and learners’ attitudes, enables us to make learning more effective, efficient, and appealing” (Liaw, Huang, & Chen, 2007, p. 1077).

In a longitudinal study of over three years Levin & Wadmany (2008) looked at the correlation between change brought about by technology integration and teachers’ beliefs about factors which affected their teaching and learning with rich technology. Their findings point at change developing when there is transformation in the teachers’ views and practices, establishing the vital importance of the teachers’ beliefs and voice: “teachers are the key players in changing the educational world, and in particular the learning and teaching processes in their own classrooms” (p. 234).

2.6 The IWB and orchestration

In recent years the IWB has gained worldwide popularity as an effective interactive technology all across the educational system and at various levels (Glover, Miller, Averis, & Door, 2007; Higgins, Beauchamp, & Miller, 2007; Smith, Higgins, Wall, & Miller, 2005). It is not the purpose of this study to investigate these claims, but it will analyse the potential and impact of the IWB on teaching practices, and whether they are enhanced or transformed.

Pedagogical practice has been observed to improve when teachers have been using the IWB for a certain amount of time. Lewin, Somekh, and Steadman (2008) have evidence that where teachers have been using the IWB for more than two years, it “becomes embedded in their pedagogy” (p.292) and thus changes pedagogic practice. In Maltese primary schools the IWBs have been used for much more than two years and effective change is expected to be apparent. Nevertheless I have

observed only a few selected teachers who show this actual change. Most teachers still use the board without any interactivity. This suggests teachers lack the knowledge and support to use the IWB software capabilities for interaction, or else resist its use for other reasons.

Most teachers do believe the IWB has a motivating and engaging impact on student learning, and accept “IWBs as a powerful and practical technology that facilitates teachers’ instructions” (Turel & Johnson, 2012, p. 392). Here again I believe is another contradiction between what teachers say their beliefs are, and what is actually happening in the classroom. One must question what teachers really mean when they say that this technology facilitates their instructions. Is it simply a substitution of their usual practices or a transformation in the way instruction is carried out; is it a more child-centred, multimodal, participative approach or still teacher-centred, one-way instruction?

The IWB is a multimodal resource tool as it leads to other digital mediums of learning. It brings together ways of teaching, learning, linking activities, visualising concepts, physical interaction, and access to multimedia all in one place, as well as supports teachers in orchestrating learning (Luckin et al., 2012). This metaphor of orchestration as defined by Dillenbourg and Jermann (2010) refers to the design and real-time management of multiple classroom activities. In effect the main affordance of the IWB, its multimodal functionality, is determined by the children’s response to the teacher whose expertise enables flexibility in orchestrating the learning environment (Littleton, Twinera, Gillen, Kleine Staarmanc, & Mercer, 2007). “Only by being part of action do mediational means come into being and play their role. They have no magical power in and of themselves” (Wertsch, 1993, p.119), demonstrating that the IWB, or any other tool for that matter, plays only a part in the activity system

(a tool) from within a sociocultural context managed by the teacher. The teacher thus has various roles to play in managing this context, and again we see the teacher as the fulcrum of the activity system. The teacher decides how to use the tools available (the technologies); how to adjust them to suit particular needs, how to tackle disruptions coming from the class such as behaviour or technical problems as well as disruptions from outside, such as persons coming into the class or outside activities. Hardman (2008), identifies four roles which the teacher needs to orchestrate, namely as mediator, instructor, director, and manager. The teacher adapts one of these roles to conform to the context, situation and needs when interacting with students. This takes great expertise and experience, an asset which does not come automatically, but takes time.

It is a fact that technology imposes new challenges which teachers are facing other than orchestrating activities such as pedagogical application. Al-Faki and Khamis (2014), in their study of the Saudi context, investigate the difficulties encountered by teachers during English language classes, when using the IWB to teach English. They found four main factors which hinder its use, namely teachers', school administrations', technical support's and students' factors. "Perhaps no one of those factors by itself is a determining factor, the interaction of them, however, has a very profound effect on teachers' performance" (p. 154). Despite these challenging factors, the IWB as an interactive tool still has the potential to not only enhance teaching practices but also transform pedagogy to encourage active learning. As children are more involved, there is a particular focus on the dialogical aspect of learning. Kershner and Warwick (2006), in their project aimed at developing primary teachers' understanding of the use of the IWB, have found that 'classroom talk' in relation to the IWB promotes active teaching and enhances learning. 'Classroom

talk' becomes central to learning as it is a process of meaning making, with the teachers' role essential to engage students in participating by probing, elaborating, supporting, and providing feedback. Findings from preschool educators' interviews resulted in the affirmation that children must have "an active role as meaning-makers in the learning process" (Mertala, 2017, p. 204).

2.7 Challenges and tensions

The notion of tensions and challenges as the driving forces in change has been discussed in its relation to activity theory earlier on. Challenges may serve as barriers to curricular integration of technology and yet, at the same time, could stimulate transformation in teaching practices. In the framework of AT, this could be translated as contradictions that may lead to development of the activity system wherein the tensions and challenges lead to expansive learning (Engeström, 1987).

Factors hindering the use of technology in the classroom are quite similar across the globe as they are in Malta. Ertmer (1999) distinguishes between two types of barriers: extrinsic first order barriers and intrinsic second order barriers. The former constitute time constraints, lack of hardware and inadequate technical and administrative support identified by several researchers amongst which Bingimlas (2009), Ertmer & Ottenbreit-leftwich (2010), Goktas, Gedik & Baydas (2013) and Keengwe, Onchwari & Wachira (2008). The latter indicate factors such as fundamental beliefs about teaching and technology and the unwillingness to change noted also by Baek, Jung, & Kim (2008), Baylor & Ritchie (2002), Karaca, Gulfidan, & Yildirim (2013), Kopcha (2012) and Liu (2011a). Surprisingly Ertmer completed her research back in 1999 and yet the concerns as well as the specific strategies indicated in her work to achieve technological integration are alarmingly very relevant and still the same today. This could imply that not so much has changed in

teachers' pedagogy and, as already discussed earlier, although there is much talk about educational change brought about by technology, traditional practices still persist.

Some of the first and second order barriers described by Ertmer could be overcome by adapting the technological, pedagogical, content knowledge (TPACK) (Mishra & Koehler, 2009) framework which addresses technological integration from the perspective of knowledge. Nevertheless there remains another unexplored barrier – teachers' design thinking. Tsai & Chai (2012) propose a third-order barrier to the successful integration of technology: the lack of design thinking: "As classroom context and students are quite dynamic, the teacher should rely on some design thinking to re-organise or create learning materials and activities, adapting to the instructional needs for different contexts or varying groups of learners" (Tsai & Chai, 2012). They argue that teachers' design capabilities are crucial in a holistic integration. The teacher here again surfaces as the crucial element with the proper expertise to moderate, facilitate, and adapt pedagogy to suit the learners.

In a comparative study of data gathered in 2005 and then in 2011 by Goktas et al. (2013), these barriers were identified: lack of hardware and software materials, limitations of hardware, lack of in-service training and of technical support. The study concluded that Ertmer's (1999) first and second-order barriers as well as Tsai & Chai's (2012) third-order barrier are interrelated and need to be addressed for a significant effective integration.

It would be tempting at this point to simplify these findings and suggest that consequently by addressing the intrinsic and extrinsic barriers described by Ertmer (1999) technology integration could be finally resolved. "Most of the current efforts

take a very narrow view of what teachers need to use technology—some technical skills and a good attitude” (Zhao, Pugh, Sheldon, & Byers, 2002, p. 511). The classroom reality though is much more complicated. In the first place it is difficult to clearly separate the first-order barriers from the second as they are so closely intertwined. Also, there may be other particular lurking factors which are not so obvious, such as the school culture. It may well be that teachers have the technology, have the skills, have the beliefs which conform with enhancing learning with technology, yet lack support, encouragement, or a form of technology integration plan by their school leaders. Teachers thus become reluctant and do not feel empowered to utilise the resources available. Authorities who dictate and impose technological innovations as well as ICT competencies within the curriculum expect changes in practice. This rarely comes about because “curriculum frameworks can even be in conflict with the characteristics of the local school system (e.g. school policy, school culture, and teacher beliefs)” (Tondeur et al., 2007, p. 974).

It is still the case though that the underlying assumption in many studies is that once the first-order barriers are eliminated then integration will follow. A successful integration is demonstrated when a more holistic approach is applied, and all factors are given consideration with continuous ongoing support from experts in the field.

2.7.1 The driving forces in the uptake of technology integration

It would be important thus to take a positive approach and look at the enablers or driving forces in technology use. These encourage and motivate teachers to overcome the second-order barriers Ertmer (1999) discusses, and which are the most challenging. These consider the more personal and fundamental issues such as underlying epistemological belief which influences teaching (Kim, Kim, Lee,

Spector, & DeMeester, 2013). It is useless to have all the necessary hardware, software, and support if teachers do not believe in the innovation because it is not in line with their beliefs and principles. In Malta numerous technological innovations have been introduced, infrastructure put in place, and hardware and software updated, but little thought has been given to the facilitator of the driving force – the teachers and their beliefs.

So, what is the relationship between teacher beliefs and technological integration? In a study carried out by Kim et al., (2013) 22 teachers were investigated over a four-year period. They found that both teacher beliefs about the nature of knowledge and learning itself as well as beliefs about effective ways of teaching, correlated with technology integration (figure 2.4). The closer their epistemological beliefs matched student-centred practices the more likely they were to practise integration. “Their status of technology integration showed a more seamless use of technology, meaning that the focus and emphasis remained on the learning rather than on the technology” (Kim et al., 2013, p.81).

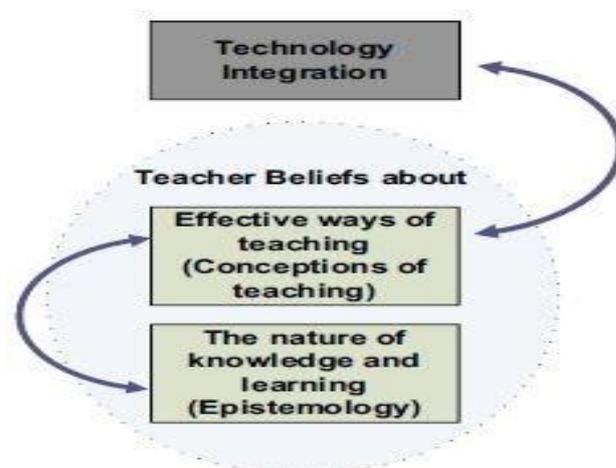


Figure 2.4 The correlation between teacher beliefs and technology integration.

Teachers' personal beliefs and epistemology are crucial dynamics in determining how teachers practise their teaching and how they integrate technology (Hermans, Tondeur, van Braak, & Valcke, 2008). A plethora of authors discuss teacher beliefs and how they are crucial in technology integration (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Ertmer, 2005; Hermans, Tondeur, van Braak, & Valcke, 2008b; Kim et al., 2013; Kopcha, 2012; Liu, 2011b; Mama & Hennessy, 2013; Pajares, 1992; Tondeur, Hermans, van Braak, & Valcke, 2008). Teacher beliefs come into play when determining the approach used in the classroom, whether using traditional or constructivist methods, teacher- or student-centred teaching. It has been found that constructivist teacher beliefs are a strong predictor of technology integration, while traditional beliefs have a more negative effect (Hermans et al., 2008).

It is thus essential that school administrators work closely with teachers to be able to identify their needs and develop their beliefs. Hermans et al. (2008) argue that professional development can be used to identify and develop teacher educational beliefs at school level (p. 1507). Professional development could focus on disseminating curricular objectives in small parts along a period of time. Instead, as is the case locally, we overwhelm teachers with information overload of a one-time two-hour period during these sessions. "When professional development is spread over a longer period of time, there is more time to experiment with new technologies in small doses. These small implementations, then, are more likely to result in success" (Ertmer & Ottenbreit-leftwich, 2010, p. 274).

A study investigating teachers with award winning technology practices showcased a strong alignment between beliefs and practices (Ertmer et al., 2012). This study highlighted the fact that although these teachers encountered first-order barriers just

like other teachers, yet this did not hinder their technology use and they still found a way to overcome them partly due to the alignment of beliefs and practices. “Not only were their attitudes and beliefs not a barrier, they served as a facilitative factor, providing the passion and drive needed to devote extra time and effort to enact their strong beliefs about good teaching and learning” (p.433).

Lewin et al.(2008) suggest the need for continuing professional development and communities of practice to sustain an improvement in pedagogical practice of the technology. This ongoing development provides a supportive framework for teachers to mutually share their beliefs and practices (Pajares, 1992). Staff development programs need to be long-term, as already stressed, providing continual support throughout a technological implementation rather than reducing them to one time workshops, easily forgotten and with little meaning (Richardson, 1998, Kopcha,2012).

2.7.2 Reflection on practice

This brings me to the realisation that such professional practice is essentially a community of practice (CoP) which fuels motivation and confidence in educators. Teachers share practices and discuss meanings assigned to their teaching within their particular school culture (Hermans et al., 2008). CoP “are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly” (Wenger, 2011). Wenger defines these communities as having three main characteristics: the domain, the community and the practice. Such a CoP encourages and strengthens the readiness to enact technology integration which is aligned with student-centred teaching (Ertmer et al., 2012). CoP may also provide the opportunities for reflection on practices, whether these are practices and methods of other teachers or of one’s own. Mezirow (1997) advocates that

transformative learning is the process of effecting change when reflecting on practices. "The process involves transforming frames of reference through critical reflection of assumptions, validating contested beliefs through discourse, taking action on one's reflective insight, and critically assessing it" (p. 11).

Change in pedagogy is analysed to determine how and if teachers reflect on their own practice and whether this happens on an individual basis, through professional development or through discussions with colleagues. In one of my observations a KGE demonstrates how she benefitted from reflecting on her practice. This is a strong implication that for transformation to happen, teachers need to reflect and evaluate their teaching with other colleagues or support teachers. Unfortunately, in general, because I have had countless experiences in classrooms, this lack of reflection on practices is common all across the Maltese educational system. Based on my own professional experience I am also aware that KGEs do not have any time allocated specifically to meet up and reflect on practices.

Learning correspondingly takes on a new perspective, that of social participation where it is part of the teachers' lived experience, becoming active learners in meaningful practices (Wenger, 1999). Wenger's social theory of learning encompasses meaning, practice, community, and identity, which are all essential elements of social participation. Through this interpersonal interactivity and communication, the process of change in professional practice can take place. "Simply providing off-the-shelf workshops designed by external sources will not have as great an impact as when teachers are surveyed and workshops are tailored to their needs" (Baylor & Ritchie, 2002, p. 410).

A case study examining 18 elementary school teachers over a period of two years shows how close mentoring in a school can promote and improve integration

(Kopcha, 2012). The mentoring, a form of CoP, commenced by first addressing the issues of access and time with the teachers involved, technical problems were then resolved, and systems wherein teachers could plan and discuss their teaching established. With these in place, teacher workshops and team training equipped the teachers with necessary technical skills, promoting active learning. This was disseminated through the co-development and modelling of lessons with the mentor. Professional development which followed focused “on reinforcing teacher beliefs about using technology for instruction and introducing pedagogical strategies for technology integration” (Kopcha, 2012, p. 1112). This strategy reinforced technology integration as it used a scaffolding process (Jacobs, 2001) wherein one experience builds upon the other, building up confidence and enhancing pedagogical beliefs which are then embedded and sustained in practice. Teachers present results through sharing of practice and ideas. In this case the integration was not forced upon teachers but rather evolved gradually allowing teachers to reflect and get equipped with the necessary skills before attempting to develop any lessons. This sequential progression is aligned with constructivist learning methods and decreases the resistance to the use or implementation of technology as innovations are not imposed.

2.8 Technology in kindergarten

My choice in researching teachers with pupils in this age group was driven by how crucial and important it is to present digital skills at this very early age. Plowman & Stephen (2003) assert that there is an incremental trend to prepare children for an ever increasingly complex and technological world and point at how technology has the potential to improve standards of pupils’ education as well as “supporting teachers in their everyday classroom roles” (pg. 150). “Technology use is

appropriate when it both capitalizes on children's natural desire to actively, collaboratively construct knowledge, and respects the unique challenges presented by children's levels of development" (Rosen & Jaruszewicz, 2009, p. 169). These authors contend that digital skills and competencies could afford young children to develop, in these early years, the 21st century skills required for their future lives and work. Hundeland, Carlsen, & Erfjord (2014) further concur with this affordance of digital skills and competencies

becoming familiar with digital tools at an early stage, in the kindergarten, is important for the children in an educational perspective. In order to become competent participant in an increasingly sophisticated and specialised society, the upcoming generation is in need of skills and competence regarding digital tools, their affordances and constraints (p. 2).

When children are culturally brought up to make use of technology for a more participative role in education they will be effectively developing 21st century skills such as collaboration and critical skills needed as future citizens. (Ravenscroft et al., 2012). The Partnership for 21st Century Learning (Scott, 2017) recognizes and emphasizes the importance of instilling such skills in the early years because children of this age are "curious and excited learners" (p. 2). It delineates the responsibility of educators in creating learning environments for such skills to develop.

This includes not only supporting emerging skills in reading, math, science, and social studies, but also most importantly, the 21st century skills of critical thinking, collaboration, communication, creativity, technology literacy, and social-emotional development. Children need to begin to develop the early

foundational skills that will help them reason, think creatively, analyze data, and work collaboratively in the future (p. 2).

This indirectly indicates that children from the early years need to acquire and be prepared with such skills to be able to function as future citizens in a global society. The multimodal features of the IWB enable such skills to flourish and are especially engaging for children at kindergarten age due to the multisensory stimuli and possibility of interaction it can offer. It also lends itself to open-ended, activities opening possibilities of exploration and discovery, which in preschool classrooms may enable the learning of new information, knowledge, and applying it. (Lippard, Lamm, Tank, & Choi, 2019, p. 188).

In a study about the relationship of play and technology in pre-school aged children Marsh, Plowman, Yamada-Rice, Bishop, & Scott (2016), demonstrate how contemporary play draws on both the digital and non-digital. They suggest that digital technologies have merged into existing activities enabling a more diverse context. In their own words contemporary play “moves fluidly across boundaries of space and time in ways that were not possible in the pre-digital era” (p.250).

My research will be looking at these affordances and how this technology has or has not changed the teacher’s methods in delivering the same curriculum and at the same time being able to involve active learning, more participation, more visual and audio stimuli, and, as a result, deep meaningful learning.

Technology may play a major role in stimulating, motivating and exposing children at the right time to learning, strengthening their ability to learn and retain that learning. Yet it is the educator, the teacher, who has the expertise and knowledge to take advantage of the potential of technologies to stimulate children’s learning experiences for their appropriate level, according to their individual abilities. This

means dedicated teachers must allow for differentiated teaching, which is not an easy task (Willis, 2012). The KGE in kindergarten supports and guides the learning process. Here again arises the notion of the teacher as the fulcrum in all activities.

Nonetheless, it is a stage in the educational process when cognitive development in children is at a very critical period when thoughts and skills are still being moulded. The way children interact and collaborate can be enhanced and even transformed with the use of digital tools. “The ICT applications become digital tools by way of their mediating function” (Hundeland et al., 2014, p. 3). The tools assist in mediating concepts and ideas, making sense of the world, through the interaction with other humans such as the teacher or their peers. Social interaction therefore takes a very important meaning in this context. The child in this social setting and through the interactive tools learn to reason and take appropriate actions only because they are acting within the zone of proximal development (ZPD). This is the Vygotskian notion (Vygostky, 1978) of “the difference between what a child is able to do alone and without assistance and what she is able to do in collaboration with adults or more competent others” (Hundeland et al., 2014, p. 3). The quality of the children’s interaction with digital tools and their teacher makes ZPD a purposeful strategy in analysing use of technology. The affordances of the IWB make the ZPD notion a more meaningful strategy as it is possible to recall material from previous lessons (by accessing other screens), assisting the teacher in scaffolding learning by going back and re-visiting concepts which would have been difficult or impossible in traditional teaching. At kindergarten level this is a very important practice and the IWB is a very resourceful tool to enable this scaffolded learning. Scaffolding involves balancing support along with challenge, where the ultimate goal is independent, self-regulated learning (Vygostky, 1978).

Apart from assisting the KGE in enabling learning through the possibility of scaffolded teaching, the IWB is also at the same time capturing the attention of the young learners and retaining it. One of the most challenging tasks for KGEs is to keep the attention of their young learners focused on the activity. Children at this age are easily distracted but the multisensory elements presented by such a tool help keep children motivated and interested by scaffolding interaction through the teacher's expertise (Warwick & Mercer, 2011, p. 9).

This implies that if teachers are not given adequate support and tailor-made professional development opportunities, they will be unable to grasp the capabilities and opportunities technology can offer in the development of their pedagogy for children in kindergarten.

More recent literature reveals how digital technology in the early years can depend on teacher beliefs and attitudes and thus pointing at the importance of practical considerations for supporting teachers' use of technology in the classroom.

Effectively it is essential to consider and study this perspective within continuous professional development (CPD) in supporting and developing teacher beliefs by providing the opportunities

“...to engage with their own and others' epistemological understandings of literacy, as well as realisations of new literacies in (children's and their own) everyday lives. This would ultimately necessitate and link to a shift in practitioners' professional identities”(Marsh, Kontovourki, Tafa, & Salomaa, 2017, p. 16).

Marsh et al. (2017), argue that for this frame of mind to develop it is essential to nurture it during early childhood teacher education programmes enabling teachers to decide when and how best to integrate technology in the classroom (pg. 5).

2.9 Chapter summary

Investigating the literature has provided me with a bird's eye view of what is happening in this field. This chapter initially describes in detail the literature review process followed by the local educational strategies and policies in Malta. The theoretical framework of AT is defined along with its application and relevance in this research citing the literature which substantiates it. I then talk about the correlation between technology integration, change and pedagogy as cited in empirical research. When putting the themes discussed together, holistically I perceive an educational ecosystem (Conole, 2013; Dillenbourg, 2008, 2011; Dillenbourg & Jermann, 2010; Ravenscroft et al., 2012) working together and depending on each factor for its expansion and progression.

The role of the teacher in managing this ecosystem then becomes more significant as the teacher now orchestrates the whole scenario (Dillenbourg, 2008).

Orchestration also takes on a more diffused meaning as it is not just the designing and managing of the activities but also “the multiplicity of unexpected events that occur in integrated learning” (p. 137). This entails flexibility to adjust and adapt to changing environments and contexts.

These concepts of orchestration and the ecosystem should not be used merely in their literal meaning and for the environments from which they originated – music and biology – but used to convey new and more thorough meanings. “Orchestration is about the real time management of multi-layered activities in a highly constrained ecosystem” (Dillenbourg, 2011, p. 21).

The challenges and tensions, so indicative of AT, are explored demonstrating the similarity of difficulties local educators encounter with other countries across the globe. CoP show the importance of reflecting upon practice for the development and

enhancement of professional practice. The final section examines literature specifically dealing with technology in pre-primary classes.

This overview of the literature is by no means exhaustive but attempts to draw upon the existing research and their relevance to the current study. It is also a means to identify those areas where research is lacking with special emphasis on the gap in the local scenario. Therefore, foreign sources serve as a starting point to investigating technology integration and pedagogy in the early years, with a focus on IWBs in Malta. It is evident, from this literature review, that the local scenario lacks empirical research within Maltese kindergarten classrooms that addresses the use of technology and how this is influencing pedagogy. Subsequently, this study will provide the much-needed research in this field by stepping inside actual kindergarten classrooms as a participative observer and documenting the lived experiences of these educators, including benefits and challenges they encounter.

Chapter 3 Methodology

3.1 Ontology, epistemology, methodology

In order to understand the whole dynamics of any research, it is essential to be aware of the author's beliefs about the nature of reality and knowledge, as these paradigms shape the chosen methodologies and research design. Methodologies are inevitably steeped in the author's way of viewing the world. Guba (1990) categorises belief systems into three main areas: *ontology* or how one views reality, *epistemology* or how one perceives knowledge and *methodology* or strategic approaches to finding out about knowledge and carrying out the research. Hitchcock & Hughes (1995) view the understanding of the world as starting from ontological presumptions leading to epistemological assumptions and in turn to methodological applications. These give rise to "issues of instrumentation and data collection" (Cohen, Manion, & Morrison, 2007, p. 5).

My personal ontology reflects a relativist approach, meaning that 'the truth' for me is subjective, contextual and dynamic, rather than that of a realist approach, where 'truth' is static and not dependent on human behaviour (Flaming, 2004). "What might be 'truth' for one person or cultural group may not be 'truth' for another" (O'Leary, 2004, p.6). Truth is also relative to the context and reality is situational: "situation determines behaviour" (Cohen, Manion, & Morrison, 2007, p. 61). Subsequently I believe that teachers must be flexible in their practice of encouraging learning and transforming their pedagogy to suit and adapt to the needs and contexts as they arise. Epistemologically, I view knowledge as constructed socially (Creswell, 2003; Guba & Lincoln, 1994). Children learn when interacting socially together towards a common goal. This substantiates my use of AT as a tool in analysing activity. In effect as a

participant observer, it further demonstrates my beliefs that observations and experiencing 'real-life' interactive settings are the most realistic methods to inquiry as not all knowledge is "articulable, recountable, or constructible" (Mason, 2002, p. 85). The varied research instruments employed continue to elicit data that is close to reality. Data can be multidimensional and in such circumstances the researcher as a participant develops empathy and in this sense is "epistemologically privileged" (p. 141).

These paradigms are complemented by phenomenology, the philosophy I adopt, which looks at individual perspectives offering insights to inform the research of practices within context. It is primarily defined as "how human phenomena are experienced in consciousness, cognitive and perceptual acts, as well as how they may be valued or appreciated aesthetically" (Wilson, 2002, p. 1).

Phenomenology, through interviews and informal discussions, seeks to understand how persons, on an individual basis, construct meaning, and a key concept here is intersubjectivity. We experience the world with and through others (Wilson, 2002). In our relationships with others, we share our subjective meanings and in the process construct definitions of reality through these interactions with each other. "Whatever meaning we create has its roots in human actions, and the totality of social artefacts and cultural objects is grounded in human activity" (p. 1). Here I do not only refer to the intersubjectivity between educators and the researcher but can also mean the interactions which go on in the classroom between teacher and students. Here the activity is set in a socio-cultural environment wherein the teacher, together with the children, through the mediating tool, construct understandings of realities or knowledge through their interactions. Both become engaged in the activities, sharing experiences "with the fully competent adult that maximizes development and creates

intersubjectivity” (Dalton & Tharp, 2002). Knowledge emerges when there is social and cultural participation. Here I envisage an intertwining of AT and phenomenology which complement each other.

Creswell (2007) states that phenomenology is the study of people’s lived experiences of a phenomenon. Social research is mostly conducted to study how human beings interpret a phenomenon, whatever that may be, and subsequently giving us a better understanding and interpretation of that phenomenon (Wilson, 2002).

3.2 Methods

The methods and research instruments I have employed reflect such philosophical approaches. Primarily they are qualitative in nature. Qualitative research explores “a wide array of dimensions of the social world” (Mason, 2002, p. 1), particularly the processes, interactions and relationships, all within specific contexts. Qualitative research can also produce “cross-contextual generalities, rather than aspiring to more flimsy de-contextual versions” (p. 1). Subsequently the qualitative methods applied were participant observations, field notes, audio recordings, photographs, and interviews. These methods, which I will further elaborate upon, reflect my beliefs of reality and knowledge and were the ideal tools to assist me as a researcher into looking at the situations and contexts occurring in their natural environment rather than sampled for an experimental study. Neuman (2014) maintains that in qualitative research the *participants* are called as such rather than with the term *subjects* to emphasize their

role in co-creating the researcher’s understanding of the phenomenon.

Because the researcher works to develop an understanding of the phenomenon as it is understood by the participants themselves—not as it

might be predicted a priori by the researcher—the participants' role is critical (p. 72).

As will be referred to in more detail in section 3.3, participant observations were conducted by not only taking a back seat and noting the activities taking place but more often than not taking an active role in the lesson/activity itself. This meant immersing myself into the “research setting to experience and observe at first hand a range of dimensions in and of that setting” (Mason, 2002, p. 84). This method allowed me to share the experience and be able to empathize as well as understand first-hand the situation presented. Subsequently data gathered was through a contextual setting and not “artificially manufactured or reconstructed” (p. 86). Some might argue that this standpoint could imply a simplistic view wherein as the ‘knower’ I can assume to understand the context fully or over-estimate my capacity to empathise. This challenge was taken into consideration and triangulation of data sources such as later interviewing the teachers shed light on any misconceptions, misunderstandings or findings which I was unaware of. Parker et al., 2007, point out that participant observation is not as repeatable as other techniques and that it does not provide quantitative data limiting any generalisations (p. 37). Bell, 2010, further denotes critics who allude to the problem of representativeness (p.15). Having referred to this it must be noted that the scope of the current study is not to generate any overarching generalisations.

Visual images and audio recordings were also an important part of the methods I used for data gathering. These provided a rich source of evidence to analyse later on and assisted me in capturing the moment in its entirety to remember practices in more detail. As for audio recordings small details were retained and I could easily go back repeatedly to the same point in time to re-visit for clarification and a better

understanding of what was being said including all the intonations, pauses, ect. As for the data collected as visual images these were not only a reminder of a particular point in time, yet as they are included in the text, are essential in providing the reader with a visual understanding of the context. Therefore, what might not be clear within the text can be conveyed through the pictures, since *a picture is worth a thousand words*. Both the visual and audio data collected, in themselves and on their own, do not say much and do not carry much meaning, therefore I needed to interpret them to enable an understanding of what was going on. Here my personal field notes were key. These were taken during the class observations and were practically turning my observations, experiences, visual and audio sources into written data. This method of manually recording reflections, observations and experiences served to capture practices as they happened giving them meaning. Due to the fact that these field notes are my personal perspectives, they could be very subjective. In effect the field notes were re-visited after the interviews, when I had a better picture of the practices having heard what the teachers had to say. This helped me look for any misinterpretations and impressions of the context. During the observations, I did not take field notes continually but intermittently as needed, shifting from taking pictures or videos to listening and observing to jotting down notes. These field notes were also taken after the observation session upon reflecting on the lesson, interview or any informal discussion. I regard my field notes as raw data which was developmental for my understanding of the context under study – they connect and put meaning into what had been captured through audio, visually or verbally.

Fieldnotes are a form of representation, that is, a way of reducing just-observed events, persons and places to written accounts. And in reducing the welter and confusion of the social world to written words, fieldnotes (re)constitute that world

in pre- served forms that can be reviewed, studied and thought about time and time again. (Emerson, Fretz, & Shaw, 2001, p. 353)

The purpose of this study was to reveal teachers' perceptions of how technology, as a multimodal digital tool, mediating social action, is supporting/challenging teachers into reaching their objectives and reshaping pedagogical practices. The qualitative methods and my epistemological position have enabled me to achieve this purpose as described.

3.2.1 Methods and AT

The theoretical lens of AT facilitated the study of this specific context and of the actors involved. "Activity theory is a practical framework which can be used to underpin the complex and dynamic problems of human research and practice" (Hashim & Jones, 2007). It has been adopted to understand and analyse the interactions in the classroom between the KGEs, the children and the tools or artefacts, mainly the IWB. The methods described in the previous section aided the capturing of the evidence and of the practices to be then analysed and studied through AT. AT is not simply a methodology wherein a strategic approach is employed to analyse and understand a specific context, but it allows for an understanding of how the knowledge is socially co-constructed together through the interaction with tools. The learning processes were studied by analysing the interactions of human activity with technology. The IWB as the *tool*, the KGE as the *subject*, the children part of the *community* along with the purpose of the lessons as the *objective* and the skills and competencies achieved were the desired *outcome*.

The participants were randomly selected from five different schools in Malta based on their willingness to participate in such a research. During the period I was collecting

data pertinent to this research I was assigned the primary schools of one particular college, yet data was also collected from several other colleges - refer to the first chapter for a detailed explanation of the structure of colleges in Malta. My role necessitates that I visit other schools as needs arise, most of the time due to the lack of eLSTs. At the time I saw this as a good opportunity to enrich the data I was collecting, by having kindergarten educators (KGEs) from other colleges as well to be part of my study.

The empirical evidence was then collected based on the case studies of these ten kindergarten teachers. Case studies, in themselves, provide rich data of the phenomenon under study and offer an excellent environment to observe AT in a situated context (Eisenhardt & Graebner, 2007). Cohen, Manion and Morrison (2007) argue that case studies “investigate and report the complex dynamic and unfolding interactions of events, human relationships...in a unique instance” (p. 253). The observations took place in the classroom and were recorded through photographs and audio recordings with the full consent of all participants as delineated in the *Ethics* section. At least two activities, of approximately an hour each, were observed in each classroom and each teacher interviewed directly after each activity, inside the classroom.

After having collected all the data and begun the analysis process I wrote up the first draft of the *Analysis and Findings* chapter. Here I employed an additional method whereby I asked for feedback from the participants about what I had written in this first draft of the analysis. Each teacher was contacted personally and sent the part I had written about their interview session. I asked for comments and clarifications about whether I had interpreted correctly what was conveyed to me, and if they would have liked to add anything else. The process ensured there were no misinterpretations and

at the same time, as a bonus, supplemented me with more information as to the rationale behind particular activities. This technique helped me also to reflect and be critical of my own interpretation of the data which in instances proved to be more than what appeared on the surface. This method also continued to add validation to the findings because of the process of the iterative consideration of the raw data between the KGEs and myself. Participants felt assured that no unnecessary personal information would be divulged. In all I demonstrated I was giving much thought as well as conforming to ethical considerations. As an example, refer to appendix seven.

3.3 My role as an eLearning support teacher (eLST)

As already discussed in the first chapter during the period I was conducting the research I was an eLST within a number of schools supporting all teachers in their curricular integration of technology. This provided opportunities for me to have incidental conversations with the staff inside or outside their classrooms. This familiarity contributed to and provided the opportunity for me to gain additional insights and perspectives into the classroom dynamics. This added up as an indirect collection of data, which came at unexpected times yet rich in ideas. Being a 'familiar friend' in school helped me to capture certain contexts as naturally as possible. An outsider cannot translate, interpret and comprehend fully a particular situation or attitudes as there is no deep understanding of specific behaviour (Wilkinson, 2000). Being an insider also allowed me as a researcher to study the activity with the AT framework in its natural settings and closely observe subject, tool, and object interacting. The insider's knowledge of the context is also deeper (Wilson, 2002) and any contradictions or tensions are not hidden, whereas with a stranger in the classroom activities may be tailor made to fit the expectations of the researcher. Goodfellow & Lamy (2009), corroborate the importance of being an insider and state that

researchers should be involved in the community being studied. “The research perspective should incorporate ‘insider’ views” (p. 182). This is because the insiders share the particular context and cultural perspective. In this respect it is by no means a linear relationship or one way between researcher and practice but also between the practitioners who are part of the context. This subsequently brings the researcher into the AT equation as part of the activity, part of the community within which the activity is taking place. In this case it is the classroom environment. For both the researcher and the teacher (subject) the core of the activity is the learning. For the teacher it is the learned object which is most important and for the researcher it is the practitioner’s practice (the pedagogy) of the learning “where the researchers may actively participate or intervene in the activities which are the object of their research” (Crawford & Hasan, 2006, p. 62). This common interest brings the researcher as the ‘insider’ into the activity system with a very advantageous position from where to observe and participate.

It is interesting to note that being an insider can be key for educational change because a research partnership is developed when the researcher is an insider (Kershner & Warwick, 2006, p. 7). There is an understanding between the researcher (the insider) and the teacher that the research being conducted collaboratively will bring about more awareness of the challenges these teachers face. This knowledge empowers teachers knowing they could be directly influencing policies for the common good. Yet if conducted by an outsider, educators know that there is a great risk of the research being carried out for other hidden underlying agendas. These might not be directly connected to their practices and pedagogy but to agendas that are politically motivated.

3.3.1 Bias

In qualitative research, the researcher is “an integral part of the process and final product” (Paul Galdas, 2017,p. 2) and cannot be separated from the study on the premise of being totally objective to avoid bias. As indicated in the previous section being an insider raises the researcher’s awareness of contributing to the construction of meaning by being directly informed, exploring what influences the research participants, and at the same time an interdependent awareness of how they as participants are influencing the researcher, an awareness better known as researcher reflexivity (Warin, 2011). This iterative, reflexive journey (Ahern, 1999, p. 408) adds credibility to the research by going back and forth to fully understand a context by having first and foremost been part of that reality in some way. The interview write-ups and analysis were each discussed with the teacher concerned to assure the interpretations were correct. Harding (1993) corroborates this idea by defining it as ‘strong objectivity’. In this current study, as I was the researcher and the participant, the teachers were more open and genuine in their responses. I was not only a colleague in the classroom with practical expertise in the field but also an academic with whom they could relate and who could comprehend the full dynamics of the activities and add rigor to them. As such I perceived a very respectful attitude from the KGEs who particularly looked forward to discussing with me the challenges they were facing or drew my attention to their innovative practices. Some would be eager to share a particular teaching method with the intention that I would demonstrate it to other KGEs during professional development sessions. I believe they assumed such an attitude because they knew I would not only advise on their practices, as could any other eLST, but that I was drawing on academic theory and practice as a researcher and professional practitioner, and in this sense had great respect for me.

3.3.2 Bracketing

An important approach I have taken in this study, with regards to establishing my insider perspective, was by clearly identifying my beliefs about knowledge and reality as I have done in the beginning of this chapter. In essence this is bracketing. The notion of bracketing within the phenomenographic paradigm is very important. This implies the identification of any bias which may taint the research. "Bracketing is a method used by some researchers to mitigate the potential deleterious effects of unacknowledged preconceptions related to the research and thereby to increase the rigor of the project" (Tufford & Newman, 2010, p.81). In other words the term bracketing is essentially putting aside one's beliefs, assumptions or presuppositions in order as to register the participant's own experience of the situation (Ashworth & Lucas, 2000, p. 297). During the interviews/observations carried out it was important to record only how the participants interpret their experiences from their point of views without letting my own standpoints or interpretations interfere.

3.3.3 Triangulation

The varying research instruments employed as well as being reflective and critical of my interpretation all supported the triangulation of the data sources, thus establishing a more holistic and reliable account of the phenomenon and social processes, at the same time validating any findings. Triangulation also reduces any bias. "By analogy, triangular techniques in the social sciences attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint " (Cohen et al., 2007, p.141). My data was mainly collected through the observations and notes I made on the observations. These observations were matched with discussions and interviews taken with the respective KGEs. Later when feedback was requested from the KGEs on the draft analysis, I could crosscheck and confirm findings or ask for more clarification. This triangulation of accounts collected

from varying perspectives did not always match perfectly since I may have had different perspectives of the same activity as that of the KGE. In these instances, I would ask for additional clarification about the interpretation. This proved at times to be quite enriching as aspects I had not perceived emerged from the activity. One example was an activity wherein the children were in groups working on different activities related to the same topic. The ones working on the IWB according to my interpretation were doing a related activity to the topic. In actual fact they were using the IWB creatively, teaching themselves and trying out mathematical concepts, practising teamwork, collaboration, and problem solving – all 21st century skills; an activity not related at all to the topic and yet they were fully engaged.

The key to triangulation is to see the same thing from different perspectives and thus to be able to confirm or challenge the findings of one method with those of another...A mismatch does not necessarily mean that the data collection process is flawed – it could be that people just have different accounts of similar phenomena (Laws, Harper, & Marcus, 2003, p. 281).

During my research this methodological triangulation also mapped out the complexities of human behaviour, complementing the AT framework which also acknowledges the multi-faceted dimensions and standpoints of an activity. Reliance on only one method may lead to bias or distort the reality being investigated (Cohen et al., 2007).

3.4 Pilot Study

Pilot studies are of utmost importance and critical to the success of a research instrument/methodology. Van Teijlingen & Hundley (2001) emphasize the importance of pilot studies and refer to them as mini versions of a full-scale study. They emphatically maintain that piloting “might give advance warning about where the main

research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated". Prior to embarking upon this research, I had conducted a pilot study within a kindergarten classroom to determine and test the appropriate research instruments, methodology and analysis for studying such a particular context.

The pilot study results were a clear indication that I was not to study a number of technologies, such as the IWB, Bee Bot, Easi-speak, Talking photo album, and educational software all together, but to focus only on one particular technology. Having conducted a short study including several technologies proved to be confusing as I continually needed to indicate to which technology or resource I was referring to, and at times repetitive because of the fact that their affordances and benefits overlap with very small variations. Hence, I opted to focus only on one technology or resource, the IWB, which was used by the majority of teachers. This allowed me to go more in depth on one particular technology used in the classroom instead of getting lost on a number of similar tools.

The interview process was piloted accordingly, modifying questions and questioning techniques such as revising ones that were repeated at several instances in different wording or were unclear to the participant. Questions such as asking if they had difficulties using the board hardware and another question asking if they had technical difficulties and any technical support were combined into one. I had another question asking if teachers felt children with special needs benefitted from this tool, another similar question to this, but with different wording, was also merged into one. The pilot study showed me I had to probe more into what the teachers would reply because in the beginning I was ending up with a yes or no reply. This was revised by simply adding a *why* and *how* at the end to remind myself to ask for details behind their replies.

As the format of the interview was a semi-structured one I did not need to adhere exactly to the list of questions but tried to be as flexible as possible and seize the opportunity to ask more questions or less as I deemed fit. I practised by asking more probing questions where replies were especially unclear. I also added questions I had not thought of to the interview which were becoming evidently important as a result of the pilot study responses. One example was adding the question about whether they reflect on the outcome of the lesson as a result of using the IWB, and in what ways this helps them or not and why .

Another important process was practising how I would record the responses, such as which devices to use and which analysis software could support me best. Subsequently all this informed me into structuring a clear strategy and plan of the whole design of the data collection methods and procedures for the research.

3.5 Ethical considerations

Ethics was given much thought in this research especially because of the fact that it involved the direct observation of classes of very young children. Although in actual fact it was the kindergarten educator who was under study, yet it was assured that all the children in the classroom had permissions signed and in order. Any artefacts that portrayed the children were intentionally taken from behind and faces were blurred. Parents signed a consent form which explained the intentions of the research (see Appendix Five) as well as the Acceptable Use Policy (AUP) issued by their individual schools in the beginning of the scholastic year (see Appendix Six).

Permission and approval for the current research was sought from the Ethics committee of the University of Lancaster, the Research and Development Department in Malta, the head teacher of the individual schools where teachers were participating, as well as from the teacher concerned. Consent forms were given to the head of school

and the kindergarten teachers to sign (see Appendix Four) along with an information sheet describing the intentions and purposes of the research as well as commitment to confidentiality (see Appendix Three).

Any data collected, transcripts of recordings, field notes, and all other artefacts, were stored and protected within 'Box', an online secure content platform for storing data. This guarantees the data is secured as 'Box' is password protected. Reference to individual teachers within the research was carried out with the use of aliases, to ensure anonymity.

In addition, another ethical consideration which had a great impact on this research and which has already been alluded to in the *Bias* section, is the nature of my relationship with the KGEs. I believe here 'trust' was the key factor. I had known these KGEs for a number of years and subsequently an element of trust developed between us and this enabled the "genuine dialogue between practitioners for the benefit of knowledge exchange" (Jameson, Ferrell, Kelly, Walker, & Ryan, 2006, p.953). Yet I am aware that I also had a responsibility in how much of the information I was to disclose, or risk, as Wolcott (1999) defines it, to maintain this trust. Wolcott discusses the importance of maintaining a balance between risk and benefits. "Risk and empathy converge in what should be a self-conscious and thoughtfully considered decision on the ethnographer's part" (p. 163). The *trust* in my case was that I was seen as the 'expert' to whom they could relate to and yet would have the professional responsibility to choose what to disclose in the research.

3.6 Data analysis

The AT framework is in itself an analytical tool studying the dynamics of an activity as the unit of analysis (Hashim & Jones, 2007), broken down into the components of subject, tool and object. Originally the primary function of AT was to "create analytical

tools for structuring empirical evidence” (Nardi & Kaptelinin, 2006, p. 97). In this research, the activity checklist created by Kaptelinin, Nardi, & Macaulay, 1999 (see Appendix One), was initially used as a tool and a guide because it provided sample questions for insights into understanding and analysing use of a computer technology context emphasizing “the principle of tool mediation” (p. 270). AT was then applied during the observations in which classroom activities were analysed.

The next step after observing and collecting data such as field notes, photographs and audio recordings was to structure and sort the data material into a computer-assisted analysis program. Atlas.ti, a software package tool which supports the process of analysing all the data systematically (Friese, 2014) was adopted. Atlas.ti supported me considerably in knowledge construction as I could lay out all my material into one place visually allowing me to notice and make connections and link concepts. In her book about this computer-aided qualitative data analysis software, Friese (2014) introduces the study by referring to a model originally adapted from Seidel (1998), the Noticing, Collecting, Thinking (NCT) model for qualitative data analysis (see figure 3.1).

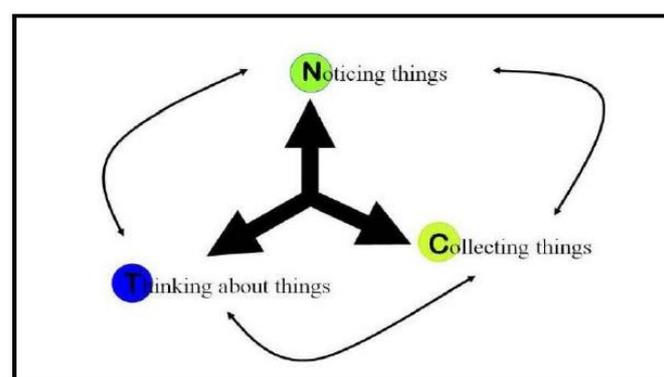


Figure 3.1. The NCT model of qualitative data analysis

This model describes qualitative data analysis as a process of noticing, collecting and thinking about things. Seidel suggests that the process is never linear but rather

iterative, recursive and holographic (Seidel, 1998, p. 2) wherein researchers go back and forth between noticing, collecting and thinking as the arrows indicate in figure 3.1. Atlas.ti has assisted me in this iterative process as it has provided the tools and functions to work with the data collected. I could look at data and assign codes, take notes and make memos, collect and group similar concepts and think about connecting codes and making links. The codes were grouped into families and linked to the relevant literature. I must note here that the Atlas.ti software was an important management tool in compiling the literature, systematically grouping them, to be then used in the literature review chapter. Relevant literature was first collected and uploaded, then sorted into themes/families and emerging ideas ready to be analysed for the literature review. Networks of linked codes and families were created and mind maps of concepts or ideas (see figure 3.2) constructed to be used in the research.

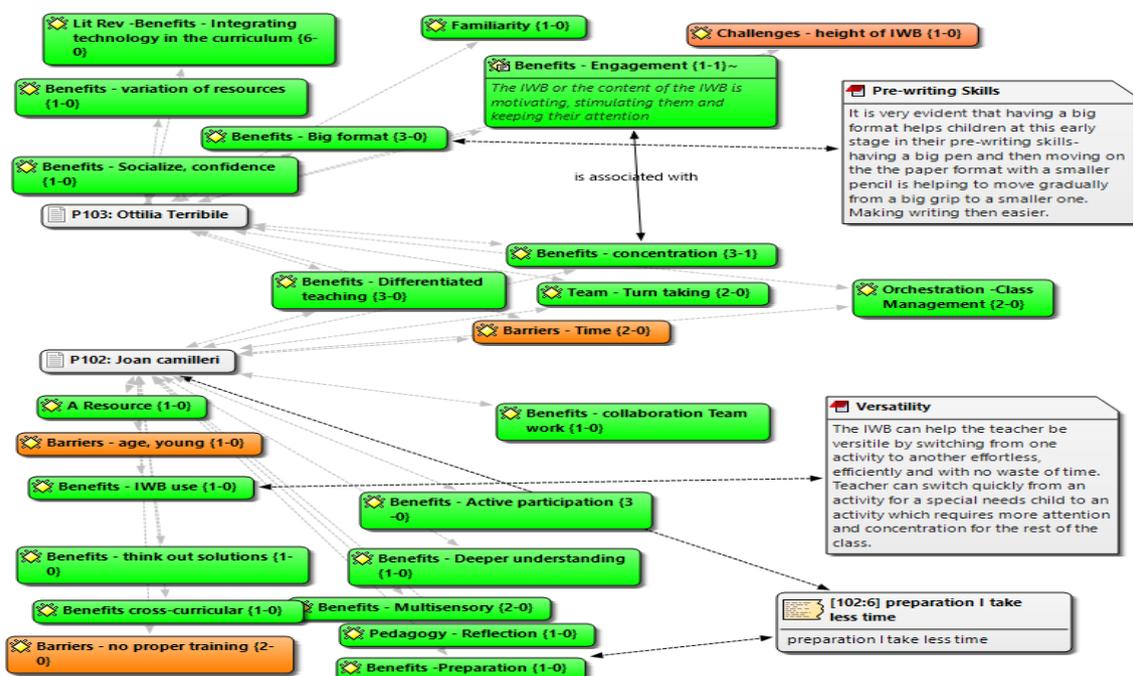


Figure 3.2. Network view of benefits and barriers

This is one example of a network view which was created as a result of codes emerging from the observations and interviews of two of the teachers. It shows the codes for barriers and benefits emerging from each teacher. The differing codes are at the very top and the very bottom, in between are the common codes which emerged from each teacher along with any additional comments, memos and links I made including links to literature, all at the same time.

The literature review was similarly analysed, and connections made. The network views created through this software were a visual asset to picture the relevant and related bits here and there.

The qualitative data collected was also coded and analysed using *content analysis*. This technique is a systematic analysis of words and phrases to develop overarching themes and categories (Bell, 2010). Content analysis was useful in creating the families for codes and analysing the transcripts of the interviews and of the field notes taken.

The interview recordings were transcribed soon after the interview session to avoid missing out minor details, cues and how arguments, statements, and comments developed. I transcribed the interviews myself because only I could capture the whole essence of what was being said. Being immersed as I was in the classroom context at a particular moment in time gave me the privilege to understand and relate to what was being communicated more than anyone else could. Nevertheless, it is very difficult when transcribing to be able to capture all that is actually said, not because you may miss a word or two but because intonations, facial gestures and emotions cannot be transcribed!

For some verbal utterances, there are simply no written translations! Therefore, do not assume that transcription

provides an 'objective record' of your interviews, or that you do not need to make a record of your own observations, interpretations and experiences of the interview (Mason, 2002, p. 77)

As I have the kindergarten teachers' trust, the interviews were more like casual conversations rather than any formal question and answer session. Having the interviewee at ease elicited more honest responses than it would with researchers who might have hidden agendas or exert power relations and thus influence the responses. Following the transcribing, the text was analysed as already explained. After writing up the interview interpretation in the Analysis and Findings chapter the recordings were then listened to once again, as I was surprised to still find data I had not discussed. This ensured complete comprehension of the data.

3.7 Limitations

The research was conducted in a limited number of classes as appropriate to such a scale of study and subsequently no overall assumptions are presumed. Furthermore, each class was studied in so much detail that there was enough data to be able to carry out a robust research that would cover many aspects of the classroom reality in kindergarten. Nevertheless, I can say that the sample size was not so much an issue because this research has no intention of generalising. Guba & Lincoln (1982) argue that in qualitative research it is doubtful whether generalisations can ever be made about any human behaviour as the latter changes with time and is bound to the nature of the context in which it happens. "Statements cannot be made about human phenomena that are likely to be true for even substantial numbers of years (not to mention forever) or for any substantial number of contexts (not to mention any and all contexts)" (p. 241). Therefore, such studies need to be taken up every so often to

identify how contexts have changed and how this change has influenced the participants under study.

My role as an eLST for so many years has provided me with experiences and expertise to speculate that what I observed during this study did in essence provide a snapshot of the realities these teachers are facing, as well as highlighting how they are truly addressing these new changes. In other words, my experiences have given me the advantage of having actually indirectly studied much more classes than the ones stated here. The conclusions or assumptions I make are based on rich experiences in the field as I have been part of the classroom reality for more than 20 years.

A major limitation that I believe was a challenge to the way the interviews were carried out was that the interviews had to be conducted within the classroom with all the children present. This meant that we had to stop several times, so the teacher could attend to the children's needs. Being so young, children at this age need constant attention as well as teachers with a lot of energy as they are continuously seeking attention and approval from their teacher. The school administration could not help in providing any support such as a temporary replacement during the interviewing period due to lack of educators and staff. I suggested that the interviews take place before or after school hours but for the majority this was not seen as an option and could not be resolved accordingly. Only two of the teachers accepted to be interviewed outside school hours. The most effective strategy was simply to get the children to do some short activity, which could keep them occupied without needing the constant attention of their teacher, at least until the interview was over. In classes where an LSE was present, this was not an issue as the LSE took charge of the class for the time of the interview.

A barrier which was in effect the driving motive behind this study was the gap in local research about the use of technology for educational purposes in Maltese kindergarten classrooms. With no or very limited research conducted in this area of the education sector, comparisons, references, and working models could not be corroborated through local literature and had to be sought from foreign sources. This did not always prove to be the ideal practice as context varies from place to place. Nevertheless this challenge was taken up and sources which had the most similar backgrounds were consulted. It was observed that most concerns were universal for all kindergarten teachers as well as other educators, including beliefs, barriers, and benefits of technology use in the classroom.

Notwithstanding such limitations this study has much value as it highlights areas in education which were not given much importance. My research shifts the focus to issues which need to be dealt with while providing the *how* and *why* they should be addressed.

3.8 Chapter summary

This chapter has described the paradigms and epistemology underpinning this research as well as mapping the research design, data collection, methods and research instruments used in detail to justify the theoretical framework adopted. The methods and software employed for the data analysis as well as the limitations encountered are discussed. With a clear understanding of the methodology, the next chapter will move on to discuss and present all the data collected – a fundamental part of any study – the findings and analysis.

Chapter 4 Findings and analysis

4.1 Observations and Interviews

Throughout this section I will be giving a brief overview and description of the activities observed and the interviews carried out with each individual KGE.

The second section of this chapter is a presentation of the analysis carried out using the AT framework.

The teachers observed were ten in all and the names used are all fictional, thus participants cannot be identified. The names used are: Ms. Brown, Ms. Smith, Ms. Martin, Ms. Webb, Ms. Wood, Ms. Lewis, Ms. Jones, Ms. Fox, Ms. Bell and Ms. Taylor.

I would like to point out that although the description, overview, and interview are of one particular lesson most KGEs were observed during two or more lessons. There is an overlap in some instances between lesson activities and interviews as I have noted important comments teachers make during the lessons which might not be referred to during the interview. I would also like to point out that certain issues were made by most of the teachers but are not always mentioned in every write-up to avoid much repetition. Yet they were noted to be a challenge or a benefit which most teachers were experiencing.

4.1.1a Ms. Brown - Brief overview of lessons observed

The objectives of this series of lessons were literacy, reading, and writing skills as well as nurturing digital competencies such as use of interactive whiteboard tools. Ms. Brown also purposefully integrates 21st century skills such as collaboration, creativity and communication in her everyday lessons.

In this lesson the KGE used a very simple slideshow (StoryMaker – see figure 4.1) where the same background is on all the slides and the children have to drag pictures onto the background to create a story. The children were shown various pictures; they named the characters, noticed how some are happy while others are sad. They gave the story a title by giving suggestions and discussing how the story would unfold, based on the pictures they were seeing and guided by their teacher.



Figure 4.1. Story Maker

Then one by one, taking turns, they came out to the board and started dragging the appropriate picture to the background according to what they had planned together with their peers. Thus, although one child is at the board the others are actively suggesting or reminding each other which picture goes where according to the sequence of the story agreed upon. A lot of conversation was stimulated as the children got involved and shared ideas.

They were very enthusiastic to get their turn to complete the story and tried to get the sequence and characters in the right order.

4.1.1b Ms. Brown – Brief outline of Interview

Ms Brown strongly believes this activity involves a high level of teamwork, creativity, collaboration, and sharing of ideas, which is made possible only with the IWB as the medium/tool. Previously such an activity would have been done by retelling a story from a book, having the children draw a picture from the story and then collating these pictures to form a booklet. There was no evident collaboration or much discussion as the tools were limited; the children did not feel actively involved.

When computers were introduced, the kindergarten classes had one computer per class. Such an activity could take place but because the monitor screen was small all children had to crowd around a single computer. Handling the mouse was also a problem as it was a skill they had to accomplish in a very short time. As not all children could “see the monitor easily most got distracted and lost interest.”

According to Ms. Brown the introduction of the IWB changed many things – having a big screen in class enabled activities to take a new dimension.

Children could “visualise the pictures at all times with vivid colours and use a normal pen to drag and drop rather than learn to use the mouse”. This multimedia affordability tool motivated the children instantly.

Thus, once the teacher had everyone’s attention she could then bring in elements of mathematics, science, language – literacy, oracy, etc. The story becomes a cross-curricular activity as the teacher weaves in skills from mathematics, reading, listening, and digital skills amongst so many more as

quoted by Ms. Brown herself “the board indirectly also enables the children to develop digital and social skills”.

The children are more focused, less fidgety, and very receptive because of the multisensory elements – colours, sounds, and the ability to manipulate the pictures easily on a big screen. Ms. Brown clearly pointed out that having the children actively participate does not happen overnight. Most of them are reluctant as they are not used to this kind of learning and teaching. Through patience and time the children gradually learn new competences and skills and become actively involved in their own learning. Unfortunately, not all KGEs are keen to use technology effectively in this manner and thus skills and methods adopted in this class are not carried forward in other classes.

The IWB has also enabled the possibility of tapping into more resources with the click of a button. The preparation time has drastically decreased, as previously with a normal whiteboard the teacher had to draw everything and cut out flashcards and have them laminated. In other words, the teacher basically had to create all the resources manually. The IWB comes equipped with a multitude of ready-made resources which are interactive and customised for specific needs, an asset for the teacher.

Ms. Brown finds the IWB helps in classroom management as well because it is easier to control the children. They know what to expect, it excites them and thus attention span and concentration is longer.

The challenges presented are mostly the lack of training, support, and time to reflect and share classroom practices. The teacher finds that she has to learn most things on her own as the eLearning Support teacher is not always available.

Another important factor which inhibited use of the technology was the lack of Learning Support Educators (LSEs) for the children with special needs. These educators assist in the education of pupils with special educational needs on a one-to-one basis. Before a child is officially statemented (a very long process) –in other words officially certified to have special needs and thus require an LSE to support him/her – an LSE is not allocated to the child and the class teacher has to deal with the whole class including the children with special needs. This poses several problems especially if the child is severely autistic or has challenging behaviour which effects the rest of the class. At times Ms. Brown stated that the IWB simply could not be used as the child with special needs would want to use the board alone and would get angry if someone else touched it. The support of an LSE would mean that the child is under control and the class teacher could carry out activities knowing that particular child is being taken care of appropriately.

4.1.2a Ms. Smith - Brief overview of lessons observed

Ms. Smith stated that her main objectives when using the IWB are to reinforce concepts, letters, vocabulary, writing, and reading through fun activities such as interactive games. The lessons observed with this teacher all immediately demonstrated a particular difference. When the teacher announced that they would be using the IWB the children took their chairs to specific spaces in front of the board without hesitation. This made classroom management very efficient and less time was wasted to decide where to sit. The IWB was found especially useful with children of special needs such as autistic or Down's syndrome. Here a great difference could be felt compared to Ms. Brown who did not have LSEs for support with children with special needs. It was

observed that these children with special needs were using the board to write big letters or numbers. The difference was that they were being supervised on a one-to-one basis by their LSE, which meant the LSE had control over the child and could guide him and give him individual attention. She could also take him out of the classroom if necessary without disrupting the rest of the class.

When writing on the IWB the children felt free to make mistakes as they enjoyed erasing their work until getting it right. They could add colours and patterns, making it an exciting activity. The thick pen used with the board served as a great introduction to learning to hold a pencil for writing; in other words as a pre-writing skill for all the class. The rest of the class also took turns in writing on the board, this was an opportunity to teach the children to learn to wait and at the same time encouraging their friends who had a slower response.

The teacher had planned all activities to be used in class by applying the Virtual Learning Environment (VLE) – Fronter see figure 4.2 – which all state schools use. She puts in all links and activities, according to the scheme of work, and thus simply clicks on a link to find all the resources needed for a particular topic. The children are used to this now and follow the activity set out by the teacher on the IWB. After a brief explanation, the children come to the board one by one to work out the activities. The children appear highly motivated as the visual and auditory effects keep them engaged and attentive. The teacher has also taught them that the cue of switching off the light means a particular activity is to be expected, without the need to utter a word, and thus is a strategy adapted for classroom management and coordination.

4.1.2b Ms. Smith – Brief outline of Interview

During the interview Ms Smith stressed the breakthrough she had with two specific children with special needs because of the IWB. These were adamant on not writing but once the teachers and LSEs let them try to write on the IWB their attitude completely changed. They actually enjoyed it and the teacher used the opportunity to introduce them to pre-writing skills such as drawing straight lines and curves, which eventually led to writing letters and numbers. In class they participated with the rest of the children and this factor truly gave them a boost as they could see their writing on the board alongside that of the others. After a while they felt confident enough to also write on their copybooks just like their peers.

The teacher referred to using the IWB directly with the VLE in her planning scheme (figure 4.2) as an efficient way to prepare lessons. “I just click, for example, Literacy, and it opens flash cards for that week which are linked to the literacy topic I prepared on the VLE. This includes any links to online games or resources. It is also a link for parents. So, I just come to the board and follow the lesson from the board”. The teacher clearly sees that the children are more attentive and engaged when using this technology “Through the IWB you can introduce the subject in a new way; example, Maths is now enjoyable”. It also supports the teacher in being able to move easily from one activity to another, from one resource to another, without much loss of precious time.

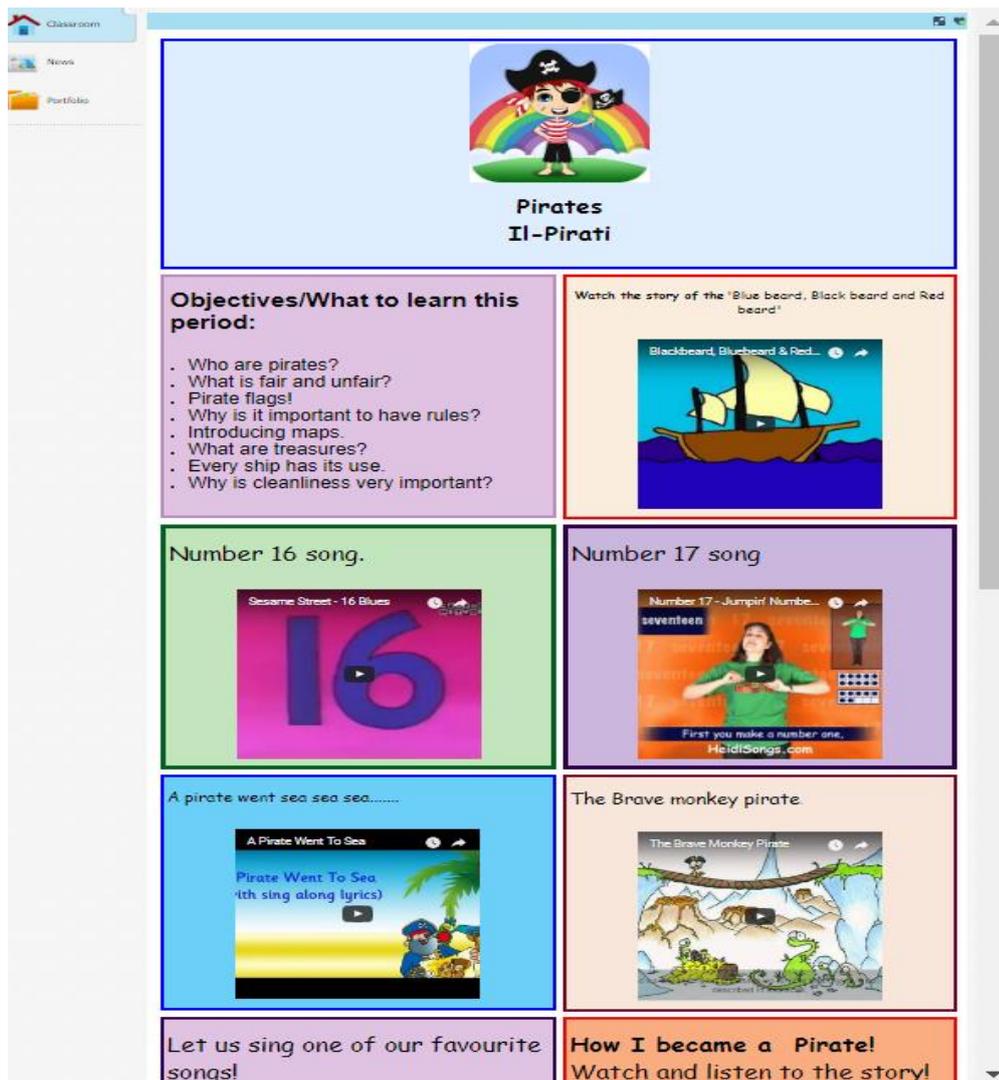


Figure 4.2 Use of the VLE

As the IWB resembles a big screen in a cinema, the children are always enthusiastic to see what is coming up next. The teacher notes that they are focused because in activities involving the IWB “...no one asks me to go to the bathroom or to go and drink, which is most often a sign of boredom or lack of interest”. The activities planned are also a means of informal assessment whereby the teacher can identify what learning outcomes individual children have achieved when asking them to individually write a letter/number etc. It is also beneficial for revision and consolidation. As work done on the IWB is always a whole class activity (see figure 4.3), the children are encouraged by

applause from their friends when they get the correct answer, or helped by their peers when in doubt.



Figure 4.3 Children in their places totally attentive

It also indirectly makes the children work harder and stay focused as they want to get the correct answers. Ms. Smith finds they are learning to take turns as mentioned, wait for each other, and get shy children to open up and talk, making friends – improving their social skills.

4.1.2c Ms. Smith – Challenges

During free play the teacher indicated that there is always someone using the board and they argue over who will be writing on it. The teacher suggested it would be ideal if more than one child could write simultaneously on the board; this would mean having groups or teams using it at the same time. Another drawback is the height. Being kindergarten children most of them need to

stand on a chair to be able to reach up and write and this is neither practical nor safe.

Lesson preparation for use on the IWB is time consuming but in the long run it does eventually save time as the lesson created or resource found can be used repeatedly and will only need to be updated or slightly modified for different abilities and classes.

4.1.3a Ms. Martin - Brief overview of lessons observed

Ms Martin was observed during a Maltese literacy lesson. The children first listened to a song in Maltese projected on the IWB as a YouTube video – a multimedia resource where children were attentively engaged listening, clapping, singing along to music as well as seeing pictures and video. Soon after the song they watched a video displaying fruit and vegetable names and sentences in Maltese. As was observed Ms. Martin's main objective was to introduce the new topic through a story or song using the multimedia tools.

The teacher then moved on to upload a presentation she prepared with pictures and words containing the Maltese letter Ċ. The children were asked to find the letter in the words so one by one they came out and pointed to the letter. In another prepared activity using the Starboard software Ms. Martin asked the children to find the Ċ letter, amongst a number of letters, on the board and circle it. It is important to note here that Ms. Martin had no training in using the features of the software but took the initiative to look it up on the internet and teach herself to be able to create such resources for her classroom. This became a fun activity and since all children could take a turn the teacher could assess whether all the class could recognize the letter.

Available within the software is a collection of videos displaying the motion

and direction to write letters correctly— so the children could play the video on the board and follow the letter with their fingers. In figure 4.4 a child follows the letter being drawn by the program; first with both hands then repeats it with one hand or finger. This is demonstrating the great benefit and affordability for the IWB to be a tangible resource where children can physically manipulate what they are learning. This was previously inconceivable and the IWB has made such an activity possible – in the SAMR model as explained in chapter 2. The technology has supported the teacher in transforming her pedagogy to a redefinition of previous tasks. The technology allows for the creation of new tasks.



Figure 4.4. Child following the letter with her hands

4.1.3b Ms. Martin – Brief outline of Interview

Ms. Martin describes the IWB as an asset in her classroom, a tool which engages, motivates children and enables her to assess individual abilities and progress informally. She has been teaching in kindergarten for 4 years and thus has always had an IWB in her class and cannot imagine how she could teach without the technology.

Ms. Martin points to the fact that while the children were listening and enjoying the song she took the opportunity of getting ready for the follow up activity – something which she could not really do with a CD player or just a small computer monitor as the children would still get distracted and lose interest. This KGE once more alludes to the importance of the IWB as a starting point for writing “through the use of their fingers as a starting point to writing as the pen resembles a crayon or marker, then when they come to the pen and paper the skill has improved”.

Lately as all educators including KGEs have been given a laptop by the Ministry of Education, Ms. Martin observes that this has been of great benefit for her because she can now prepare activities for the IWB from home as the IWB software is installed on these laptops. Previously she had to do these preparations early in the morning before the children arrived at school, which was at times impossible.

The use of the IWB in the case of special needs children was again shown as an important resource. She described one particular child with special needs who was afraid of using the IWB and reluctant to do any writing. He is now confident and keen as he first uses the pen on the board and then is not afraid to do the same thing with crayons on paper.

Ms. Martin acknowledges that the IWB allows for differentiated learning/teaching. Children use the board according to their needs. If a child needs more cues or time this can be done through differing activities.

Classroom management is easier because through the various resources (multimedia) the children are listening to other voices not just their teacher’s and thus they are more attentive and grow less bored. “I use it for children to

practise pre-writing skills by using their fingers and writing on it. For matching and sorting games that I find online where the children use a pointing arm to select the right answer. It makes it easier for me to plan and implement activities to help my students achieve the learning outcomes I have planned.”

Ms. Martin is also involved in eTwinning, which is a networked platform for teachers across Europe. The IWB helps in displaying the Twinspace which is a virtual space shared by the members of a project between different countries. “It helps by allowing me to make a conference call more visible and hence more interactive for all the children to see each other and each other’s work”.

This teacher states that she has become very dependent on the IWB as almost every lesson somehow includes its use. Subsequently when something is not working due to any technical issue, she cannot continue with the prepared activities, as they are interrelated. The lack of training is also an issue. She has been given no training whatsoever but has taken the initiative to learn on her own. She would like to have more support and training as she believes the IWB has much more potential to enhance learning and teaching. Occasionally professional development sessions are organised by the school specifically on the use of the Starboard software but that is very limited and infrequent. The eLearning support teacher visits the class from time to time and the one-to-one support is very effective, but it is again very limited due to the lack of such teachers.

Ms. Martin passed a very insightful comment about reflecting on her lessons and pedagogy “reflection brings about change in the way I teach – to do it better”.

Although it seems, from the teacher's comments, that technology is used extensively in her lessons and she is very dependent on it, observations have proved this not to be the case. Ms. Martin still incorporates all the other usual activities such as hand painting, sand/water play, reading from books, etc. The IWB is used as a resource which she utilises at the most appropriate times during the day, blended seamlessly and complementing other activities.

4.1.4a Ms. Webb – Brief overview of lessons observed

Ms Webb uses the IWB as part of a lesson rather than the whole lesson itself. The main objectives being the visualisation of concepts through multimedia and multisensory resources.

In this particular lesson Ms. Webb brought the children around the IWB in a semi-circle to watch a short video on mountain goats. The teacher uses the VLE to present her lesson which was prepared complete with the links to the videos, vocabulary and activities which followed. The lesson is made more captivating by a video of real live mountain goats. At times Ms. Webb would stop the video to make an explanation of what the children were seeing in Maltese. As the children in this school are of mixed cultures and nationalities, most of the lesson is conducted in English but still the teacher takes note to make important points again in Maltese. After having seen the video/song encompassing vocabulary associated with goats the lesson now moves away from the board as Ms. Webb asks the children to act out the story of the 'Billy Goats Gruff'. The children dramatize the story which they have been hearing from the teacher and through online reading books on the IWB. Ms. Webb records this dramatization through photos and video clips. The children

become fully engaged and all enjoy re-telling the story in such an entertaining way.

After the activity has ended the teacher again gathers them around the IWB to watch the video clips and photos she took, “they really enjoy watching themselves on the ‘big screen!’” Ms. Webb excitedly recounts. This exercise allows for a recapitulation where indirectly the teacher is assessing if any child is missing out on something through pre-thought questioning techniques. The children are then split into groups to work on diverse activities. Those on the tables have crafts to complete while another group works on the class computer which is connected to the board. They create a PhotoStory with their teacher guiding them. This is not the first time and so most of them already know what to do. The children rotate activities such that all have a go at working on the computer or on the tables. See figure 4.5 for a glimpse of all the activities.



Figure 4.5 A Glimpse of the various activities.

4.1.4b Ms. Webb – Brief outline of Interview

Ms. Webb has been teaching for over 5 years and has always had the IWB available in the classroom. Her initial training was very effective because the teachers were split into small groups and the training was specifically tailor-made for KGEs. Unfortunately, it was the only formal training Ms. Webb has received.

The teacher stresses the importance of the functionality and interactivity of the IWB especially at this age where the children make use of the various features it presents. She uses it in the beginning of any activity as a means of whole class instruction by bringing up worksheets and having the children physically interacting, writing, dragging, colouring etc. This builds their confidence later on when working individually on their own copybooks or at home. Lessons can be prepared beforehand at home through the software installed, something which they could not do before. Ms. Webb notes that to prepare such lessons is time-consuming but lessons can be used again and again with slight modifications or updates, effectively in the end, it is more worthwhile.

“I would start off a lesson with showing a small clip perhaps to highlight what we would be talking about and grab the children’s attention on that particular subject. And then I would proceed to do some creative activity (not always using the IWB) I would then proceed to finish the lesson off by actually showing photos of this activity or with a further visual aid. When used in this way, I feel that it enhances the lesson. If used on its own, children then will view it as

another 'television viewing' which in my opinion does not always contribute to new learning".

Ms. Webb argues that it is important to instil 21st century skills, and the IWB helps develop these skills and expose children to technology through a single tool. One of the main challenges pointed out is that activities need to be as short as possible as the children's attention span at this age is very limited. She also finds that having a big number of children in her class makes it difficult to conduct activities on the IWB easily. On the other hand, Ms. Webb points out how the IWB is especially helpful in her class for supporting children with special needs such as autistic children. She has a particular child who is unable to do anything and yet he is capable of taking pictures which are uploaded on the board. This makes him so proud that he can manage to do something and participate in the class. Keeping him occupied and interested has also helped in classroom management as he now disrupts the class less frequently.

4.1.5a Ms. Wood – Brief overview of lessons observed

After some routine greetings and physical exercises in the morning, Ms. Wood gathered the children around the IWB to start off the lesson.

In the first activity, she introduced a story of Grandpa Ninu (Nannu Ninu) through a presentation emphasising the letter N. Together they read the slides dramatizing the letter N. Then they played a game wherein the children had to think of the word beginning with N represented by a picture. In the next activity the teacher used the Rub & Reveal feature of the IWB software, wherein the children rub spaces to find different letters. They also drew the letter N using

the pen tool –changing colour and taking it in turns. Children with special needs could follow a dotted pattern of the letter (join the dots).

4.1.5b Ms. Wood – Brief outline of Interview

Ms. Wood has been using the IWB since the introduction of IWBs in all kindergarten classes. Her initial training as regards use of the IWB was at MCAST (Malta College of Arts, Science & Technology) where she was trained to become a KGE. This was a 3-hour session which the teacher found very effective. At school during curriculum time she was given one or two sessions partly dedicated to the use of the IWB in the classroom as well as some one-to-one sessions with the eLST which were more effective as they were tailor-made for individual needs.

Overall the teacher finds such a tool more effective than a normal whiteboard as, in Ms. Wood's words, "one can be more adventurous and more flexible".

Less time is spent to create activities as most are done on the spot as the lesson progresses or early in the morning before the children arrive at school. For other more demanding activities more time is needed in preparation but is well worth the time spent according to this teacher. This is something she can do now that she has a laptop to work with at home. At kindergarten level the teacher notes that they need to have many hands-on and practical activities which the IWB can offer, and this is why it is so appropriate and useful. Pre-writing skills are easily introduced on the IWB, as well as experimenting with colours and shapes, before moving on to pencil and paper. The multisensory element including texture is a great bonus in the class; see figure 4.6

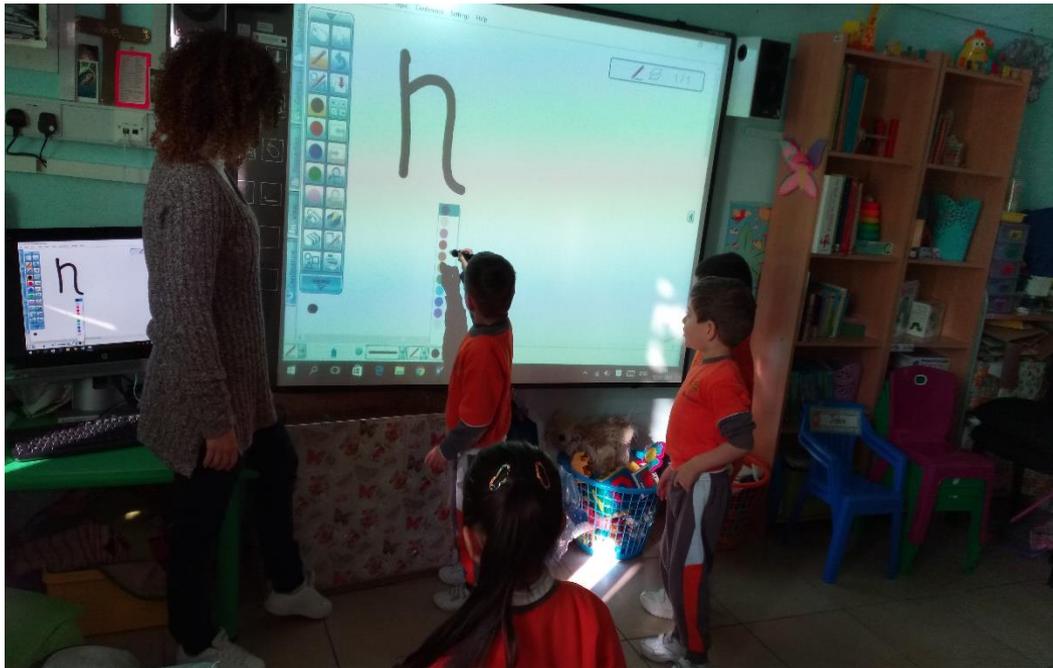


Figure 4.6 Children experimenting with colours and thickness of pen

The main challenge Ms Wood mentions is the problem with colours not appearing truly as they are, thus confusing the children. In this instance, the children are directed to look at the screen of the laptop instead of the board before being asked about the colour. (This is a technical problem with the lamp of the projector which starts to fade by use). The teacher remarked that the tool was useful because it allowed the display of presentations, YouTube videos, songs to help with the understanding of numbers and letters. It assists her in scaffolded learning by easily going back to previous pages unlike traditional boards.

Although Ms. Wood feels that she is making good use of this tool, after the observations and interview I note that there is no evident change or enhancement of her pedagogy and the interactive features of the board were very minimally used. This is a clear example of a teacher at the enhancement level of the SAMR model where the tool is merely a substitution of tasks and

activities done without technology as there is no actual transformation in practices.

4.1.6a Ms. Lewis – Brief overview of lessons observed

The objective of this lesson and a number of activities observed with this KGE was differentiating between healthy and unhealthy food through technology. Learning to use digital skills, competencies, and stimulating discussion. Very evident in this teacher's lessons were the integration of various forms of technology through the IWB.

As with most of the other classes the children gather round the IWB and take their places. The teacher introduced the topic through a musical video enticing the children with phrases like 'yum, yum' while rubbing their tummies to indicate something good to eat, and at the same time moving to the rhythm of the music.

The lesson then continued with the use of the Easi-view. This resembles an overhead projector where the teacher can project flashcards, small pictures or anything onto the IWB for everyone to see easily however small (see figure 4.7).

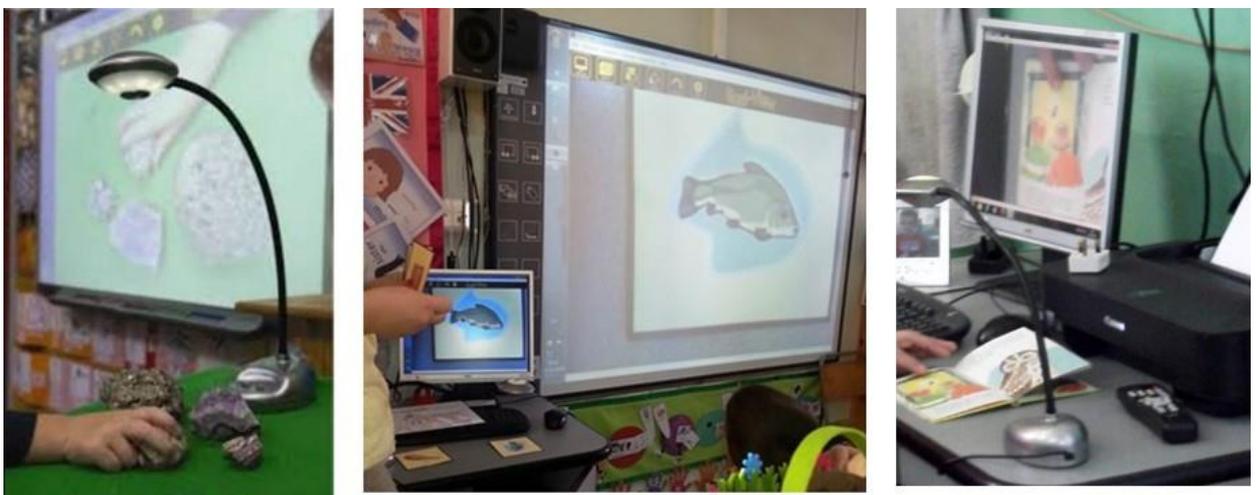


Figure 4.7 The Easi-view being used in the classroom

Using the Starboard tools the teacher herself created another activity/resource using the Starboard software showing two lunchboxes, one healthy and another unhealthy. The children had to drag the food underneath into the appropriate lunchbox deciding whether the food is healthy or not, reinforcing the children's understanding. See figure 4.8

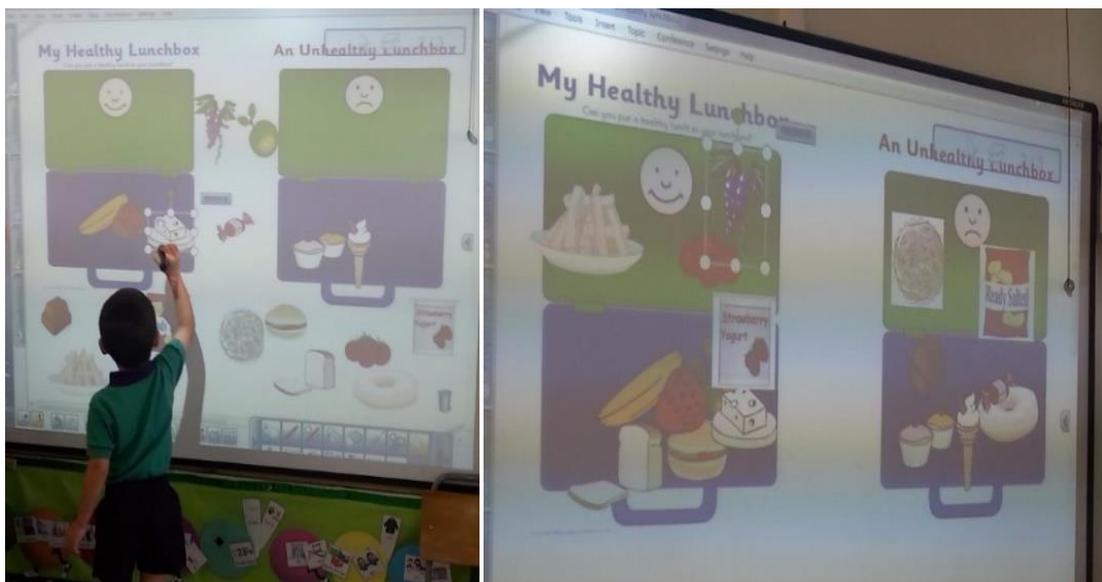


Figure 4.8 Dragging the food into the correct lunchbox

Using an online game, the children learn to differentiate between different foods only through their shapes. Ms. Lewis encouraged class discussion before attempting to answer. An integral part of this activity structure is the skill of knowing how to drag an object.

4.1.6b Ms. Lewis – Brief outline of Interview

Ms. Lewis stated that the IWB was supporting her as a teacher because she could reach out to all children at the same time, having more control of the class. When using flash cards, these can be projected onto the board where they are shown to be much bigger and clearer. Previously she used to go

around each child individually with the consequence that most of the time the other children waiting lost interest and the teacher lost control of the class.

4.1.6c Ms. Lewis – Challenges

According to Ms. Lewis her biggest challenge is when the technology does not work as most preparation of the lesson planning depends on the technology working. Although having said that Ms. Lewis expresses her delight that recent upgrades in the school infrastructure and new equipment have contributed to this now happening very rarely.

The teacher comments that not everyone can come to the board at the same time and thus some children might get restless or lose interest, and so to avoid this she devised a simple strategy which seems to work. She starts off with the quiet ones and leaves the more fidgety/distracting children till last, so they remain attentive and focused because they know that if not they will miss their turn or the teacher will not allow them to take part. Also, another method to manage her classroom is by not following a clear ordered routine where the children know when they will be summoned to contribute their participation but are chosen randomly. Thus no one knows when he/she will be called to the board to contribute. Ms. Lewis used this method mostly when the children are a bit more fidgety than usual so as to keep them attentive. Ms. Lewis notes that she has to be very flexible in assessing the children's mood on the day. Being very young it changes from day to day depending on several factors and thus lessons have to be adapted accordingly.

As the observations were done during the beginning of the scholastic year, the children were still getting accustomed to using the IWB in the classroom and thus they were much less obedient and easily distracted by the crying of other

children who were still settling in. (These 3-year olds were coming in from nursery classes and were still getting used to the idea of sitting in specific places as directed by their teacher, rather than roaming around the classroom in free play as in nursery). Ms. Lewis notes that by the end of the first term the children would have settled down to a routine and got used to the system and of what is expected of them.

Ms. Lewis stresses that she has to make it a point to use different tools and vary the lessons to keep their attention and not let them get too confident in using certain tools as they may become bored or less attentive. The spotlight tool for example is not used frequently so the WOW factor is still very evident.

4.1.6d Ms. Lewis – Opportunities

Ms. Lewis points out that the IWB is a great tool in providing feedback on the children's understanding – formative assessment. In working the online game and the game she herself prepared, she could determine if they understood the concepts/lessons presented as individuals. The teacher was surprised that a lot of learning was taking place by observing their classmates working out the activity and through discussing why someone made a mistake. This was an opportunity for discussion for which only technology could provide the context for it to happen.

On mastering certain skills Ms. Lewis learned to use the tools offered by the IWB to create her own lessons and activities. She could customise/create each activity to specific needs. Some activities are made specifically for the special needs children in the classroom who need more visual and auditory cues. Ms. Lewis states that the technology gives her the tools to do this, and is why she is experiencing transformation in her teaching practices. She is

using methods that could not have been done without the technology.

Creating the resources used to be very time consuming and the resources were not so effective. Listening to an audio cassette player, looking at a distant flashcard or just looking at a small laptop screen, crowding over other children, made the lesson difficult to follow and children of low abilities would continue to fall behind.

4.1.7a Ms. Jones – Brief overview of lessons observed

In this lesson Ms. Jones was mainly aiming at introducing dinosaurs, what they were, how they lived etc. through digital media and interactive games. It is important to note that this class is very small in number making it a much more manageable group. The children were first shown an introductory video for children in English on the IWB about dinosaurs. Later the teacher explained and simplified it in Maltese. The video was part of the website: <http://www.sheppardsoftware.com>. This is a very versatile website for the early years with animated activities filled with sound and visual effects to make learning fun. The online games have sequential difficulty levels and include a variety of topics which are all found in the kindergarten curriculum such as animals, nutrition, colours, language games, and so many more areas. For the second part of the lesson the teacher continued using the same website for an interactive game of matching cards. The children had to find two matching cards of dinosaurs doing some action. Although the children were taking it in turns, those who were finding some difficulty were helped by their friends who showed where the right matching card might be. The teacher here was guiding them through verbal clues and reinforcement in the

background, while the children were at the forefront creating their own learning.

This lesson concluded with some movement through a dinosaur dance where the children imitated dinosaurs in a dance shown on the IWB. It was noted that the teacher also used other resources to capture the children's attention such as posters, colouring handouts, models and tiny eggs which would hatch once placed in water.

4.1.7b Ms. Jones – Brief outline of Interview

Ms. Jones has been teaching for four years and thus has always had the board as part of the classroom. She says that children now look forward to using the technology because of the multimedia and multisensory elements. Having a huge display is also an important factor in keeping the children's attention, especially at this delicate and young age.

Prior training has been next to nil as Ms. Jones did not initially even have an IWB in the classroom, and later, when this was installed, only very limited one-to-one training was offered due to lack of support staff. For Ms. Jones it was on her own initiative that she learned to use the IWB, considering this as a challenge, and was very pro-active.

Ms. Jones views the technology as a stepping-stone in scaffolding children's writing from a big display working together to the smaller papers they use at their tables individually. This is something which they could not do using other tools in the classroom. It builds their confidence as well as skills in working with others, discussing and collaborating. Being a digital media the IWB allows for work to be saved for continuation at a later stage with no need to rub everything off to make space for new material. Thus, recapitulating or revising

what was done allows for scaffolded learning and development as well as going from the known into the unknown, the familiar ZPD.

Ms. Jones alluded to the importance of balance in using technology and traditional activities in her teaching. Children learn to move and adapt accordingly from using any form of technology to manual activities, which may not involve technology but are very much related or are a progression of what was initiated digitally.

4.1.8a Ms. Fox – Brief overview of lessons observed

The lesson observed had as its overall theme and learning outcome the topic of healthy living. Ms. Fox used the IWB first to refresh the children's memories about an outing wherein they learnt about how strawberries are grown and how certain farm animals are taken care of. They were shown pictures taken and could remember what they were told. After this quick introduction, the children did some physical activity by dancing to a video which included written and sung instructions. The children were evidently enjoying this as their faces lit up with delight and even the shy pupils participated, (see figure 4.9).



Figure 4.9 Visual and auditory cues from the IWB stimulate motivation

The visual and auditory cues from the song projected on the board encouraged participation and at the same time literacy was reinforced as the children heard and saw the written words. A story followed narrating the tale of Jack and the Beanstalk. This motivated the children to participate by singing the words shown on the board and physically doing gestures to show they know the meaning of the words. These activities were all-inclusive as the IWB became the main focus and everyone whatever their level could join in. Ms. Fox was just guiding and giving instructions to those who missed some part or needed more guidance.

For the next activity, numeracy was integrated through the theme of the story by counting numbers. Children came out one by one to work out the activity. It was noted that waiting for their turns made the children restless and loose interest. This happened in many of the observed classes, yet in some classes strategies were implemented to counter this. Finally Ms. Fox used a tool from the IWB software called the Spotlight where a spotlight appears and the children had to search for specific numbers indicated by their teacher. This reinforced their number recognition and served as a formative assessment tool to identify those children who had difficulty in identifying numbers.

4.1.8b Ms. Fox – Brief outline of Interview

Like most of the others Ms. Fox also complained about the lack of training. The only training as in most cases was the initial 3-hour crash course which at the time meant little as the IWBs were not even yet installed in the classrooms. As a result the teachers could not practise anything they learned. It was only with the help of the eLST that she could start using the tool interactively. Ms. Fox does try to integrate the technology in ways which

engage children in learning. She feels that when children are enjoying an activity they become enthusiastic and more open to learn. This technology allows them “to have a go and try things out in a fun atmosphere” before committing to pen and paper, which could be daunting to children at this age. Once again, there is mention of the importance of pre-writing skills for which the IWB is an excellent tool in helping children develop their writing, again in a fun activity.

Ms. Fox frequently shows her lack of confidence in using technology and the need for more ongoing training, one-to-one support and professional development. “I wish I had more knowledge. I do not try things out alone or experiment because I am afraid I will press the wrong button by mistake and do something irreversible or fail”.

As regards classroom management she feels that using the IWB helps in managing a bigger group as they are more focused and can include more activities. When organising the class in groups and going around one table at a time the children become distracted and lose interest, causing problems in class control. Now that the IWB has been around for a while the children are used to it and thus being a familiar tool are not afraid to use it and play around with it. Ms. Fox stresses the importance of the multisensory element of the IWB making it appealing to the young learners and easier for them to learn concepts which otherwise would be difficult to assimilate.

Ms. Fox maintains that the amount of preparation for such lessons using the IWB take up much more time but are well worth the effort. She has noticed her planning has changed and using this tool has helped her focus more on the learning.

The main challenges mentioned are the lack of skills to use the IWB to its full potential. The need to share practices and learn from other colleagues who are not eager to share. Ms. Fox suggested that an eLST who is more present in the school would be an asset and boost her confidence in trying out activities, because she would know there is help and support.

4.1.9a Ms. Bell – Brief overview of lessons observed

During this lesson, Ms. Bell intended to revise the letters done so far and the main learning outcomes were letter recognition, pronunciation, and being able to write the letter correctly.

The children gathered around the IWB and Ms. Bell loaded a prepared short presentation of letters alongside pictures starting with the letter as a quick recapitulation. The activity that followed required each child to come out and figure out the letter with which a picture shown starts with. Then they were required to draw the letter. It was interesting to note that while one child was drawing the letter the other children were commenting amongst themselves about whether the letter was correct and if the child at the board was writing it correctly, thus encouraging discussion and to a certain point critical thinking. Another important factor I noted was that the children were accustomed to using the IWB tools such as changing the pencil tool colour and thickness. This is evidence that the children used this interactivity on a daily basis and not simply to impress anyone visiting the classroom as observed in some other classes. They have become more observant to what features can be used and even surprise the teacher as to finding new ways of doing tasks.

More interactive games included finding the correct letter by clicking on the letter with a magic wand with sound effects. Lots of incidental teaching was observed wherein children learn competences from their mistakes or those of others, and through the informal discussions that arise spontaneously.

4.1.9b Ms. Bell – Brief outline of Interview

Ms. Bell practically repeated the same issues with training which was given in the beginning when the IWB was not even yet installed in classes, making it difficult to understand how basic tools work. She suggested that being given support on a one-to-one basis or in very small groups of three to five, which she had experienced, was very beneficial. She commented that during this type of support she could learn from others' practices and also share her own. This is beneficial because it also happens away from the classroom, when the teacher is totally focused on what is being discussed or taught. The way in which most support is given happens within the classroom with the children all present, making it very difficult for the teacher to concentrate on what the support teacher is trying to convey.

The teacher argues that she has seen drastic changes in the children's interest. They have become more engaged in what is going on in the classroom. The technology is helping her create interactive activities which could never be achieved with traditional tools such as the normal whiteboard. After reflecting on a question about any change in her pedagogy, Ms. Bell said that although preparation takes longer she is more confident in what she does because the tool (IWB) enhances her teaching and she feels it has developed the way she delivers lessons. Today what she does is more engaging and motivating for the children, the IWB can show her if the children have really

assimilated what she is trying to convey. They remember things much more than usual as the multisensory element helps in comprehension and memory. Ms. Bell commented that the classroom is more manageable because the IWB grabs their attention. Activities can be so varied as regards levels and interest. Formerly videos were shown on a class television monitor which was limited as a resource and too small as a screen. Now she can look up more relevant educational videos which are also interactive as they ask children questions to be able to continue and move on to higher levels.

Specific ICT skills were mentioned as major challenges as well as more training. Special needs children were mentioned as benefitting from use of the IWB but poses a big challenge when no LSE is assisting the child.

4.1.10a Ms.Taylor – Brief overview of lessons observed

The lesson observed was the writing of letters. Children practised writing the letters and finding pictures starting with specific letters. There was use of the IWB software which provides animated writing of letters – thus children could see how a letter is written and if needed repeat the animation as required.

They could also trace over the letter on the board while it was being played until they could confidently do it on their own, first together on the board and then individually on their copybooks (see figure 4.10 and 4.11).

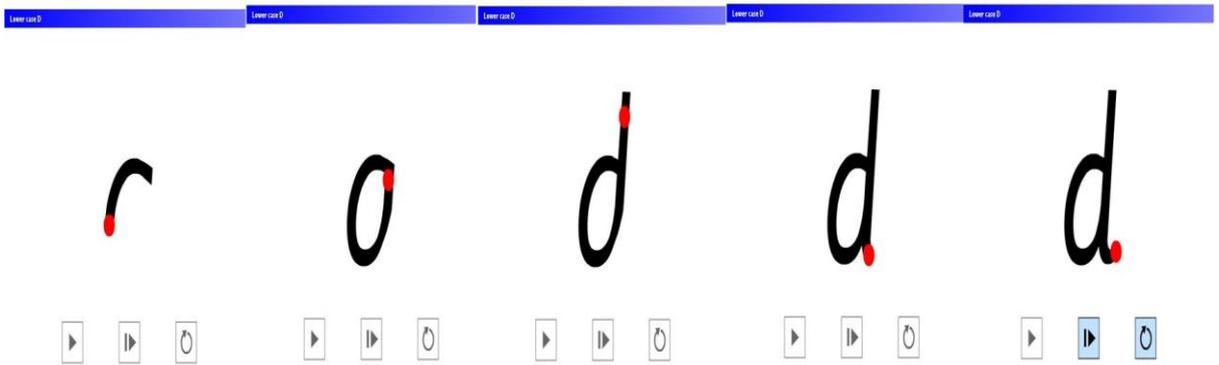


Figure 4.10. Animation of the letter d lower case

Later the children were asked to identify the specific letters in words by circling them. This game aroused much interest as the children who were seated were thinking out the answers and correcting their peers who were at the board selecting the letter.

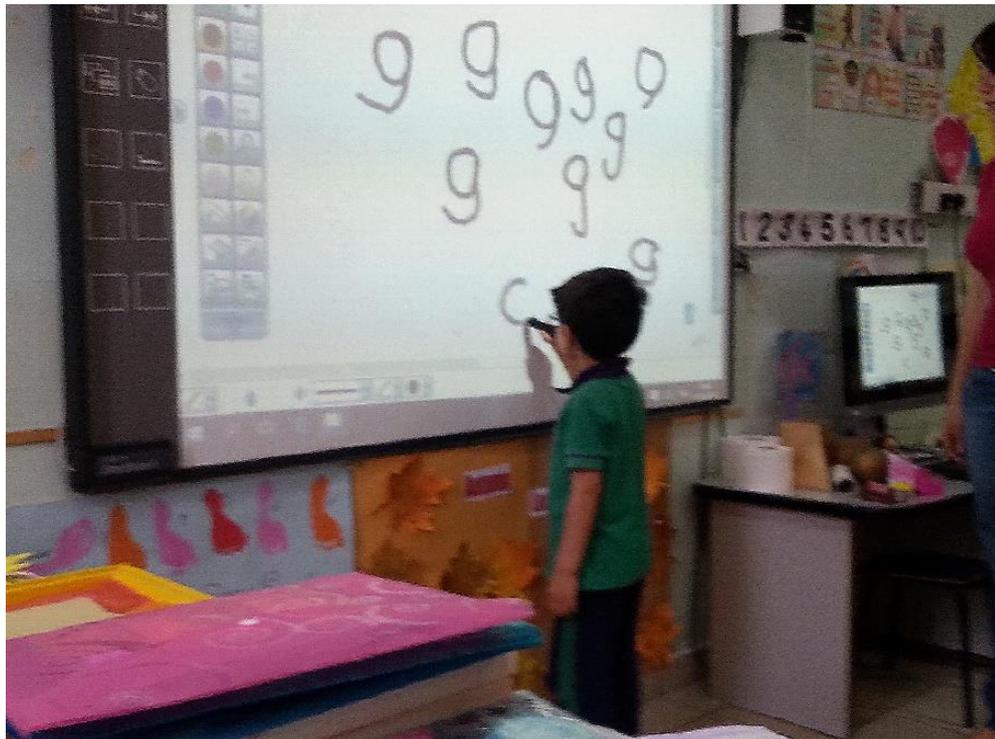


Figure 4.11. Child trying letter out on IWB

4.1.10b Ms. Taylor – Brief outline of Interview

Ms. Taylor made an interesting comment about learning collectively. This is a clear example of co-constructing knowledge. She noted that the IWB changed certain dynamics of the classroom in that the children are interacting and being active in their learning not as individuals only but together as a class.

“The fact that they can see what others are doing or how they are going about the activity helps those who feel insecure to contribute just as much. This helps in giving them confidence.” She added that it helps the not-so-confident children to try out possibilities or talk about solutions which in effect is part of the process of learning. In traditional style teaching with a non-interactive whiteboard the teacher gives out information and maybe some children might come out to write but the activity is very limited without any multisensory, vivid stimulations. Thus, children become bored and distracted, losing interest. The IWB has opened up a new dimension/perspective wherein the children feel motivated to think and try out solutions. “they can see each other and so I can make mistakes, rub, and rewrite. Learn from each other’s mistakes. Working as a group together has a great effect on them rather than each alone at the desk. Like thinking collectively”. They can listen to and hear different voices, not just their teacher’s voice, providing the element of surprise in presenting topics, something they look forward to. “The technology has given us the potential for such activities including collaborative activities which are more possible this way.”

Ms. Taylor said that although the IWB is an essential part of the learning, the children still need and do activities away from the technology, in other words finding a balance for other more traditional activities. “I do not use it for a

whole day but just as a resource /tool at particular times in the day”. Use of the IWB in Ms. Taylor’s lesson is intended to initiate the thought process collectively as a class, to practise new skills, competencies together, to make mistakes together before working more on an individual basis. The teacher finds that children learn more this way and thus are more confident and competent than work on their own.

Reference was made to when the IWB had some faults and could not be used. Although they did a lot of other activities yet certain interactions were not possible. “The children were rather upset and kept asking when it would be fixed!”.

The lack of having an LSE to take care of the children with special needs is the greatest challenge she faces as this disrupts the lessons especially when working on the IWB – a challenge voiced by a number of teachers.

Ms. Taylor also indicated that as an experienced KGE she gauges the time when the children are most receptive and uses the tool at that time “... if they are not in the mood it will be useless, so I have to read the signs and use it appropriately”.

This particular teacher emphasized the importance of the IWB because it introduces technology for the first time in an educational institution at such a young age. Kindergarten children can easily start to build 21st century skills through this tool, competencies which are a child’s right today and not just an option. “...I believe ... it is important that future citizens know how to use the technology that surrounds them, and if you cannot do this you will not be able to integrate in society.”

4.2 Analysis using Activity Theory; research questions, and themes

The main research questions referred to in chapter one section 1.3.1 (p. 10) along with emerging themes, have been categorised in this section. Chapter three, section 3.6 (p. 64) the Data Analysis, explains this in detail. As the themes are so closely related, and because this analyses actual classroom scenarios, at times they may overlap and thus it was impossible to discuss only one theme entirely without referring to another related theme at the same time. Table 4.1 below illustrates the various nodes in AT and what they mean or whom they stand for in this particular research.

Activity Theory Concepts in a pedagogical activity system. Nodes of the activity system as identified in this research project.	
Subject	Teachers (KGEs) with their epistemic assumptions of learning and teaching and the understanding/beliefs of how technology can be used as a tool.
Mediating artefacts (Tools)	Tools which mediate thought during interaction. In this case the IWB and other digital resources used with it as well as language .
Object	Objectives/goals/learning outcomes the teacher targets to accomplish using the technology.
Rules	The norms/rules/policies/expected behaviour in the classroom/school setup, rules of technology use, skills, curriculum requirements. What is expected in particular contexts. The socio-cultural influences play a major role here.
Division of labour	Division of responsibilities, tasks and power relations of teachers and pupils in the classroom.
Outcomes	What was actually achieved through using the tool

	(IWB) in the learning and teaching process
Community	The social context within which teachers, pupils, and school staff work. These can include the LSEs, eLSTs, and school leaders.

Table 4.1 – Nodes of the activity system

4.2.1 How does the IWB, as the mediating device, within the activity system, hinder, enhance or transform pedagogy, from the teachers' perspective?

4.2.1a Theme 1 – Engagement – Motivation

The level of stimulation, motivation and engagement the children get by using this technology could be the driving force for teachers to transform pedagogy as the teacher is re-thinking activities done in the classroom. The IWB captures the children's attention through its multisensory stimulations. The visual presentation plays a major role in learning (Winzenried et al., 2010). Thus within the AT triangle the tool is enabling the subject to achieve the object - the lesson outcome. Ms. Brown noted the great improvement in the updating of the infrastructure; "the children can see pictures without having to crowd over a small monitor which most of the time was not working properly". The software (the tool) allows the teacher to create activities where the children can actively get involved in the thinking process rather than just listen to the teacher, such as the videos watched which include movement and sound wherein the children could sing along or count. Ms. Lewis points out the benefits of this interactivity: "Children are more attentive because of the visual and hands-on, making it easier for teachers to use and getting the children more concentrated. They get bored less quickly as you have a variety of

activities in a shorter time and so lengthen their attention span. You can change more easily from one activity to the other, keeping their motivation and interest”.

Within the activity system, the tool acts as a mediator between the subject (teacher) and the outcome/goal (the learning). During an activity, the subject was more able to reach her objective through the IWB – the mediating tool – because the children could interact with the items on the board, at times also moving them around accordingly. This physical manipulation of the tool encouraged active participation and hence motivation which fuels discussion: “Their learning is mediated by the ways in which the teacher has constructed the task to be accessed on the board and by the children’s understanding of the affordances of the board” (Warwick & Mercer, 2011).

The tool assists the internal processes of thinking about creating a story by externalizing the process where children physically come to the board and move pictures around according to the progression and sequence of the story/activity. The externalisation then enables an internalisation wherein understanding is happening creating a complete cycle of processes. AT contextualizes the processes by establishing the importance of the mediating tool (the IWB) and other factors such as the teacher (the subject) facilitating the lesson and guiding the children for a holistic activity.

...because it is the constant transformation between external and internal that is the very basis of human cognition and activity...not only do mental representations get placed in someone’s head, but the holistic activity, including motor activity and the use of artefacts, is crucial for internalization. (Kaptelinin, Nardi, & Macaulay, 1999, p.29)

Morf & Weber (2000) describe this externalisation- internalisation process in activity theory as the activity being primary. They explain it as coming before the thinking process, in other words understanding and comprehension happen as a result of doing “activity is primary, that doing precedes thinking, that goals, images, cognitive models, intentions, and abstract notions like ‘definition’ and ‘determinant’ grow out of people doing things” (p. 81). This is what is happening with the young learners who do things via the IWB, which in turn stimulates them to think, comprehend and learn.

The game element embedded in IWB activities offer another source of motivation and the ‘doing’ as just described. The children are kept on edge, curious, excited and promoting active participation, not only individually but also as a group/team. This collective participation is a boost also for the children who are usually shy or reluctant to participate in the classroom. This collective ‘doing’ encourages co-construction of knowledge.

As the activities conducted on the IWB are a whole class activity, individual children get positive reinforcement not only from their teacher but also from their peers, so most try their utmost to get it right. Making a mistake is not such a big issue as they can always try again or have other children help them out – creating a collaborative community of young learners trying to solve problems collectively. Ms. Brown believes this 21st century skill is enabled very effectively through the IWB. The active engagement of children with the subject matter also stimulates student inquiry processes (Hall, 2010), even at this tender age.

On the other hand, it was observed in several instances that the IWB was not being used interactively such as when the children were listening to a simple documentary, song, or video. This could have easily been done using a projector and screen or in the case of a song, a CD player. The children here are passive recipients and the IWB becomes almost like a 'babysitter'. "If IWBs are used...as glorified blackboards, or as occasionally animated passive white boards, then there will be little effect on pupils' learning"(Lewin, Somekh, & Steadman, 2008, p.297). In these observed situations, the children were not attentive and very passive and little, or no learning was happening. There could be several reasons behind this, one of which could be the lack of a school policy about the interactive use of the IWB, leading to teachers not utilising the full potential of such a tool. It could also be the lack of training and support or also a question of beliefs about use of technology in the classroom. The use of technology, as observed in this research, not only motivated and engaged children but also educators. Its functionality entices educators because of the multitude of functions which primarily endorse active participation through a constructivist approach for all learners. "Although the constructivist approach can be effectively implemented without technology, the use of computers appears to encourage many teachers to teach, and their students to learn, in a very different manner" (Snoeyink & Ertmer, 2001, p. 85). This is clearly demonstrated by the ripple effect wherein through the increased engagement of learners, the subject (teacher) is motivated to continue to utilise the potential of the tool as a mediating artefact to accomplish tasks within an activity. Ms. Fox adds that her teaching has

changed and she is willing to work more because of the added value the IWB has on the learning.

preparations are different, children are enjoying the fact that they can participate more, and they have more enthusiasm because they can have their turn to have a go and try things out.....you have to prepare more but things are more manageable . Before I had to write them and file them now they are more organised and I feel more enthusiastic to do them (Ms. Fox).

4.2.1b Theme 2 – Resource in transforming pedagogy

The IWB provides the opportunity for the learning of new digital skills and competencies such as applying the tools used in the Starboard IWB software; changing colours, thickening the pencil, saving etc., as well as social skills – communication, collaboration, discussion, and more interaction with others – in a new and more effective way. Although social interaction is not new to the classroom environment, the IWB provides further opportunities for children to actively participate in the learning process and develop these skills more effectively as observed. It is the source of stimulating discussion and collaboration in a fun way. In figure 4.12 the first top three pictures show children dragging and dropping numbers around. In the first one the girl appears to be doing the activity alone, but she is getting suggestions from her peers whilst trying it out herself. In the following pictures the children help each other suggesting and guiding others to get a correct answer. This is the environment which stimulates creative thinking and problem solving – 21st century skills. The teacher's role here is more of a facilitator as she is seen to stand back and only guide when necessary – this is a change in the delivery

of such a lesson. The children take the front seat in their own learning, and the tool makes this happen.



Figure 4.12. Children working together

The technology, as the tool, is the vehicle which is effectively engaging students in the activity set out by the subject to achieve the desired outcomes and object of the activity. In view of this change in the classroom tools, the teacher is thus modifying classroom practice to make use of the potential of such a tool. The subject is transforming the activity system by incorporating the new tool. In the case of Ms. Bell she is now creating resources using the IWB software which she is customising for her specific class. As can be seen in Figure 4.13 Ms. Bell created a series of activities in Maltese asking the children about identifying specific letters in Maltese.

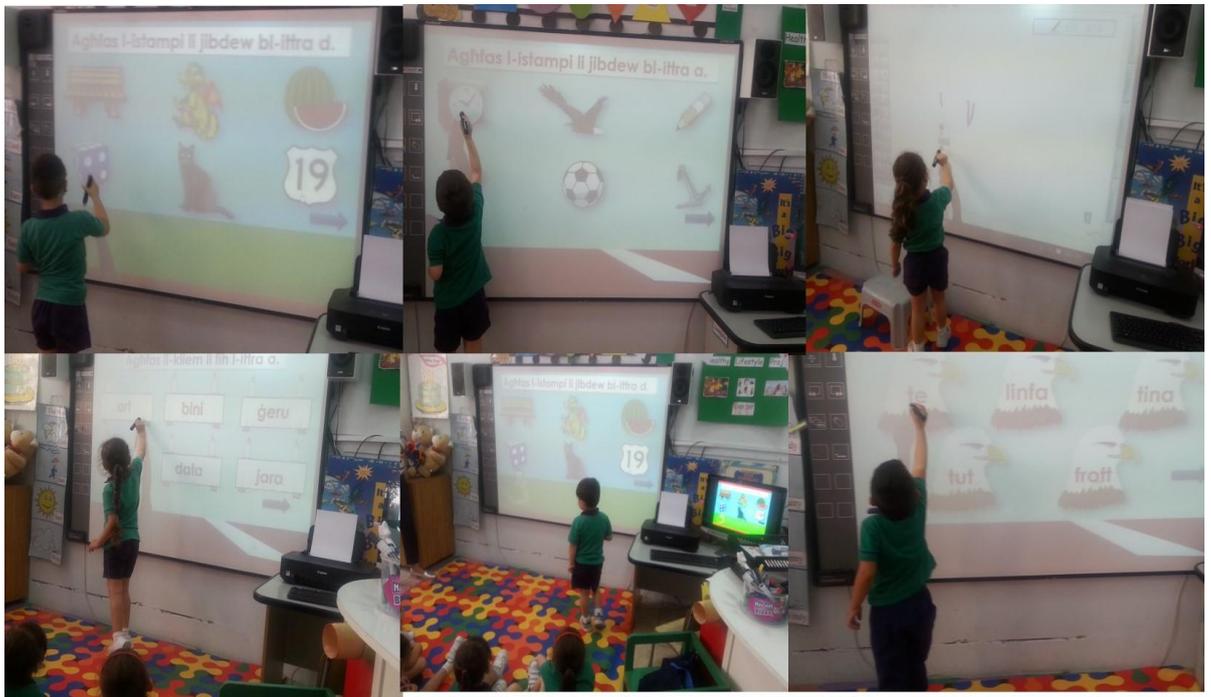


Figure 4.13. Various activities created by the KGE

The subject is not only benefitting from use of the tool as it is to achieve learning outcomes, but manipulating the tool accordingly to create specific resources. In the hierarchical structure of activity, as described by Leont'ev (1974), there is a purposeful human interaction between the subject and the world (nodes within the activity system) for a mutual transformation to be accomplished. The use of the IWB (activity) is at the top level of this hierarchical structure with the intention of achieving the object/motive (learning outcome of the lesson). To fulfil this motive Ms. Bell carried out an action/goal (the creation of specific resources in Maltese) which is moving down in the hierarchy. Again further down are the tasks/operations, which are automatic processes such as the use of dragging and dropping, changing

colours/thickness of the pencil tool etc. “Actions transform into operations when they become routinized and unconscious with practice” (Kaptelinin et al., 1999, p. 29). Development of practices brings about changes and this is observed when the children are participating in the activities. Figure 4.14 depicts the hierarchical structure wherein participating in an activity involves the performing of actions with identified goals and tasks or operations.

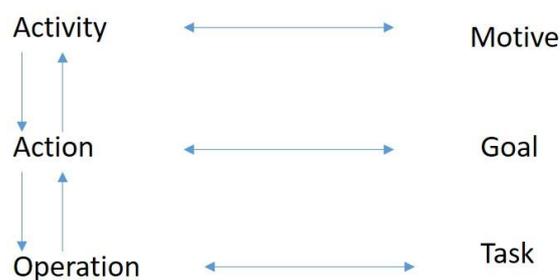


Figure 4.14. The hierarchical structure within an activity system

In a few of the observations, the change is not only an enhancement of pedagogy but also more of a transformation in the way these teachers now teach. For some of the teachers the enhancement of activities is only a substitution, in other words doing the same activity only in a different way. Yet Ms. Brown and Ms. Martin have been observed to have moved to the level of augmentation as described in the SAMR model.

For teachers who were using the IWB superficially it was evident that no actual transformation was occurring; the tool was being used as a glorified projector, and as a result the children were not so engaged and often distracted or very passive. They were not providing stimulating activities to motivate and create discussions or critical thinking with the tool at hand. Activities were rather repetitive, requiring little thought, and the teacher was not creating an environment that encouraged enquiry. This lack of aroused

thinking created passive learners who, although posing little or no behaviour problems in class, were not learning new skills. This tension in the activity system implies that introducing the technology does not automatically bring about change or improvement in pedagogy. I argue here that the subject has first to believe in the value of the technology being used and how it relates to the practice and their teaching. "The teachers as subjects are particularly influential in transforming the Activity System of their teaching through the beliefs and biases they hold about the value of technology" (Verenikina et al., 2010, p. 2612).

Encouraging discussion amongst children in the kindergarten classroom is not a widespread practice but in some classes, it was surprisingly evident that the children were used to interacting with each other, such that this activity was becoming part of their daily activities. The teacher here was developing a sense of collaboration and teamwork because she has decided to take the risk to change. This change in pedagogy greatly depends on teacher beliefs, which is whether they are reluctant, dubious or believe in the potential of the use of technology in this particular age group. Hence the actions of the subject in the activity system are key in how the resource or tool is manipulated to extract the full benefit and reach the desired outcomes.

The change in pedagogy is also a direct influence of the school culture. Policy planning, support from peers, and school leaders have a great influence on the use of technology. Ms Brown and Ms. Jones, both from the same school, have a great amount of support from the head of school and this plays a very important role in the effective use of technology and subsequently change in practices.

The IWB in kindergarten could be seen as the perfect tool for pre-writing skills as children can explore, experiment in a playful, less formal environment – building confidence as they use the pen (its thickness sets the ability to grip pencils and pens later on) on a large scale rather than start off on a small copybook or paper. Subsequently the tool is key in the development of skills which as a result leads to the objective and targeted outcome.

Some time back when teachers in kindergarten only had one desktop computer and a normal small monitor to display such activities, the internet connection was also a problem. It was so slow to upload activities that the children easily got distracted and lost interest. As a resource the computer was thus not so helpful. On the contrary in this activity system the tension created did not lead to development but was counter-effective.

Today the infrastructure has improved, and internet is faster, thus there is less waiting time. Some KGEs I came across had initially resolved the internet problem by downloading any videos prior to lessons to run them offline. Today the big screen of an IWB helps keep the children attentive and when reading books, the teacher can now easily find an e-book or create a presentation and thus all the class can see the pictures, colours, and animations, making a book come alive like a movie in a theatre.

Fullan (2013) asserts that in essence, learning follows purposeful engagement. “The potential integration of technology, pedagogy and change knowledge can be designed to create learning experiences that operate to produce high, natural yields in what is learned.” (p.17) The active participation, engagement and persistent attentiveness of a child, comes about through the

mediating tool (IWB), which stimulates, leads to the object/outcome (learning) facilitated by the teacher (subject).

Another important point which has been repeated is the new possibility of preparing lessons at home because KGEs have been supplied with laptops which have the IWB software installed. This is another factor in bringing about change in how lessons are planned. The IWB software is not only another tool but is having an influence on the way teachers plan their lessons, as it is transforming pedagogy. Interactivity and active participation by the children means deeper learning, as they are involved in their own learning – they are not passive learners. Thus KGEs need to understand “that children are active constructors of knowledge and that development and learning are the result of interactive processes” (Rosen & Jaruszewicz, 2009, p. 165).

Scaffolded learning is being made more possible through the technology while enhancing the process through sound, images and interactivity. Most of the teachers remarked about this possibility wherein they can go back to work done previously – teachers can save children’s work and move on from where they left off. With a normal whiteboard any work done the previous day had to be rubbed off to allow room for current work. Teachers are re-thinking their activity because of the tool which is supporting their pedagogy more effectively.

In kindergarten it is essential to have scaffolded learning wherein we go back to what we did before, revise it and start off from there. The IWB allows this unlike traditional boards where you have to rub off all the work done in previous days (Ms. Wood).

Ms. Fox has found that there is more focus on the actual learning. Without the technology teachers had to spend hours creating a tool to carry out an activity, wherein the IWB has the activities incorporated in the software and teachers simply apply them to activities customised for specific learning needs.

The IWB is in most cases the central focus, that is the fulcrum regulating and initiating the rest of the class activities, whether they include technology or not. Thus, it plays a very crucial part in the activity scenario especially with teachers who can use it effectively. Ms. Taylor clearly stated this when interviewed, demonstrating how it has changed the dynamics of classroom activity and effected her pedagogy.

4.2.1c Theme 3 – Classroom Management/ Orchestration

Ms. Brown and Ms. Smith both insisted that through the IWB they had more class control as the children were more focused on it rather than distracted by other things. As Ms. Smith indicates, the children promptly go to designated seating spaces to use the IWB because they are eager to follow such activities, a rule in the activity theory dynamic. This synergy between all nodes in AT – the community (the children), the tool, the rules, and the teacher – enhances classroom management (Kervin et al., 2013). Ms. Bell stated that “classroom management is better as now we have a lot of things to do with the children through this means. Before we used to show them only videos but now we have much more educational, interactive resources which can be done with the children than them just watching a video”.

Classroom management is also enhanced when it comes to children with special needs as they are feeling stimulated, motivated, and can contribute and participate in their own particular way. As a result, behavioural problems,

which are so common, particularly with these children because they feel they cannot cope with the rest of the class, are minimised. The IWB is giving them access to different levels and needs of learning. Children with special needs in Maltese classrooms are assigned a Learning Support Educator (LSE). This educator has the specific role of supporting children with special needs on an individual basis. Unfortunately, the reality in many classes is such that the LSEs available are not enough to cater for all such children, and as a result the class teachers or KGEs have to support these children as well. In such cases classroom management becomes a major issue and using technology does not help if the teacher has to cater for all needs at the same time on her own. I observed that when a classroom with a child with special needs has no LSE to support the child, it becomes impossible, in some cases, to use the technology. A particular autistic child demanded use of the IWB at all costs all the time as he pleased, disrupting the classroom with behaviour problems. The child was uncontrollable, and the teacher frustrated at having to abandon using the IWB for that time. These particular challenges show the reality of the classroom, which although not the norm, do happen. Upon reflection, such tensions within the activity system hinder and disrupt the learning. Although such contradictions may result in a development of classroom management and the teacher may find alternative means to develop the tension into an opportunity most of the times this is not the case. In such a situation the level of contradiction is both a primary and secondary contradiction as it is primarily happening within the same node, within the community wherein the rest of the children cannot continue with their learning. It is also occurring between the nodes of the activity system, between the community wherein the child with

special needs pertains to and the subject because the teacher cannot use the tool to reach an objective. Therefore the learning is 'disabled'. Such tensions cannot lead to change and development because the teacher here has no control in providing an LSE for the child.

Nonetheless in other classes where the KGEs do have LSEs Ms. Brown had this to say about her class control: "My classroom is more manageable and there has been a difference. Because I repeat the activity, they know what to expect and thus their behaviour is much more controllable, and their attention span/concentration is longer. This happens because they see enjoyable things and because they know they will have the chance to try out things themselves – hands-on". The tool is seen to have a cascading effect on all activities going on in the classroom.

Ms. Martin pointed to a strategy wherein the technology assists and supports her management of the classroom in ways that could not be done prior to the introduction of the IWB.

While the children were listening to the story on the IWB I was preparing the next activity for letter recognition - it helps a lot because in that 5mins the children are singing or listening to something while I can quickly get ready the activity as a follow up.

Ms. Martin continued to comment that the IWB was key in classroom management also because her children were not always listening to her voice in the reading of stories something which they easily get used to. Thus they were more attentive through listening to someone else read the story and also more manageable in keeping class control.

The activity is orchestrated by having the children interact with the resource, mediating artefact (IWB) through the teachers' guidance to achieve the outcomes (learning) set by the subject (teacher). This triangulation, within the activity system, enables more classroom management because the children are engaged in the learning and the teacher as the key element can mould and shape activities accordingly.

4.2.1d Theme 4 – Cross-curricular

Most teachers use the IWB for varied subjects and topics. It enables them, for example, to integrate songs with mathematics and language or reading with science and mathematics. Being such a versatile resource, it aids the educator into rapidly bringing in multimedia with writing, reading, and listening. The teachers find that the VLE and the IWB work very well together in that they can plan a whole topic and have the links, resources and activities all gathered in their VLE. During the lesson the teacher simply clicks on the part to be covered and the children follow. The pictures in figure 4.15 show the cross-curricular activities associated with a particular topic (The Three Billy Goats Gruff) and how the IWB enables the teacher to move from one activity to the next, from one resource to the next, with the click of a button instead of having a number of resources in a folder not clearly marked. As parents have access to this platform they can follow what their children are doing at school by being updated on their children's activities and learning. Here the parents are an extension of the community within the activity system contributing towards supporting the holistic education of the child. Consequently the tool and the resources associated with it have widened the classroom community.

It-tlett mogħziet

The Three Billy goats Gruff

moral of story : Don't be greedy

Mathematical concept learnt through storytelling

This week the children are going to revise the following mathematical concepts:

small medium large : using sizes of goats

on under : the troll will be on and under the bridge

recognition of numbers 1 2 3, writing skills and values : there are 3 billy goats in story



[Click here to see photo story PhotoStory2.wmv](#) [PhotoStory1.wmv](#) [PhotoStory3.wmv](#)



Today 11th January the children were taught how to make a photo story. Please appreciate that the work is the children's own and so at times, the words are not always clear....but I am so proud of my young storytellers ☺.

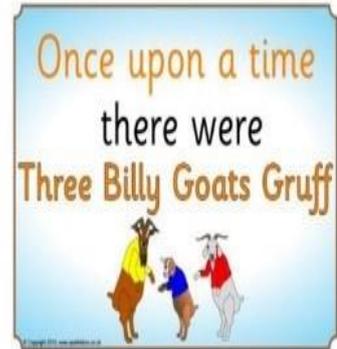


Norway and its folklore



The troll plays a significant part in Norwegian and Scandinavian folklore. The troll is an ugly, messy, nasty creature that lives in caves or forests and will turn to stone if sunlight hits them. There are even a few areas in Norway that have been named after the troll.

Billy goat gruff story visual aids



This year one of our aims in class is to help children develop thinking skills ...this will help them reason things out and become creative individuals. After the story, I asked the children 'What happened to the troll?' gave them 1 minute to think and here were their answers ...



Trolls in Norway



Video of story



Billy Goat Gruff story



About goats



After thinking constantly about the Billy Goat gruff story and how to present it to the kids, I happened to meet Ms. Gillian Zammit's goat :)

Click here to see video 20170104_162539.mp4



Another famous bridge -London Bridge



Look at these bridges !



Figure 4.15. Cross-curricular activities

The cross-curricular activities – mathematics, crafts, online songs, videos, games, stories, and information – are all evidently shown within the VLE tool prepared by the teacher who then uses the IWB to work out in class.

Ms. Brown manages to integrate various areas into an activity using the IWB because it allows for teamwork: “The objective is building a story in teamwork with so many different ideas. During the activity it is not just a story that is involved but integrated are mathematics, science as well as personal and social development. The Easter bunnies, for example, are helping each other; maths comes in the counting of the eggs as well as literacy and oracy – cross curricular activities”. Affordances of the tool (IWB) allow for the integration of a thematic approach which covers diverse areas and skills.

4.2.1e Theme 5 – Inclusion

Some teachers have alluded to the use of the IWB as a major role in learning especially with children of special needs. Ms. Smith gave an example of how the IWB stimulated special needs children in pre-writing skills. The informality associated with the IWB gave confidence to the children who could actually make mistakes. Mistakes were easily erased, and it resembled a game with the options of changing colours, patterns, changing thickness, and being creative, something they cannot do with paper. "...This fascinated them as they were seeing their own work alongside the rest of the class, as it made them feel important and played a major part in their writing confidence. Today they have moved on and are doing well in Year 3". Although at kindergarten level children write with pencils so they can easily erase mistakes, there still is this an underlying *known* (culture) that this writing on paper is still seen as a formality and children feel it is imperative to get it right. This element can be seen as a rule (invisible but clearly felt) in the activity system. The element of fear takes away the confidence to write on paper but when the children (not only special needs children) are introduced to writing in this manner, the IWB helps them build up their self-assurance to later on use paper and pencil more confidently. Ms. Jones commented that "for children with special needs the IWB keeps them more engaged than traditional methods. They are able to keep more concentrated because it is more attractive".

As indicated earlier on, classroom management becomes easier when children are engaged in activities tailor-made for their needs. Ms. Martin made a clear observation that this allows for differentiated learning "it helps because

I can give her a different activity or more time on the board because I know for her this makes a difference more than the other children”.

As observed this is not always the case and when LSEs are not present to support a child with special needs the class teacher has to cater for all levels on her own. In such contexts, it is almost impossible to do this. In this situation, I have observed teachers focusing on the needs of the rest of the class who they need to address, resulting in activities which are either too easy or too difficult for the special needs child. Behaviour then becomes an issue. This is the real-life situation which most KGEs are encountering and which deter the use of any technology, as the presence of children with special needs is on the rise.

4.2.1f Theme 6 – Hinder/obstruct learning

At times the IWB posed challenges and difficulties, which resulted in the opposite to being a benefit in teaching and learning. There were instances when the technology did not work properly for several reasons: poor infrastructure, a slow internet connection, projector lamp starting to dim after a number of working hours, making the board difficult to see clearly. When these problems arise the children easily become distracted, do not pay attention and, as a result, the teacher loses control of the classroom with behaviour issues from some of the children. It is important to note here that this is more likely to happen in these kindergarten classes because the children are so young and their attention span is much shorter. It would be easier to explain to older students what is going on, such as *the video is still loading due to a slow internet connection*, but this cannot be explained to a 3-year-old.

As already indicated during the observations in Ms. Brown's classroom, using the IWB when a particular severely autistic child was present would mean chaos in the classroom, as the child would only want to use the board himself and get into a tantrum if any other child tried to get even near it. Naturally, this happened because the child had no LSE and the teacher had to manage all the class on her own.

Technology has its risk factors as well because the children could lose interest, but this is something some of the teachers have learned to cope with and devise strategies to deal with such challenges. Ms. Webb saves any YouTube videos which are essential to the lesson and can at any time play them offline when needed without having to wait for the media to load or having it stop in the middle and disappointing the eager children. This is a clear example of tension created in the activity because of the tool, which tension is acted upon and resolved, as discussed further on.

4.2.2 What role does the teacher play in this dynamic system when integrating the IWB in the classroom?

4.2.2a Theme 1 – Teacher as a crucial element

Much depends on the teacher's own initiative and how far they are willing to explore the potential of technology. For the transformation of methods in pedagogy, the teacher's beliefs come into play and how much she/he believes in technology for transforming learning. This can be demonstrated in the case of Ms. Brown who allows much room for discussion and allows the children to fully participate in their own learning unlike some of the other teachers who are reluctant to allow children at this age to take control of the lesson.

Ms. Brown, Ms. Webb, and Ms. Lewis are ready to shift roles from being at the forefront leading the lesson to taking a back seat, facilitating, and guiding the children in their active participation. This set-up of teacher as facilitator enables the children to construct understanding as they think out solutions to the activity. (Hall, 2010) This constructivist learning is the process of figuring out the best way to solve a task collectively and having the teachers “serve as facilitators in the learning process, answering questions along the way and providing just-in-time learning” (Ertmer et al., 2012). I note here that the children part-take in the division of labour because at times we have the children suggesting or correcting their peers without the teacher interfering but acting only as a facilitator. In the activity system this division of labour occurs as there is a potential shift from the teacher teaching the children to children becoming *teachers* to their peers. On the other hand passive learning where the teacher *knows it all* is not learning.

Although technology plays a crucial part, the teacher is the pivot in orchestrating the activity, as could be seen in the way Ms. Lewis managed so many different activities, keeping class control and managing the technology, in other words multi-tasking in such a way as to create a meaningful experience and in the process initiating change (Fullan, 2013).

On the contrary Ms. Wood, who does not use the full potential of the IWB but merely as a projector, could easily have done all her activities using a normal whiteboard and a projector to show any videos. Although Ms. Wood believes the IWB is more motivating – “of course its more adventurous more flexible” – yet her use is very limited and is only substituting one tool for another rather

than using this tool with which she can do activities which cannot be done without technology.

In this dynamic system it is crucial to use the tool when the children are the most receptive, and thus seize the opportunity for it to have any pedagogical value. The teacher thus is crucial in perceiving when the opportunity arises and to meticulously integrate the tool in teaching and learning. Naturally, for this to happen the teacher has to be experienced, flexible and sensitive to the classroom needs and equally competent in using the interactive features to use the tool effectively employing its full functionality. In other words, in the activity system dynamics, the teacher as the subject plays a very important part in moulding the activity to achieve set goals. Yet it is also crucial that the teacher has the skills and knowledge to use the interactivity of the board, if not, the tool will not be serving its main function.

4.2.3 What are the tensions and contradictions encountered, if any, when using technology? How are they resolved, developed?

4.2.3a Lack of training, support

“AT is a unique theoretical framework that allows the conceptualization of teacher concerns in a systematic way, enabling the study of contradictions and tensions in connection to ICT-based innovation”(Karasavvidis, 2009, p. 438). Most of the teachers interviewed showed the need for more one-to-one support and training such as professional development sessions on the use of the IWB as they recognize the potential of this resource in the classroom. There is “the need for long-term, continuous, professional development experiences for teachers in their schools, which should be dynamic and adaptive to differentials in teachers’ needs, skills, views, and commitments to

learning and to experience innovative classroom practices” (Levin & Wadmany, 2008 p. 259).

When this training is lacking the tool is then not used for its interactivity but mostly for projection on a large display. This factor at times renders it as just a big display monitor rather than a tool which fosters 21st century skills such as collaboration and critical thinking. I must remark though that this was not the rule in all observations conducted. In activity theory it is often prominent that the lack of something essential or of a major challenge triggers the contradiction or tension to become an opportunity for development. In the case of some of the teachers who acknowledged the lack of training and support, they were driven, as this provided the incentive, to self-learn. Ms. Martin, Ms. Brown and Ms. Webb who experienced lack of training, turned it into an opportunity to seek out online resources and courses to help develop their use of the IWB as an interactive tool. This initiative was so successful that they now also support their colleagues on a voluntary basis by giving tips and demonstrating best use of this technology in the kindergarten classroom. It has been manifested several times that contradictions or challenges are the main drivers of change and transformation.

In this study it was also evident that although teachers believe they are using the IWB in the best possible way, most have still barely touched upon the potential of such a tool. This may be due to the lack of training and support, an issue which keeps surfacing, and also due to the socio-cultural climate in the school and the school community beliefs. Some teachers are resistant to change and may influence the rest of their colleagues who might be more innovative. Within the activity theory dynamic this socio-cultural contradiction

arises between colleagues creating tensions. Yet for those teachers who recognise this tension and act upon it can bring about organisational change and development or in other words expansive learning.

In expansive learning, learners learn something that is not yet there. In other words, the learners construct a new object and concept for their collective activity, and implement this new object and concept in practice (Engeström & Sannino, 2010, p. 2).

Tensions and challenges in using the tool may arise due to the embedded beliefs of teachers, who do not acknowledge its potential or are not eager to change their current practices. "...Teachers do not enthusiastically embrace technology because it is not compatible with their current practices and when they do they use it to sustain these practices rather than reform them" (Karasavvidis, 2009, p. 437).

4.2.3b Whole School Approach

The influence of a whole school approach indicates the importance of school leaders (heads and assistant heads of school) in the enforcement and monitoring of use of technology. This is a very crucial factor and its absence/lack is hindering the change in pedagogy and subsequently the way in which children learn from various teaching methods. One teacher may be using innovative methods such as allowing children to take active roles in using technology in their learning, allowing room for discussions, collaboration to take place, and for the children to create and be critical. Yet in subsequent years, when the children move on to other classes, other teachers may be using very traditional methods such as simply using the IWB as a glorified whiteboard with no real interactivity. Thus, there is no continuation or

development of the skills and competencies developed. To provide an actual example from the observations conducted; the skills and competencies which children achieve in Ms. Brown's class, are not reinforced by teachers such as Ms Wood who does not allow for much interactivity.

This demonstrates that the "implementation of structural changes do not on their own lead to fundamental change; innovation depends on transformational learning which results from the inevitable contradictions which arise through attempts to change deeply embedded educational systems"(Solomon & Lewin, 2016, p. 236). In other words, implying that although a few innovative teachers may be using the full potential of an IWB the whole school system has to be working together for a truly effective outcome in teaching and learning. Engeström & Sannino (2010) argue that contradictions are necessary for expansive learning yet not sufficient. In this case it is a tension which arises between activity systems "quaternary contradictions between the newly reorganized activity and its neighbouring activity systems" (p. 7).

In Literacy and Numeracy teachers do follow a prescribed curriculum or set of learning outcomes for each particular year group. Yet in the area of Digital Literacy in Malta, there does not exist any pre-defined curriculum specific with learning outcomes. This is so because the existing learning outcomes are rather sporadic and diffused in other learning outcomes due to the nature of it being a cross-curricular area. Hence, this may be one of the reasons it is up to teachers to decide whether or not, how and when they are to teach and provide engaging opportunities for such skills and competencies.

4.2.3c Lack of time, sharing, and reflection of practices.

The sharing of self-reflective self-critical process, as well as sharing of good practice with other colleagues, is extremely lacking in most schools. The culture amongst most Maltese teachers is to keep resources and ideas to oneself and any attempt to go against this norm is very difficult, as Ms. Fox notes “not everyone likes to share their lessons and that would help”. School leaders do encourage such communities of practice, but it is very challenging to have teachers share their experiences/ideas amongst their colleagues and bring about such a culture change. Ms. Lewis specifically commented about how beneficial it was to her to have reflected upon her use of the IWB because of the questions I posed for her during the research observations and our discussions. She stated that she was realising the importance of reflecting on her methods and how the children were responding because it helped in assessing her own practice. Thus, her lessons were being planned in accordance with the outcomes and impact on the children. If an activity was not so effective, she reflected on how to change or modify it. Ms. Lewis stated that she could see a transformation in her own pedagogy as a result of this reflection. Subsequently she established the importance of reflecting about learning outcomes and if they were achieved or not and why. This would encourage more use of technology for active participation and thus learning. Noormohammadi (2014), states that “reflection increases job satisfaction and would help teachers to foster their autonomy and independence also have confidence to participate in determining the school and/or institutes’ policy” (p. 1388).

One of the major tensions indicated by several teachers is that the preparation is time consuming. “Sometimes you forget how to use a certain tool or take a

lot of time to find an appropriate online game or song”, yet at the same time they conclude that “it is still worth the time as children learn more and although traditional lessons are easier to prepare they are not as effective”. This is an example of how contradictions can bring about transformation in teaching practices. Seen through the analytical lens of activity theory tensions may thus result in change in practice and not become barriers.

4.2.3d Skills in using the software.

Children are expected to master the basic skills in using the software such as drag and drop, changing the pen tool colour and size amongst other things. As a consequence, this created tensions when a child was unable to master such skills. The KGEs most frequently assisted the child into instructing them how to go about changing the colour of the pen tool, for example, or would allow others to assist their friends, creating a sense of support and collaboration. In the activity theory structure, we can say that this tension is one of the hidden rules. An interesting observation is that when children realise they have finally mastered a skill which they could not get right (something which they feared), they achieve a great sense of satisfaction and become more motivated to learn and also to help their peers. Here the tension has transformed into development of basic skills as well as the drive to continue learning and assisting their peers. This has been observed across all lessons.

The most common challenge observed here was with teachers who felt they themselves needed upskilling in using the software. As a consequence, they did not use certain features of the tool but were ready to learn when the opportunity arose. “Teachers occasionally lose confidence in use of the

technology. However, they show evidence of searching for new approaches and opportunities to learn from other teachers” (Sweeney, 2013, p.222)

4.3 Summary of key findings

AT has played an important role in this research, throwing light on the interaction between students, teachers and reality in a specific authentic context. It has assisted in analysing this space more closely in correlation with a phenomenological approach, which explores how individuals construct subjective meaning, rather than taking an objective standpoint with the analysis coming from the expert researcher only. AT has supported the analysis of the various relationships between object, subject, and tool for a more dynamic and true picture of the reality experienced where innovation and technology uptake depend on the context which is crucial.

4.3.1 The main themes:

4.3.1a Enjoyment/engagement

IWB use can be seen to bring about engagement in learning evidenced through the children’s excitement, attention, motivation, body gestures – smiles, less behaviour problems and a more controllable classroom. This was not only observed but also indicated by teachers such as Ms. Brown:

“Children love to use digital tools. It means having fun and if they are enjoying it then it means that they will memorise and learn the concept more easily.

That’s why technology has changed my teaching practices”. In a study carried out by Li, it was found that students believe learning becomes fun. “It’s a different way of learning that’s usually fun for everyone...Others indicated, [Technology] is hands on and it is interesting to me. I can learn more if I learn it that way” (Li, 2007, p. 387). Ms. Fox demonstrated how the introductory

song synchronised with movement brought about delight; this gave a good starting point to the rest of the lesson.

The IWB has proved highly beneficial at this age for pre-writing skills, multi-sensory opportunities, and collaboration – most teachers mentioned these as factors for engagement.

4.3.1b Socio-historical cultural influence

The school culture plays a very important role. Teachers resisted changing their pedagogy because their school culture does not reinforce and support this transformation as needed. There is no culture of sharing of good practice, role models to look up to or support from school leaders. Most of the teachers are not eager to explore new methodologies unless instructed or enforced to do so. These factors have had a negative effect on the uptake of the IWB as a tool to transform teaching methods. For the few who have transformed their teaching practices, there is little support and encouragement from colleagues. Teachers who have nurtured competencies and skills supported and enhanced by the IWB such as collaboration, active participation, and critical thinking, do not have them continued in the following year in the other classes. This lack of continuation demotivates the few educators who try to be innovative and creative in their teaching. There is no or very few opportunities for professional development as regards the integration of this particular technology in the classroom for KGEs. The teachers whose use of the IWB brought about a change in their pedagogy lamented of the lack of sharing of good practice, reflection, and long-term planning. Here a CoP would have been an ideal setting to foster the good practice and support KGEs finding difficulties by sharing ideas and resources.

The school context is thus a driving force which inhibits or encourages interactive use.

4.3.1c Tech Integration vs tech-enabled learning

Findings show there are teachers who adopt a technological integration while others adopt a more pedagogical integration. Although not the majority, this research shows how teachers have successfully used technology to enable and support meaningful learning.

4.3.1d Beliefs

In general it is teachers' beliefs about how children learn that determines the actual integration and uptake of technology – “teachers with the most student-centred beliefs were also the ones implementing the most innovative and authentic classroom practices” (Ertmer & Ottenbreit-Leftwich, 2013, p. 178). This has clearly been reflected in the observations and in how certain teachers go about their planning and teaching methods.

4.3.1e Change in pedagogy

Teachers are planning their lessons in a more holistic manner, giving more attention to 21st century skills such as critical thinking and collaboration because of their use of the IWB. Teachers are focusing more on interactivity, getting the pupils engaged. They are being challenged into changing their methods of teaching to encourage active participation, active learning.

Change in teaching has been possible, as some commented, because owning a personal laptop (given by the Ministry) made it possible to prepare lessons from home. The technology is also allowing teachers to go back to previous lessons and thus scaffold learning.

Yet some teachers still use the board to project videos and presentations without any interactive factor – using technology for the sake of using it – just because it happens to be in their classroom environment. These showed no change in pedagogy but rather substituted a traditional tool for a more convenient one.

4.3.1f Special Needs

Special needs children seem to benefit from the IWB only when the child is assisted by an LSE. The IWB allowed more confidence in learning, engagement and working with others. The absence of LSEs in the class presented the most challenges, which demotivate the teacher from using the interactive features as well as making it impossible to keep class control.

4.3.1g IWB as Initiator

The IWB was observed to have set in motion the need to reflect on practice, to share practice and also to learn or self-learn (when support was not available) to enhance their pedagogy. In other cases when not used interactively, it had very little effect as the children were passive and participation was minimal.

4.3.1h The teacher as key in change

The teacher is the most important element in this activity system as she brings together the learners and tools to achieve specific goals. It depends on how the teacher decides to use the IWB that determines whether there is a simple enhancement in activity or a transformation.

The teacher, as the fulcrum, brings together the tools and learning experiences such that the affordances of tools available are used to their best

potential accordingly and tailor made for the specific needs of each class and child.

Teachers play key roles in shaping practice, which depends upon internal factors such as beliefs, passion for technology, problem-solving mentality and sharing practice.

4.3.1i Tensions / Contradictions

The lack of support, training, professional development, whole school approach including the school culture and lack of LSEs where needed were predominantly the main challenges.

4.4 Chapter summary

This chapter has presented all the findings collected through the observations and interviews of each individual classroom and KGE. These were then analysed and discussed using the activity theory framework. Finally the chapter highlights the main themes and key findings which emerge from these results setting the scene for a thorough and more detailed discussion.

Chapter 5 Discussion

The previous chapter presented all the findings with detailed accounts of the class observations and interviews. This chapter will discuss those findings in relation to the literature and research questions which guided this study. Although the main research questions are discussed in turn, they will invariably overlap in theme and subject.

5.1 Purpose of research

This research investigated KGEs' perceptions and their use of the IWB in the classroom, as a tool, in supporting/challenging their pedagogical practices, and in achieving their objectives. The teacher as key in bringing about change or contrastingly for various reasons, not bringing about any change, was analysed through the lens of AT which captures the essence of activity. This was conducted through observations of lessons and interviews with the KGEs as well as through informal discussions outside the classroom.

In chapter two I alluded to the proposed framework of Price & Oliver (2007) to study technology impact more closely. This research has demonstrated execution of the framework to eliminate the inflated rhetoric surrounding technology integration, especially by policy makers and politicians, and evidence the actual reality of ongoing processes and practices by the practitioners. This has divulged the limitations as well as the potential of the IWB. Such an understanding of what we can achieve with technology and how this can be supported has provided a more dynamic and realistic picture of its application and integration (p. 24).

Following are the research questions which are discussed separately.

5.1.1 How does the IWB, as the mediating tool within the activity system, hinder, enhance, or transform pedagogy, from the teachers' perspective?

The IWB was perceived by most of the observed KGEs as an effective tool, because it motivates and engages the children capturing their attention through its interactivity, multimodal, and multisensory functionality. The children become active participants in their learning by engaging physically with the activity presented. They co-construct meaning by writing, dragging, colouring, working in teams, and collaborating with their peers and with their teacher. This indicates that teachers do realise its potential but “lack a clear vision as to its real purpose and usefulness in shaping the educational system” (Ertmer & Ottenbreit-Leftwich, 2013, p. 175). This was evident by those KGEs who assumed they were making best use of the technology and yet I could observe very limited interaction and participation. This was a common observation I made wherein KGEs believe they are using the technology appropriately and with its full functions, yet in actual fact are just using it as a glorified whiteboard for videos and static presentations. Some of them did involve the children working on the board but these were drill and practice exercises which involved no critical thinking or collaborative work and could have easily been done on a normal whiteboard. I argue that from what I have observed, resistance to using the technology available or using it only on a substitution level as portrayed in the SAMR model defined in the literature review indicates that teachers may be uncertain of the uses of technology and thus become anxious and fear taking risks. Howard (2013) contends that

the uncertainties around technology, teaching and change are not likely to be resolved in the near future. In fact, it is certain that teaching and technology

will continue to change, thus uncertainty will only increase; and, with change, risk will always be present (p. 370).

Teachers could be supported by helping them understand better the technology and its implications in education. It would be important also to address what is perceived to be at risk and what is in actual fact being risked. "Only with this understanding can teachers be helped to make clear decisions about technology and teaching, rather than resisting change with the heat of emotion" (p. 370).

Referring back to the second chapter I mention Fullan and his concept of the stratosphere (2013), made up of the connecting elements of technology, pedagogy and change knowledge. These three forces need to work together to bring about change. KGEs must have a clear picture and understanding of why they are using the technology and why they need to change the way they teach. Only such an understanding can lead to an effective transformation rather than a superficial substitution.

This anomaly clearly portrays the need for shared practice as it effects the whole school system. Such practice would give teachers more confidence, encouragement and empower them to take risks. It would create an awareness as to the use of the IWB and of the features of the IWB software and how they could go about creating activities which could easily be interactive and most importantly, integrated in their lesson plans. Learning from their colleagues is an important factor as I have noted that teachers are more open to learning from another colleague who is in their own situation and shares the same context rather than from an external educator who does not share the same trust.

As a participant observer, I have also at times contributed to the lesson by putting on another hat other than that of the researcher in the classroom and taken up my role as an eLST during the observations. I would demonstrate a particular feature on the IWB which would have complimented the activity in the lesson or assisted the teacher with any difficulty arising at the moment. The KGEs appreciated this intervention, as most of them are unaware of certain applications and capabilities of the software and how they can be put into practice in a particular activity. I found they are very willing to learn more and make best use of a tool which is so readily available in their classroom and which has so much potential. Obviously, this clearly points to the lack of professional development, training opportunities, and, again, the shared practice which the school needs to address for the development of pedagogical practices. This is evidenced and discussed by authors mentioned in chapter two such as Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Kopcha, 2012; Lewin et al., 2008; Pajares, 1992; Richardson, 1998.

A whole school policy and approach towards technology needs to be adapted by the school leaders specifically in the use of the IWB. The current study clearly shows how such lack of support affects the way individual teachers view and use this technology. The IWB is used in contrasting ways by the KGEs, either superficially as a mere substitute or interactively by involving the children through active participation. For the latter to happen there must be a supportive school environment in place, focusing on meaningful integration of technology (Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017), and on creating opportunities for professional development. In the findings it was evident that this is needed in most schools. Some KGEs were reluctant to teach skills and competences to the children because they knew that other teachers cannot provide a continuation and development of such

competences, rendering their efforts futile. The reasons being that either the other teachers lacked the necessary support and training or do not believe in the importance of such skills and competences; and thus again addressing the need to have a whole-school policy in place. This policy could be developed by the whole staff during the school development programme meetings. Shared leadership, as discussed in Chapter 2 reinforces the bottom-up approach, encouraging reflection as well as providing a common framework for all teachers to follow with progressive skills and competencies to be achieved. This result is also established in the study conducted by Cranmer & Lewin (2017), wherein whole school support was seen to bring about change and innovation.

This study has also delineated the practice wherein KGEs are adopting different types of integration. This again is happening because there is no structure or policy provided by the administration and thus each KGE decides how they make use of the technology. There are teachers who simply use the IWB because it happens to be in the classroom and thus use the technology for its own sake where learners are rather passive, while others have understood the potential of such a tool to enable learning. Here again when looking at the SAMR model we have teachers who remain at the enhancement level or others who achieve the transformation level. As a consequence the pedagogy of the latter has changed to be able to “achieve meaningful learning outcomes” (Ertmer & Ottenbreit-Leftwich, 2013, p. 175). These authors have also identified, in accordance with the current study, how educators today still do not entirely use technology as a means for authentic student-enabled learning environments (p. 181). The authors stress the need to acknowledge and shift focus from technology integration to technology-enabled learning wherein the

IWB could be one of the driving forces in enacting transformation in teaching methods.

This research has evidenced that most KGEs are more concerned with *what* technology should be used, rather than *how* it can be used to achieve learning outcomes. This finding reflects the need for professional development to create awareness of the digital resources available in the school and the pedagogical integration of such tools. It also resonates the consequence of having too many digital resources implemented in a very short time and without any pedagogical training as to how teachers can use them in their day-to-day lessons. Jonassen's vision, as referred to in chapter 2, back in 1995 had already claimed that such "technologies should be used as knowledge construction tools by learners rather than programmed tutors, that students should learn with technology, not from it..." (Jonassen, 1995, p. 41). This finding is also aligned with what Cranmer & Lewin (2017) set out to achieve and focus on in the iTEC project. "The project focused on *how*, not *what*, technology should be used" (p. 411) for meaningful learning outcomes.

As indicated earlier, there were a number of reasons hindering the use of the IWB. Amongst these was the lack of support from the school administration or a whole school approach to technology integration as already alluded to. This resulted in some teachers not feeling supported or intimidated and thus refraining from taking any interest in the IWB other than as a large monitor for the display of videos. Prior studies from the literature corroborate the current findings where teachers were observed to refrain from integrating the IWB in their teaching upon encountering repeated technical difficulties, poor infrastructure such as a slow internet connection,

or predominantly because of a lack of skills, support and training in its curricular integration.

The IWB in the kindergarten classroom has shown to pose a slightly riskier element than in the older classes. This is due to the very short attention span kindergarten children have considering their young age and who are thus very easily distracted by anything else going on in the classroom. Their age is also a very important factor as they require more individual attention from their teacher. At the same time as already alluded in the literature review, if used appropriately by the teacher the IWB can also be an element which keeps their attention focused on the activity due to the multimodal stimulations which keep the children attentive and motivated. This substantiates and strengthens the important role the teacher has in orchestrating activities while managing the tool (IWB) by focusing attention on it and minimizing any other distractions. As argued by Lippard et al., 2019, pre-school children have already a natural pre-disposition towards questioning, problem-solving, creativity, communication and discovery, factors which are not exploited enough. The IWB, as a mediating tool in the classroom can provide the opportunities for educators to keep their young learners engaged and motivated by capitalising upon these natural qualities for learning. “Communicating ideas challenges children to clarify their thinking, and in turn exposes that thinking to either affirmation or correction by others” (Lippard et al., 2019, p. 189).

During my observations there were instances of teachers who were not inhibited by this but rather recognised it as a challenge and an opportunity to be change agents in the school system. At times the school administration, recognising this potential in the KGEs, did then offer support and re-think their whole school approach towards technology in the classroom. This proved that the KGEs were not only driving forces

for change in their own teaching practices and their own classrooms but were also influencing other colleagues on a school level as corroborated by the literature (Fullan, 2007, 2013). The AT framework made this transformative process more evident and transparent as it demonstrated how the mediating tool was driving and challenging teachers into re-thinking their practices and adapting to the new technology, supporting earlier observations about this theoretical lens.

The multimodal functionality of technology has been shown to assist the KGEs in structuring their teaching practices, shaping activities, to present pupils with multisensory tools and to actively involve them in the creation of their own learning as well as equipping them with 21st century skills. “Acquaintance and experience with digital technologies can afford young children the opportunity to develop technology skills and fluency that will be required in their future lives and work in the 21st century” (Rosen & Jaruszewicz, 2009, p. 162).

5.1.2 What role does the teacher play in this dynamic system when integrating the IWB in the classroom?

The teacher’s pedagogical beliefs and mindset about the use and importance of technology in the classroom has been shown to play a major role in whether or not KGEs use the IWB with all its functionality to facilitate learning. Teachers are the crucial elements in this system and thus their beliefs determine how and if this is employed. In most classrooms, the children were observed to be sitting in a semi-circle around the IWB for whole class teaching and took it in turns to use the board. This did not always reflect good pedagogical practice, as there were times where children waiting for their turn lost interest and became disruptive or uninterested. I must point out that this was not always the case. Ms. Lewis used the semi-circle set-up and yet the children were always engaged because of the particular strategy

adopted wherein she would call out the children randomly to work on the IWB rather than in an orderly fashion, keeping them attentive and alert. Ms. Webb on the other hand, for example, had the children sitting in small groups and thus each group had a different task to complete. Tasks varied from use of a particular software, IWB, role play, and craft making. The groups rotated and when their turn came to use the IWB they did not have to wait because they worked together on the task at hand. This was an excellent example of orchestration, class control, planned activity outcomes, and active participation wherein the KGE was not at the centre of the classroom focus and yet was in a very central position to facilitate and direct the young learners. Ms Webb was quoted saying “I used the IWB as another ‘station’ and allowed the children to draw on it or do some games unattended. The children are indirectly teaching themselves 21st century skills together with creativity or mathematical concepts through trial and error”. This practice demonstrated innovative teaching methods where children were given the opportunity to construct their own learning through discovery. Such practice in kindergarten classes in Malta is not common but demonstrates that if KGEs were given the opportunity for sharing their teaching methods with staff other educators could benefit hugely.

See figures 5.1 and 5.2 showing both instances where children are very engaged in each set-up.



Figure 5.1 Children working in groups.



Figure 5.2 Children in a semi-circle together around the board.

As indicated earlier this does not necessarily mean that the children who were sitting together as a whole class around the IWB were not learning. I am only emphasising the point that the small groups setting was giving more opportunities for differentiated learning. Ms. Webb who planned the groups setting did not always have her class set up in that way. She varied the setting according to what was going to be taught. Alternatively, she did at times find that the best setting for a particular lesson was as a whole class around the IWB. In other words, the teacher has to be flexible and adapt accordingly, specifically in the early years where the children are of such a young age. Ms. Martin likewise was one of the KGEs who used the whole class semi-circle set-up and yet she always had the children totally engrossed in the activities.

The results further support this idea of the teacher as the crucial element in the activity system. Teachers who were guiding and facilitating the use of tools within the system were providing opportunities for learning, by prompting and instructing for appropriate pathways and development. The findings confirm what the authors Lippard et al., 2019; Marsh et al., 2017; Mertala, 2017 & Scott, 2017, referred to in the literature review argue as regards the KGE as key in supporting the learning process. On the other hand, an unexpected observation was noted as those teachers who did not make use of the IWB as an interactive tool where the young learners were rather passive, believed and had the false impression that they were making good use of the technology. Such an example was Ms. Wood who used teaching methods involving a lot of drill and practice with little space for creativity, discussion and problem solving. As a participant observer I could see no active learning happening within the classroom, the children became easily distracted

because they were bored or simply not interested, which could again indicate the need for more training, shared practice, and reflection.

Ms. Martin demonstrates how the scenario for play is changing as argued by Marsh et al., 2016. There is a new meaning to play which moves between the physical and the virtual (p. 244) yet keeping the two connected providing the traditional play with more rich opportunities to be creative. This happens because the children are being stimulated by the IWB with its multisensory resources, which they then manifest in their traditional play away from the technology. The findings thus substantiate the current debates about the teacher as having a very important role in providing the opportunity in planning when and how to expose the children to achieve outcomes.

In the activity system the mediating tool of this study is mainly the IWB, yet there is another important mediating tool which is indirectly playing a very crucial role in the children's learning experiences. It is the language used. Although language is a symbolic indirect tool it plays an important part in the process of interacting. A number of the teachers observed encouraged discussion amongst the children to foster critical thinking and problem solving, even at this young age. Externalisation and internalisation discussed in chapter 4 assist the cognitive processes to comprehend and learn. Discussions and interactions in the classroom through language, using the IWB as the starting point, trigger and enabler, is the external factor, enabling the internalisation of concepts and thoughts which are then manifested through the external physical active interaction, in this case with the IWB. I see this as a cycle of learning through the IWB – language which brings about comprehension reinforced by the physical interaction with the IWB. This process is scaffolded by the KGE, again highlighting the central role of the educator as the fulcrum in facilitating the activity.

Learning, from a Vygotskian perspective, is a process of internalisation and externalisation i.e. we attempt to take in and make sense of what we see as valued in our societies and work with those understandings as we act in and on the world. Consequently the role of education is to employ mediation to enhance the conceptual resources that are to be externalised in action (Edwards, 2011, p.7)

Very enticing was the fact that during the observations and through the interview questions conducted with Ms. Lewis, she admitted to becoming more reflective of her own practices and upon evaluating her lessons was changing her teaching methods. This happened after each observed lesson wherein she improved or realised what could have been more effective after having discussed her methods with me. This is a strong implication that for transformation to happen, teachers need to reflect and evaluate their teaching with other colleagues or support teachers. Reflecting on practices and bringing about change through this reflection complies with what has been discussed in chapter 2. Mezirow (1997) supports the idea that critical reflection brings about transformation. Studies have shown that teachers who are more reflective and aware of their own pedagogical beliefs are generally more adaptive and flexible “the efforts to use technology were more likely to yield positive results” (Zhao, Pugh, Sheldon, & Byers, 2002, p. 492). This demonstrates that given the space as part of their professional development most KGEs would welcome such opportunities to reflect on their pedagogy together with other colleagues.

5.1.3 What are the tensions and contradictions encountered, if any, when using technology? How are they resolved?

The current research has shown that the KGEs were working as individuals rather than as part of a team of educators. This meant that they were not teaching specific

skills and competencies as agreed upon and monitored by the school leaders and school policies but rather in an ad hoc manner (because no such policies or structure were in place). Consequently, the KGEs who did instil skills in using the technology and involve participation for active learning were not supported, and there was no follow-up in the subsequent years for the children. Instead of refraining from changing their practices these educators transformed their pedagogy in innovative ways and went as far as supporting their colleagues themselves and sharing their practice with others when given the opportunity. Thus, as discussed in the literature review within the AT framework, tensions and contradictions could be the driving forces for change and development as observed. Yet on the other hand for other teachers the limitation of continuous support and professional development has encouraged the superficial use of the technology and lack of interest in seeking other means of professional development other than that offered by the school. In accordance with the idea of a CoP (Wenger, 2011), as already discussed in chapter 2, the sharing of good practice could be one of the agents encouraging this change in pedagogy. When teachers listen to the experiences of other teachers who are sharing the same environment are facing the same challenges and have the same opportunities, the likelihood would be that teachers will model the practices or adapt them for their own classes because these are people they can identify with. I have often myself animated professional development sessions as an eLST demonstrating how teachers can integrate technology in a meaningful way in the classroom, and although the teachers find the sessions very helpful, having a practitioner (a teacher from the same staff) sharing practices with whom they can relate more closely makes the session more significant.

5.2 Chapter summary

This chapter has looked at the findings and analyses emerging from the data collected and shown how the existent literature strengthens my findings. Here I have discussed the challenges and opportunities Maltese KGEs encounter and the outcomes which develop in particular contexts, and how the AT framework has supported the classroom dynamics to understand the various interactions taking place. The final chapter of this study draws conclusions on the findings, analyses, and on the discussions which were corroborated by the literature, to present new findings, recommendations for the local scenario as well as recommendations for further future research.

Chapter 6 Conclusion

This investigation initially set out to study KGEs' perceptions and use of technology in the classroom, specifically the IWB as a multimodal tool, in supporting/challenging teachers into reshaping and achieving their pedagogical practices and objectives. The study focused mainly on the role the KGE plays and the tensions and contradictions encountered. Activity theory played an essential part as the theoretical lens encompassing and analysing the activities within the actual authentic context.

My main research question was:

How does the IWB, as the mediating tool, within the activity system, hinder, enhance, or transform pedagogy, from the teachers' perspective?

This inquiry was of a qualitative nature and was conducted through participative observations within Maltese kindergarten classrooms during lessons and interviews carried out with the teacher. The main research findings and results of the analysis have been discussed thoroughly in the previous chapter by addressing each individual research question. I will now move on to discussing the significance of these findings and my contribution to local research.

6.1 Significance of findings and contribution of the study

The driving motivation that initially inspired me to conduct this study was the existing gap in local literature as regards technology integration in kindergarten classrooms. I was also driven by the sheer underestimation of the kindergarten educator in the Maltese educational system along with the lack of empirical data and studies of how and if these educators integrate technology, specifically the IWB. I focused on this particular technology because it is so diffused in all state kindergarten classes, making it the main tool teachers are using.

The current investigation has contributed to this field of knowledge by providing empirical up-to-date research carried out in the field itself. It has provided a snapshot of the realities ten KGEs face with all the challenges and opportunities technology, specifically the IWB, presents. This research also exposes how KGEs are taking up these challenges and resolving them with innovative practices. Additionally, it also has studied why some resist change and includes recommendations I will be listing on resolving this, based on foreign studies I have come across and which can be applied to our context. Through the basis of the theoretical framework of AT my research relates theory with professional practice merging both to provide a robust piece of work.

I have contributed to local literature by providing direct evidence on what goes on in our kindergarten classrooms. This new knowledge demonstrates how the KGEs themselves perceive technology in their classroom, as I have sat down with them individually and experienced a typical day with all its ups and downs. Through the interviews, I have additionally given them a voice to say what their main concerns are, how they cope, and the benefits they perceive. My study has added a wealth of knowledge enriched by the detailed and intricate observations and analyses of the practices of KGEs. This new knowledge establishes the originality of my findings, contributing to the literature both locally and internationally.

This research study serves the purpose of not only drawing attention to the importance of instilling 21st century skills at this very young age, which is to a certain point already acknowledged and understood, but paramount to this it also intends to emphasize that being content with creating awareness is not enough. All influential stakeholders, mainly policy makers and school leaders, need to move on and primarily understand the crucial importance of providing these educators with the necessary skills,

opportunities, support, and space to develop their pedagogy accordingly. To date such educators have been provided with an array of tools and digital resources but not with the expertise and pedagogy of applying them in their classrooms. KGEs need to be treated as the true professionals they are and thus be included in any research, surveys, training, professional development set out for other primary school teachers as they are key, if not, I dare say, the most important, part of the educational spectrum. This significance is acknowledged by the European Commission through a report which presents a common European Framework for the Digital Competence of Educators - DigCompEdu (Redecker, 2017). The report is directed towards educators beginning from early childhood, stressing the importance of developing digital competencies in kindergarten and subsequently equipping KGEs with skills and competencies to enable this progression.

6.2 Recommendations

6.2.1 Professional development

All through this study it has emerged that professional development is key to bringing about the change in the whole school culture. In the Maltese scenario especially in kindergarten it is sporadic and with no definite targets or long-time planning. Professional development needs to be continuous and driven by the needs of the KGEs themselves resulting in a bottom-up approach along with shared leadership. Professional development can and should lead to the formation of a CoP (discussed in chapter 2), and which could support and nurture the sharing of practices and knowledge to benefit all. This needs to include time opportunities for critical reflection and evaluation of their own practices and those of others which can be transformative, as evidenced by some KGEs and sustained by Mezirow (1997). This culture

of continuing professional development (CPD) needs to be nurtured by school leaders to truly flourish and be effective.

CPD may offer early years practitioners opportunities to engage with their own and others' epistemological understandings of literacy, as well as realisations of new literacies in (children's and their own) everyday lives. This would ultimately necessitate and link to a shift in practitioners' professional identities.

(Marsh, Kontovourki, Tafa, & Salomaa, 2017, p. 16)

6.2.2 Shared leadership – a whole school technology policy

For change to be affected the top-down method has shown to bring about more resistance because of imposing the technology implemented without any prior consultation or preparation. As already discussed if the KGEs are part of the decision-making at school level, collaborating collectively with school leaders, and other educators such as eLSTs and education officers, to create technology related school policies and planning, the effects may be reversed as teachers would be setting their own targets which would be more realistic and topical. This shared leadership would also bring about more responsibilities which the KGEs would then readily live up to because of their direct involvement in the decision-taking. Having a common school policy will also set standards which all the KGEs will then need to accomplish. It would then eliminate, as much as possible, the present situation where children are not all given the same opportunities to develop digital competencies. This would also eliminate the frustrations of having children learn and achieve skills which are not developed in later years due to the lack of continuation arising from no structure or long-time planning.

6.3 Application of the study

This study is highly recommended for school leaders and policy makers who are the game-changers to make such transformations at school level possible. It would be futile if only KGEs considered this research as they are not empowered to effect drastic changes at school level but only in their individual classrooms. This study could be applied in schools by having school leaders implement the recommendations in their school development plans, by discussing it with their respective staff and specialised teachers such as the eLSTs for an effective outcome. It could also be discussed during the curricular sessions held each term in all schools for KGEs to encourage the notion of shared leadership before attempting to apply any of the recommended strategies. Thus, through small group workshops, action plans for a whole school policy could be planned and adopted by contextualising the needs of the particular teachers in particular school contexts.

Another crucial application and exposure of this work, which would yield most benefits, would be during student-teacher educational programmes which prepare and train future KGEs. It would assist them in adopting, learning and integrating digital practices in their future classes as well as in formulating views and providing pedagogical experiences from the KGEs interviewed. Since this is an empirical study carried out in the local field they would be able to identify with actual challenges and how they can be overcome in advance.

6.4 Recommendations for further research work

Technology in itself is continually changing and thus although basic principles remain the tools may change, be modified, or improved. Consequently, further future research is highly recommended to provide more updated evidence and information.

Sometime after the data collection for this research was completed national authorities commenced the process of substituting the IWBs in all schools with Flat panels (FTP). These offer the advantage of functioning just as the IWB but without the need of a projector which was too expensive to maintain for several reasons. Additionally, the FTP enables teams and groups of children working on it all at the same time, encouraging collaboration, due to its multi-touch sensor points, instead of the single user possibility. FTPs are also crisper and brighter in resolution and do not depend on the lighting in the room which was a tremendous inhibitor in many classes. Furthermore, the use of the IWB is not as innovative as much as it was during the course of this study as it has now blended in with the day-to-day practices. This could provide a valuable focus for the emergence of new findings as to how its use has developed with time and practice. Thus, it could be the follow-up to this current investigation to study what has changed and the impact of implementing any of the recommendations made.

Such research could go further as to include classes from a wider cross-section of the Maltese educational scenario such as from non-state schools. This could be developed to establish if KGEs in these schools encounter the same challenges as their state school colleagues or not, and determine if there are essentially any contrasting contexts, policies, or strategies. Results could be shared to benefit both state and non-state schools.

I would like to conclude this research with the following quote which delineates and continues to substantiate the importance of my findings in providing a supportive framework for KGEs in this particular field and sector of the educational system, to be able to make use of the full potential of technology with the young learners in their classrooms:

“Early childhood teacher educators provide a critical link in helping the early childhood field move into the 21st century” (Rosen & Jaruszewicz, 2009, p. 170).

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Appendix One

The Activity Checklist

The activity checklist presented by Kaptelinin et al. (1999) was designed to guide researchers to “specific areas they should be paying attention to when trying to understand the context in which a tool will be or is used” (p.28)

1. Means and ends – how the technology facilitates or constrains the attainment of the users’ goals and the impact of technology on resolving or provoking conflicts between different goals.
2. Structure of the environment – Integration of target technology with requirements, tools, resources, and social norms of the environment.
3. Learning, cognition and articulation – Internal vs. external components of activity and support of their mutual transformations with the target technology.
4. Development – developmental transformation of the foregoing components as a whole.

Appendix Two

The following table illustrates the applied checklist as indicated in Appendix One, designed and created to help evaluate research using the AT mode of analysis.

Tool Mediation of the IWB (enabled by the following principles)			
Means and ends	Social and physical aspects of the environment	Learning, cognition, and articulation	Development
<p>*The IWB facilitates attainment of learning outcomes in more engaging/effective methods.</p> <p>*Teachers use the IWB to have a particular topic's outcomes and learning objectives displayed along with all the links and resources</p>	<p>*The IWB has a central importance in most of the activities.</p> <p>Topics/concepts are introduced through the use of the multisensory resources, moving on at a later stage to other activities away from the board.</p> <p>*It is also used as a means of recapitulation/revision of lessons.</p>	<p>*The IWB enables children to go through the process of learning. They are actively involved in 'thinking out loud' their learning by physically trying out what they are thinking.</p> <p>*Socially they discuss and</p>	<p>*Some of the IWB activities help develop in the children their sense of criticism. They discuss, argue, agree or disagree, find reasons for their actions.</p> <p>*Teachers find the technology is making them</p>

<p>connected to the topic.</p> <p>*Learning Outcomes are achieved in a more holistic approach as the tool can offer various modes of learning experiences such as hands on, trial and error, multisensory and collaborating with peers, learning to work in a group.</p> <p>* Teachers' find the IWB resourceful/ supportive in providing extra resources in planning their lessons and to be able to reach their goals</p>	<p>*Children know they are expected to sit/act in a fixed predetermined way.</p>	<p>collaborate on a task collectively which is a process enabling deep learning. They help their peers understand the concept through their own language: a child teaching another child.</p> <p>* The IWB is stimulating and motivating especially to children with special needs.</p> <p>*The visual, tactile, auditory senses enabled, encourage active participation and effectively deep</p>	<p>change their methods of teaching</p> <p>*The process of adapting to the potential of the IWB is bringing about transformation in pedagogy and how lessons are planned.</p> <p>* IWB is stimulating active participation and in effect active learning.</p>
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<p>* Teachers commented on the interactivity aiding children reach the specific learning outcomes implemented by the teacher.</p> <p>* The IWB enhances activities done away from the technology and thus complements and reinforces learning goals.</p> <p>* To be a means to an end the children need to enjoy the experience of learning and the IWB is a tool which brings excitement and engagement</p>		<p>learning at all levels.</p> <p>*Learning ICT skills associated with the IWB is a challenge which when accomplished motivates children into wanting to learn more.</p> <p>*Enables internalisation first through the physical manipulation / stimuli of external artefacts (externalisation) to aid the understanding of a concept or rule. This in turn brings</p>	
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<p>through fun activities.</p>		<p>about internalisation wherein the tool is then no longer needed.</p> <p>* Enables Externalisation transforming internal activities to external ones such as coordinated collaborative activities with others.</p>	
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Appendix Three

Participant Information Sheet

Title of Project: Investigating the impact of technology on teaching practices in Maltese kindergarten classrooms.

Research Student: Rose-anne Camilleri

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Date: _____,

Dear _____,

I would like to invite you to take part in my PhD thesis research with the Centre for Technology Enhanced Learning in the Department of Educational Research at Lancaster University.

Before you decide if you wish to take part you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Aims and purpose of this study:

This research is for my thesis on the PhD in Technology Enhanced Learning programme with the Centre for Technology Enhanced Learning in the Department of Educational Research at Lancaster University.

I aim to study how technology, namely the interactive whiteboard, is changing the teaching practices of Maltese kindergarten teachers. The study will reveal how the interactive whiteboard supports, challenges teachers into reaching and reshaping their pedagogical practices. This study will also contribute to the research in Malta about the integration of technology in kindergarten classrooms.

Why have you been invited?

This study is based on data gathered from kindergarten teachers from primary state schools, this is why you have been chosen.

What will this entail?

Observations will be carried out in your classroom when you will be using the interactive whiteboard. I will also be asking you questions about the lesson later through an interview.

Do I have to take part?

No, your participation is entirely voluntary. If you do not wish to take part, be observed or recorded, then please let me know.

You can withdraw at *any* time during the study and there is absolutely no obligation on you to continue nor penalty for withdrawing. Your related data (recordings, notes) can be destroyed and all reference removed at any time.

How will data be stored?

All information collected will be kept securely and in confidence. The data collected; transcripts of recordings, field notes and any other artefacts, will be stored and protected within 'Box', an online secure content platform for storing data. This will ensure the data is secured as 'Box' is password protected. A pseudonym will be given to protect your identity in the research report and any identifying information about you will be removed from the report. All pseudonyms will be securely stored and kept by myself.

All data from individual participants will be coded so that their anonymity will be protected, as required under Data Protection legislation, in any reports, research papers, thesis documents, and presentations that result from this work. Freedom of Information legislation will allow access to certain non-personal or generalized data.

What will happen to the data?

'Data' here means the researcher's notes, audio recordings and any email exchanges we may have had. The data may be securely stored for ten years after the successful completion of the PhD Viva as per Lancaster University requirements, and after that any personal data will be destroyed. Audio recordings will be transferred and stored on my personal laptop and deleted from portable media.

Identifiable data (including recordings of your voices) on my personal laptop will be encrypted. With devices such as portable recorders where this is not possible identifiable data will be deleted as quickly as possible. In the mean time I will ensure the portable device will be kept safely until the data is deleted.

You can request to view the field notes or listen to the audio at the end of the interview and any parts you are unhappy with will be deleted or disregarded from the data. Data may be used in the reporting of the research (in the thesis and then potentially in any papers or conference presentations). Please note that if your data is used, it will not identify you in any way or means, unless you otherwise indicate your express permission to do so.

You have the right to request this data is destroyed at any time during the study as well as having full protection via the UK Data Protection Act. The completion of this study is estimated to be by December 2017 although data collection will be complete by January/February 2017.

Data will only be accessed by members of the research team and support services, this includes my supervisor.

The research may be used for journal articles and conference presentations.

What are the possible benefits of taking part?

The expected outcomes from this research will lead to further development in this area. It will be beneficial in presenting a better picture of the current national educational change which is challenging the teacher and bringing about a subtle local culture change as well. Thus, in taking part you will be making a valuable contribution to this research.

Who to contact for further information or with any concerns

If you would like further information on this project, the programme within which the research is being conducted or have any concerns about the project, participation or my conduct as a researcher please contact:

Professor Paul Ashwin – Head of Department

Tel: +44 (0)1524 594443

Email: P.Ashwin@Lancaster.ac.uk

Room: County South, D32, Lancaster University, Lancaster, LA1 4YD, UK.

Thank you for reading this information sheet.

Rose-anne Camilleri

Appendix Four

Consent Form

Title of Project: Investigating the impact of technology on teaching practices in Maltese kindergarten classrooms.

Name of Researcher: Rose-anne Camilleri

		Please Tick
1.	I confirm that I have read and understand the information sheet dated _____ for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2.	I understand that my participation in this research study is voluntary. If for any reason I wish to withdraw during the period of this study, I am free to do so without providing any reason. I understand that any observations and interviews will be part of the data collected for this study and my anonymity is ensured. I give consent for observations during lessons and any interviews to be included and/or quoted in this study.	
3.	I consent to the observations being audio/video recorded.	
4.	I consent to the interview being audio/video recorded.	
5.	I understand that the information I provide will be used for a PhD research project and the combined results of the project may be published. I understand that I have the right to review and comment on the information I have provided.	
6.	I agree to take part in the above study.	
Name of Participant:		
Signature		
Date		

Appendix Five

Parental Consent Form

(ENGLISH VERSION)

Date:

Dear Parents,

Re: Investigating the impact of technology (the interactive whiteboard) on teaching practices in Maltese kindergarten classrooms

You are being invited to participate in a study carried out by a researcher who is doing doctoral studies in the Department of Educational Research at the University of Lancaster, UK.

The research aims to study how the interactive whiteboard, is changing teaching practices of Maltese kindergarten teachers. This study will also contribute to the research in Malta about the integration of technology in kindergarten classrooms.

The researcher will be studying the teacher's practices, through observations and interviews (conducted only with the teacher). Therefore, this will not directly involve the children. They will be simply present and participating in the activity during their normal classroom lessons. Any photographs which may identify the children will be blurred.

If you consent to your child participating in this study, as described above, please agree by signing below. If you have further queries, please do not hesitate to contact the headmaster/mistress on (phone/email of participating school) or the researcher through the details given below.

Regards,

Researcher's name: Rose-anne Camilleri

PhD Student

Educational Research Department,

Lancaster University, U.K.

Email: r.camilleri@lancaster.ac.uk



I consent to my child/children participating in the research as described.

Child/Children's Name/s:

Parent/Carer Signature:
Capitals

Parent/Carer Name in Block

Date:

(MALTESE VERSION)

Data:

Għeżież Ġenituri

Studju dwar l-impatt tat-teknologija (*l-interactive whiteboard*) fuq il-mod ta' kif jgħalmu l-għalliema ġewwa il-klassijiet tal-*kindergarten* Maltin.

Intom qed tiġu mistiedna tipparteċipaw fi studju ta' studenta tad-dottorat li qed tagħmel ir-riċerka tagħha mad-Dipartiment tar-Riċerka fl-Edukazzjoni, fl-Università ta' Lancaster, l-Ingilterra.

L-għan tar-riċerka huwa li tistudja kif *l-interactive whiteboard* qed ibiddel il-mod kif l-għalliema tal-*kindergarten* Maltin jgħallmu. Din ir-riċerka ser tgħin biex jiżdied l-għarfien dwar l-integrazzjoni tat-teknologija fil-klassijiet.

6. Can we use photos of your child on the website of the College and/or the Education Directorates?

7. Can we use photos of your child on other selected websites?

(The identity and details of the child will remain anonymous)

Signature

ID No:

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Date

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Data Protection Statement

This information is required for the school administration purposes. Information may be passed to the College of which the school forms part and the Education Directorates as required by law. It will be held in strict confidence both manually and on computer where only authorised staff can have access to it. The school, the College and the Education Directorates carry out their functions under the Education Act 1988. All data is collected and processed in accordance with the Data Protection Act 2001, other subsidiary legislation and the school Privacy Policy, a copy of which is available on demand.

Appendix Seven

Feedback from participants about the analysis write-up (excerpts).

Teacher 1

Just read the write up and I think that I could not have explained it better myself. I still use the same method of opening and closing a lesson using resources from the IWB.

I do not know if this is relevant or not but this year, since my children are slightly even older and we have even better technology (particularly a IWB which adjusts itself to the children's height) , I feel even more confident to let a group of children experiment on their own while I am doing craft work on a nearby table. In other words, I use the IWB as another 'station' and allow the children to draw on it or do some games unattended. They are indirectly teaching themselves twenty-first century skills together with creativity or mathematical concept through trial and error.

Perfect!

Teacher 2

If I were you I would mention that through the VLE the parents know exactly what the children would be learning in the classroom. The children can revise what they learnt (talking flash cards etc.) and the parents can rest their mind that the children, once they are using the VLE, are using safe links etc. Wish you good night.

Teacher 3

When doing the PPT with the children it wasn't a problem in having just one computer because while one child was dragging the picture to form a story the other children are watching to see if she puts a wrong picture in the page. So, they are participating as well. This is what I find really good in working with the IWB.

Also, other teachers' support isn't necessary because you have to communicate with the children and write what they tell you. You can cope on your own.

I find the PowerPoint **Story Maker** advantageous because you save a lot of time and since our children are young, they don't know how to look for pictures and upload them. It is not possible to do it if you don't find such material from websites or you have to spend a lot of time at home to prepare it.

What concerns me a lot are the interruptions from other staff who come knocking on the door and the interruptions from students especially with special needs.

Otherwise I have nothing else to add. This was no trouble at all. I am glad I could help you because it's nothing compared with what you taught me

Teacher 4

Everything is perfect. Thank you very much