# The use of the Interactive Whiteboard within early years practice: Lived experiences of kindergarten educators in Malta

Rose-Anne Camilleri
Ministry for Education

## Abstract
This paper presents a reflective appraisal of my doctoral research wherein I investigated 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 lens was adopted to examine the concepts of the IWB a technology-enabled tool, the early childhood educator's role and the pedagogical activity within this specific dynamic sociocultural context. This paper highlights the key findings emerging from participative observation and interview methods grounded in qualitative methodology. The personal narrative provides a deeper insight into the researcher-insider relationship, its implications and contribution to bringing out the reality experienced. Data was analysed using a content analysis approach. Findings revealed how these educators perceived the use of the IWB and how the tensions experienced were related to lack of professional development and support both in technical and pedagogical aspects. The role of the educator was found to be key in enabling change and innovation. The study has enriched the local literature giving a voice to the kindergarten educators as well as providing recommendations for future policy and practice.

## Keywords
Early years pedagogy, interactive whiteboard, technology-enhanced learning, kindergarten educators, activity theory

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

Contact: Rose-Anne Camilleri, rose.anna.camilleri@ilearn.edu.mt

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; young 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).

## Purpose, context, and research questions

This paper presents the main findings as well as a reflective appraisal of my doctoral study wherein I investigated 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. It also conveys, in an informal tone, the learning journey and driving forces which are most evident upon reflection after the research is completed.

The main driving force behind conducting such empirical research in the field of technology enhanced learning in the early years was the realisation of the sheer lack of support for the kindergarten educators (KGEs). Yet my motivation went beyond this as I was also constantly aware of the lack or limitation of local research to inform policies and practice in the kindergarten classes. Throughout this paper I will be referring to the KGEs interchangeably as either KGEs or teachers.

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 Teachers. This meant my role was to support educators at various levels in their curricular integration of technology.

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 within the same school, and yet whenever training, Professional Development (PD), research or surveys were being

planned and effected in this regard, this was offered and conducted primarily with primary-class educators. KGEs were still expected to use the technologies available on a professional level, even though they were given less support and less priority, as also pointed out by Sollars (2013). This was notwithstanding the acknowledgement from various stakeholders of the importance of introducing digital technologies in early childhood education as affirmed by Hansen (2008): "Clearly, technology within literacy instruction has the potential to benefit young learners" (p. 110).

This realisation prompted me to specifically identify 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 unfortunately 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.

## Research questions

The research questions arising from this inquiry and this need to investigate technology-enabled tools in the kindergarten classroom were narrowed down to the implementation and use of the Interactive Whiteboard (IWB) which was installed in all local state classrooms including the kindergarten classrooms. My main driving question was:

How does the tool impact teachers' pedagogical practices and activity within the classroom context?

This was 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?

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?

The IWB

One of the main interactive resources available in all Maltese state schools 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 et al., 2010). The IWB also supports whole class teaching, acting as a mediating tool between teacher and students (Lewin et al., 2008). As a tool the IWB is essentially a large whiteboard display with a touch-sensitive surface. 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 et al., 2012, p. 139).

Theoretical / conceptual framework

Activity theory (AT) was adopted as the main theoretical lens to examine the concepts of the IWB as a technology-enabled tool, the early childhood educator's role and the pedagogical activity within this specific dynamic sociocultural context.

An AT framework holistically encapsulates the whole dynamics of 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.

AT is not simply a theoretical framework and analysis tool but also a methodology wherein a strategic approach is employed to analyse and understand a specific context. 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.

Although a literature review revealed 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 is 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.

## Methodology

In order as 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.

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). 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 observing 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).

### Methods

The methods and research instruments I have employed are primarily qualitative in nature and include participant observations, field notes, audio recordings, photographs and interviews. These methods 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 being sampled for an experimental study.

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.

Participants

The participants were randomly selected from five different schools in Malta based on their willingness to participate in such a research. The teachers observed were ten in all and it is important to note that the names used were all fictional, thus participants cannot be identified.

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. 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.

My role as an insider

My role as an eLST 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. The researcher as the 'insider' to the activity system is placed in a very advantageous position from where to observe and participate.

## Findings, analysis & discussion

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 for a truer and more dynamic picture of the reality experienced where innovation and technology uptake depend on the context, which is crucial.

Key findings and themes

*Enjoyment/engagement*

IWB use was seen to bring about engagement in learning evidenced through the children's excitement, attention, motivation, body gestures – smiles, less behavioural 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." In a study carried out by Li (2007), it was found that students believe learning becomes fun: "It's a different way of learning that's usually fun for everyone … I can learn more if I learn it that way" (p. 387).

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.

*Socio-historical cultural influence*

The school culture plays a very important role. Teachers resisted changing their pedagogy because their school culture did 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 are no or very few opportunities for PD 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. The school context is thus a driving force which inhibits or encourages interactive use.

*Tech integration vs tech-enabled learning*

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

*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.

*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 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 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.

*Special needs*

Special needs children seem to benefit from the IWB only when the child is assisted by a Learning Support Educator (LSE). The IWB allowed for 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.

*IWB as initiator*

The IWB was observed to have set in motion teachers' needs 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.

*The teacher as key in change*

Teachers are the fulcrum, the most important element in this activity system. They are key to adapting the potential of the tools available for the specific needs of their learners. It depends on how the teacher decides to use the IWB that determines whether there is a simple enhancement in activity or a transformation. Teachers play key roles in shaping practice, which depends upon internal factors such as beliefs, passion for technology, problem-solving mentality and sharing practice.

*Tensions / Contradictions*

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

Findings in relation to the research questions

*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 the KGEs 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. 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 technology indicates that teachers may be uncertain of its uses and thus become anxious and fear taking risks.

The IWB is used in contrasting ways by the KGEs, either superficially, 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 et al., 2017), and on creating opportunities for PD. In the findings it was evident that this is needed in most schools. Some KGEs were reluctant to teach skills and competencies to the children because they knew that other teachers cannot provide continuation, rendering their efforts futile. Thus, the need to have a whole-school policy in place.

This research has evidenced that most KGEs are more concerned with what/which technology should be used, rather than how it can be used to achieve learning outcomes. This finding reflects the need for PD 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, 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.

The IWB in the kindergarten classroom has been shown to pose a slightly riskier element than in the older classes. This is due to the fact that kindergarten children have a very short attention span and are thus very easily distracted. Their age is also a very important factor as they require more individual attention from their teacher. At the same time, 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. 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 already have a natural predisposition towards questioning, problem-solving, creativity, communication and discovery, factors which are not exploited enough. As a mediating tool in the classroom, the IWB 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.

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).

*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 some children 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. The children were called out randomly to work on the IWB rather than in an orderly fashion, keeping them attentive and alert.

Ms Webb, on the other hand, 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. 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 as saying, "the children are indirectly exposed to 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 of sharing their teaching methods with staff, other educators could benefit hugely.

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. On the other hand, an unexpected observation was noted where the young learners were rather passive, while the teachers believed 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. 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, demonstrated how the scenario for play is changing, reinforcing Marsh et al.'s (2016) ideas. 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 richer 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.

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 that upon evaluating her lessons she 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 agrees with Mezirow (1997), who supports the idea that critical reflection brings about transformation.

Studies have also shown that teachers who are more reflective and aware of their own pedagogical beliefs are generally more adaptive and flexible (Zhao et al., 2002, p. 492). This demonstrates that, given the space as part of their PD, most KGEs would welcome such opportunities to reflect on their pedagogy together with other colleagues.

*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 indicated in school policies but rather in an ad hoc manner. Such policies or structures were not in place.

Consequently, the KGEs who did instil skills for using the technology and involved 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. They went as far as supporting their colleagues themselves and sharing their practice with others when given the opportunity. In accordance with the idea of a Community of Practice – CoP (Wenger, 2011), 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, facing the same challenges and having the same opportunities, the likelihood would be that teachers will model or adapt the practices because these are people they can identify with.

Significance of findings and contribution of the study

The current investigation has contributed to this field of knowledge by providing empirical up-to-date research which was carried out in the field itself. It has provided a snapshot of the realities that 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.

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 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 in children at a very young age, which is to a certain point already acknowledged and understood, but paramount to this it also intends to emphasize that 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, PD set out for other primary school teachers as they are key, if not, I dare say, the most crucial, 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.

## Recommendations

Professional development

PD is key to bringing about the change in the whole school culture. In the Maltese scenario, especially in kindergarten, this is sporadic and with no definite targets or long-term planning. It needs to be continuous and driven by the needs of the KGEs themselves, resulting in a bottom-up approach along with shared leadership. It needs to include time opportunities for critical reflection and evaluation of their own practices and those of others. Such practice can be transformative, as evidenced by some KGEs and sustained by Mezirow (1997). This culture of continuing PD (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 et al., 2017, p. 16).

Shared leadership – a whole school technology policy

For change to be effected, the top-down method has been shown to bring about more resistance because of imposing the technology implemented

without any prior consultation or preparation. If the KGEs together with school leaders and other educators are part of the decision-making at school level, collaborating collectively 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. It would then eliminate, as much as possible, the present situation where children are not all given the same opportunities to develop digital competencies.

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 to encourage the notion of shared leadership before attempting to apply any of the recommended strategies.

Another crucial application would be during student-teacher educational programmes which prepare and train future KGEs.

Recommendations for further research work

Technology is continually changing and thus although basic principles remain, the tools may change, be modified, or improved. Consequently, further 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 without the need of a projector. Additionally, the FTP enables teams and groups of children working on it 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 and 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.

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.

"Technology is just a tool. In terms of getting the kids working together and motivating them, the teacher is most important." (Bill Gates)

## Notes on contributor

**Rose-Anne Camilleri**, PhD, is currently the eTwinning Coordinator for Malta and an education officer within the Directorate for Digital Literacy and Transversal Skills. She was a class teacher in primary state schools and then moved on to supporting educators in their integration of technology. She obtained an MSc in Interactive Teaching Technologies from the University of Ulster (North Ireland) and a PhD in eResearch & Technology Enhanced Learning from the University of Lancaster (UK). Her main research areas are technology enhanced learning, early childhood education and eTwinning. Currently she also supervises students and examines dissertations. She has published a research paper entitled *Global Education and Intercultural Awareness in eTwinning*.

## References

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). Routledge.

Cranmer, S., & Lewin, C. (2017). iTEC: conceptualising, realising and recognising pedagogical and technological innovation in European classrooms. *Technology, Pedagogy and Education, 26*(4), 409–423. https://doi.org/10.1080/1475939X.2017.1299791

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Sage Publications Ltd.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal, 50*(1), 25–32. https://doi.org/10.5465/AMJ.2007.24160888

Ertmer, p. A., & Ottenbreit-Leftwich, A. (2013). Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic technology-enabled learning. *Computers and Education, 64*, 175–182. https://doi.org/10.1016/j.compedu.2012.10.008

Flaming, D. (2004). Nursing theories as nursing ontologies. *Nursing Philosophy, 5*(3), 224–229. http://ezproxy.library.uvic.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=2005021576&login.asp&site=ehost-live&scope=site

Goodfellow, R., & Lamy, M.-N. (2009). Conclusion: Directions for research in online learning cultures. In R. Goodfellow & M.-N. Lamy (Eds.), *Learning Cultures in Online Education. Continuum Studies in Education* (pp. 170–183). Continuum Books.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In *Handbook of qualitative research* (pp. 163–194).

Hansen, C. C. (2008). Observing technology enhanced literacy learning. *Contemporary Issues in Technology and Teacher Education*, 8, 108–121. http://www.citejournal.org/vol8/iss2/languagearts/article1.cfm

Jonassen, D. H. (1995). Computers as cognitive tools: Learning with technology, not from technology. *Journal of Computing in Higher Education, 6*(2), 40–73. https://doi.org/10.1007/BF02941038

Kervin, L., Verenikina, I., Jones, P. , & Beath, O. (2013). Investing synergies between literacy, technology and classroom practice. *Australian Journal of Language and Literacy, 36*(3), 135–147.

Lewin, C., Somekh, B., & Steadman, S. (2008). Embedding interactive whiteboards in teaching and learning: The process of change in pedagogic practice. *Education and Information Technologies, 13*(4), 291–303. https://doi.org/10.1007/s10639-008-9070-z

Li, Q. (2007). Student and teacher views about technology: A tale of two cities? *Journal of Research on Technology in Education, 39*(4), 377–397. http://www.tandfonline.com/doi/pdf/10.1080/15391523.2007.10782488

Lin, C.-H. (2012). Application of a model for the integration of technology in kindergarten: An empirical investigation in Taiwan. *Early Childhood Education Journal, 40*(1), 5–17. https://doi.org/10.1007/s10643-011-0494-5

Lippard, C. N., Lamm, M. H., Tank, K. M., & Choi, J. Y. (2019). Pre-engineering thinking and the engineering habits of mind in preschool classroom. *Early Childhood Education Journal, 47*(2), 187–198. https://doi.org/10.1007/s10643-018-0898-6

Maher, D., Phelps, R., Urane, N., & Lee, M. (2012). Primary school teachers' use of digital resources with interactive whiteboards: The Australian context. *Australasian Journal of Educational Technology, 28*(1), 138–158. http://ascilite.org.au/ajet/ajet28/maher.html

Marsh, J., Kontovourki, S., Tafa, E., & Salomaa, S. (2017). *Developing digital literacy in early years settings: Professional development needs for practitioners*. http://digilitey.eu

Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J., & Scott, F. (2016). Digital play: a new classification. *Early Years, 36*(3), 242–253. https://doi.org/10.1080/09575146.2016.1167675

Mason, J. (2002). *Qualitative Researching* (2nd ed.). Sage Publications Ltd. http://www.sxf.uevora.pt/wp-content/uploads/2013/03/Mason_2002.pdf

Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult & Continuing Education, 74*, 5.

Moos, D. C., & Marroquin, E. (2010). Multimedia, hypermedia, and hypertext: Motivation considered and reconsidered. *Computers in Human Behavior, 26*(3), 265–276. https://doi.org/10.1016/j.chb.2009.11.004

O'Leary, Z. (2004). *The Essential Guide to doing research*. Sage Publications. http://eunacal.org/metodakerkimi/wp-content/uploads/spss/The_essential_guide_to_doing_research.pdf

Puentedura, R. (2013). SAMR: *Moving from enhancement to transformation* [Conference Presentation]. Strengthening Your District Through Technology Workshops. http://www.hippasus.com/resources/tte/

Redecker, C. (2017). *European Framework for the Digital Competence of Educators: DigCompEdu* (Y. Punie (ed.)). https://doi.org/10.2760/159770

Rosen, D. B., & Jaruszewicz, C. (2009). Developmentally appropriate technology use and early childhood teacher education. *Journal of Early Childhood Teacher Education, 30*(2), 162–171. https://doi.org/10.1080/10901020902886511org/10.1080/10901020902886511

Sollars, V. (2002, December 5). Early childhood education: *Use of and satisfaction with childcare facilities and small kindergarten centres in Malta* [Public Lecture]. University of Malta, Malta.

Sollars, V. (2013). *Early childhood education & care in Malta: The way forward*. Ministry for Education & Employment.

Tondeur, J., van Braak, J., Ertmer, p. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educational Technology Research and Development, 65*(3), 555–575. https://doi.org/10.1007/s11423-016-9481-2

Verenikina, I., Wrona, K., Jones, p. , & Kervin, L. (2010). Interactive whiteboards: interactivity, activity and literacy teaching. *World Conference on ...* , 2605–2614. http://www.editlib.org/p/35004?nl

Wenger, E. (2011). Communities of practice: A brief introduction.

Wilkinson, D. (2000). *The researcher's toolkit: The complete guide to practitioner research.* Routledge.

Wilson, T. D. (2002). Alfred Schutz, phenomenology and research methodology for information behaviour research. *Fourth International Conference on Information Seeking in Context*. http://www.informationr.net/tdw/publ/papers/schutz02.html

Yong, T. L. (2010). Integrating the technological dimension into teaching and learning — A sociocultural perspective. *Education*.

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. L. (2002). Conditions for classroom technology innovations. *Teachers College Record, 104*(3), 482–515. https://doi.org/10.1111/1467-9620.00170