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Research Article

An Exploration of the Lived Experiences of a Visual Art Teacher in a Smart Classroom

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Abstract

The impact of digital technologies in education has been the subject of numerous studies. The findings have produced mixed results, highlighting the high degree of complexity involved in teaching and learning and the uniqueness of school settings. Continuous and rapid technological developments present educational communities with opportunities to solve numerous academic challenges. Current trends reveal a move towards the seamless integration of digital technologies into learning spaces to complement face-to-face teaching and learning. This study used Interpretive Phenomenological Analysis to understand an Art teacher's lived experiences as her classroom was transformed into a smart teaching and learning space using a combination of technologies to increase efficiencies in the delivery of the curriculum and address individual learning needs. The case study indicates that transforming traditional classrooms into smart learning spaces using a combination of technologies: uses time more effectively by automating the distribution of a range of educational resources; enhances teaching and learning by blurring the boundaries between physical and digital spaces; increases flexibility, mobility and creates extra opportunities for learning; frees up teaching time to address individual needs; enhances time on task and students' focus on the learning intention; and, encourages students to self-regulate their learning.

Keywords: smart classrooms, digital learning, learning spaces

INTRODUCTION

The ubiquitous use of digital technologies in education provides new possibilities and opportunities to optimise teaching and learning approaches in different spaces and contexts (Long & Ehrmann, 2005). Mobile devices connected to the Internet combined with technologies that push content to learners can transform physical spaces into smart learning environments and multiply the ways students access learning resources and connect with experts in different geographical locations (Kloos et al., 2018). Even with the impact of the recent pandemic, classrooms remain the main space where K-12 students spend most of their time when involved in formal learning and preparing for a technology-rich society. The arrival of the digital beacon, a technology that can trigger a series of actions resulting in digital content being pushed onto students' devices

within a certain proximity, can be embedded in traditional classrooms to optimise teaching and learning (McDonald & Glover, 2016). This idea has sparked a wave of interest in transforming conventional classrooms into smart learning spaces where educational resources appear on students' screens timely and efficiently. Students seamlessly use several technologies to support their learning (Zhu et al., 2016).

Initially, the beacon technology was designed to market products to consumers by pushing advertisements onto mobile phones within the proximity of beacons (Allurwar et al., 2017). Later, museums adopted the technology and embedded it in various exhibits to provide information to visitors in formats such as text, images, sound and video (Chen et al., 2017). Apart from museums, and tourist destinations (Gretzel & Koo, 2021), many universities have adopted this technology to engage students in their learning (Tsai et al., 2019). Beacons have also been used in libraries to automate specific tasks (Liu et al., 2019). Beacons connected to learning management systems or cloud servers can be strategically embedded in physical classrooms to detect digital devices within a specific range and trigger a series of actions resulting in learning content timely being pushed on the screen of young learners. Research related to teachers' lived experiences in K-12 smart classrooms driven by beacon technology is limited (Atherton, 2019). Given the widespread use of mobile devices and intuitive applications, 24/7 connectivity, and technologies embedded in physical environments, further research is needed in this area. Indeed, researchers need to continue directing their efforts towards studying the relationship between pedagogy, relevant curriculum and the seamless use of current and emerging technologies for engaging students, supporting individual learning needs and developing self-directed life-long learners (Ertmer & Ottenbreit-Leftwich, 2013). There is also a need to explore further the concept of smart classroom models from a teacher's perspective and not from a technical point of view and bring to surface the possible challenges and opportunities for better education in spaces where new technologies are embedded in the physical environment (Kwet & Prinsloo, 2020). In this study, the terms smart learning spaces, smart classrooms and smart environments are used interchangeably to indicate that technologies have been embedded in the physical space to automate certain tasks and enhance teaching and learning. This study focuses specifically on a smart classroom model driven by digital beacons that sense the presence of students as they walk in the classroom and automatically populates their devices with multimedia resources designed to support their learning. The beacon technology was initially created to promote products to consumers and has been adapted to push educational resources onto students' learning devices in an attempt to make learning more interactive, engaging, easier to access and more efficient.

METHODOLOGY

We selected Melbourne City College (MCC) (pseudonym) as the setting for this study. Teachers at MCC have access to mobile devices, tablets, technical support and professional development on-demand. They use a common pedagogy to teach the sequential curriculum in core subjects. The teachers have adopted a balanced teaching and learning approach recognising the importance of print resources and digital technologies. MCC sets high expectations for academic achievement and values individual success. We purposefully selected one teacher, Roberta (pseudonym), based on her recent lived experience in an art room that was transformed into a smart learning classroom using a combination of beacon technologies, cloud servers, mobile devices and multimedia content. We purposely selected Roberta as she is not a unique teacher, believing that this will have a greater impact on educators who may read this research. If a teacher is seen as unique, it makes it harder for readers to identify with the subject and consider following the change pathways that the selected person has taken. By choosing an ordinary teacher who experiences effective growth and change, we believe others may decide to follow. We have chosen an experienced teacher who was an early and enthusiastic adopter of digital technologies whose practice can be emulated by others, thus strengthening the implications of our research for educators and education researchers. We aimed to explore her lived experiences as a Visual Art teacher in this novel environment.

We employed Interpretive Phenomenological Analysis (IPA) to address Roberta's perceptions, as an experienced Visual Art teacher working in a smart classroom where learning content is pushed to students automatically. The researchers recognise that this is a single case study in a unique educational setting, and generalising to other educational environments may not be possible. In line with the philosophy that

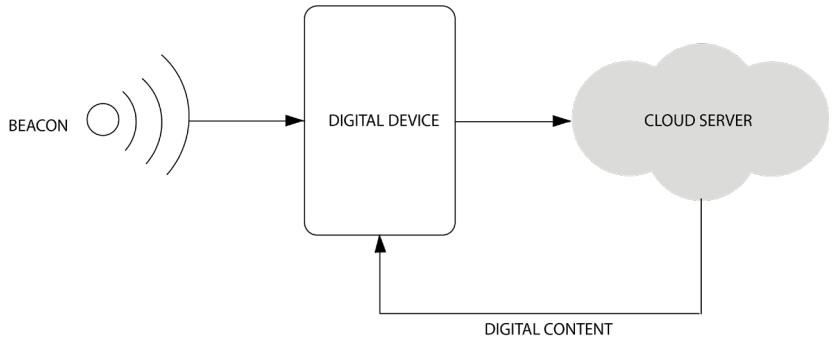

Figure 1. A beacon set up to work with digital device and a cloud server

underpins IPA, a single case study can highlight helpful information and generate specific knowledge that can illuminate phenomena in similar studies related to the concept of transforming classrooms into smart learning spaces.

IPA is a framework developed by Jonathan A. Smith for analysing and interpreting qualitative data and has its roots in the works of Husserl, Heidegger, Merleau-Ponty and Satre, on phenomenological philosophy. This approach offers researchers a systematic approach to examining and developing a deep understanding of lived experiences. IPA differentiates a simple event from an experience where the individual is consciously aware and understands what is taking place in the moment through reflection. The researchers are concerned with detail and depth of analysis of a person's experiences in specific contexts and may focus on one or more cases studies (Smith et al., 2009). The combination of IPA and hermeneutics allows the researchers to study and analyse the phenomena in-depth. By nature, this process required a double hermeneutic as the researchers tried to understand how the volunteer understood her own lived experiences (Smith et al., 2009). This article is a single IPA idiographic case study (Larkin et al., 2006) that explores the richness of information provided by the participant and a desire to engage in a deeper investigation of the lived experiences provided by both the researchers and Roberta. IPA suggests that the "overall outcome for the researcher should be a renewed insight into the 'phenomenon at hand' - informed by the participant's own relatedness to, and engagement with, that phenomenon" (Larkin et al., 2006, p. 117). This approach allowed for a more in-depth analysis of the accounts provided and the establishment of links to current research to illuminate findings (Smith 2004).

RESEARCH QUESTIONS

The following questions guided our research:

How did you experience the novel smart learning space driven by beacon technology?

What impact, if any, of the new smart space on teaching and learning?

The answers to these questions may help the educational community better understand the potential, if any, of transforming traditional classrooms into smart places by embedding new technologies in physical structures. In this case, a digital beacon was embedded within the four walls of a classroom to transmit its signals to mobile devices and trigger a series of actions resulting in learning content curated or created by the teacher and stored on a cloud server to timely pop up in front of students. **Figure 1** illustrates how the beacon worked seamlessly in the art room, sensing devices within a specific range and sending a signal to a cloud server to push the learning content to students' devices.

Figure 2 demonstrates how one beacon was embedded in the art room to create the smart classroom. The beacon detects the presence of a device, and a signal reaches the cloud server causing digital content to be pushed on the students' screens.

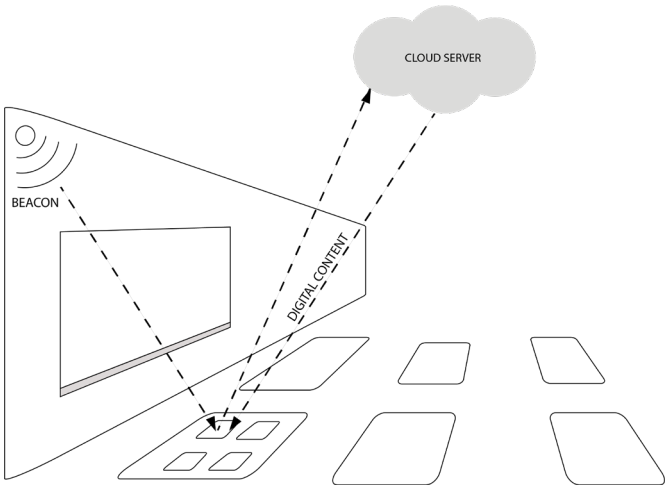

Figure 2. Embedding beacon in the art room

After gaining ethics approval from Monash University, we used semi-structured interviews to elicit the volunteer teacher's thoughts concerning her experiences in the new visual art smart teaching space. Over time, the interviews were conducted after school at a convenient time for both parties. Initial open-ended questions were used to find out Roberta's experiences prior to using smart spaces, followed by more specific questions seeking deeper clarification of her initial experiences and the implementation processes. Examples of interview questions included: Tell me about your technology experience as a teacher? What do you believe are the attributes of a good teacher? What went through your mind when you first heard about smart learning spaces? Describe your experiences when you commenced teaching in a smart space. When and how do you produce the digital resources? How are the resources distributed to students? Describe some of the resources. Compare your current experiences in delivering lessons with past experiences.

We listened to the audio recording of the semi-structured interviews and read the transcripts repeatedly to better understand the entire experience. Next, we identified significant statements that repeated throughout the transcript to form emergent themes. As Finlay (2014) supports, "meanings have to be mined, and layered themes have to be shaped up through successive iterations" (p. 126). Consequently, we identified three major interrelated themes related to time, space and resources. These themes were examined from different perspectives in our attempt "to make sense of the participants' sense making" (Finlay 2014, p. 127). Underlying these themes was the participant's strong desire to increase efficiency and efficacy in all aspects of teaching and learning using the smart space. We proceeded to analyse the information using an iterative process and focusing on Roberta's life-world, in an attempt to capture the essence of the phenomena rather than focusing on the themes. Finlay (2014) suggests that "the goal of analysis is not simply to "find" themes; the point is to explicate the phenomenon, the lived experience, holistically (p. 136). The researchers commenced forming "an interpretative account of what it means for the participant" (Larkin et al., p. 113) to deliver lessons in a smart classroom. Finally, we solicited the participant's input about our observations to validate the findings and produce the final report (Phillips-Pula et al., 2011). In the next section, we present the results of this study by including a "rich description, backed by illustrative quotations, which evokes the phenomenon in immediate and potent ways" (Finlay 2014, p. 135).

FINDINGS

The semi-structured interviews with Roberta focused on her perceptions of the potential of using the smart classroom for the delivery of art lessons to Year 5 boys. We present the data are under three broad themes represented in **Figure 3**. The first theme, time, explores how the participant used the smart space to optimise teaching and learning strategies during the fifty minutes lessons. The second theme, space, looks at how the physical learning space of the art room evolved and expanded through the introduction of new technologies and digital spaces. The third theme, resources, explores the advantages of digital learning resources as well

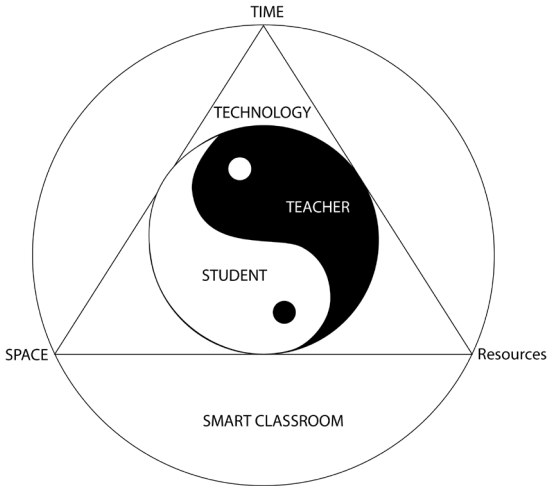

Figure 3. Broad themes

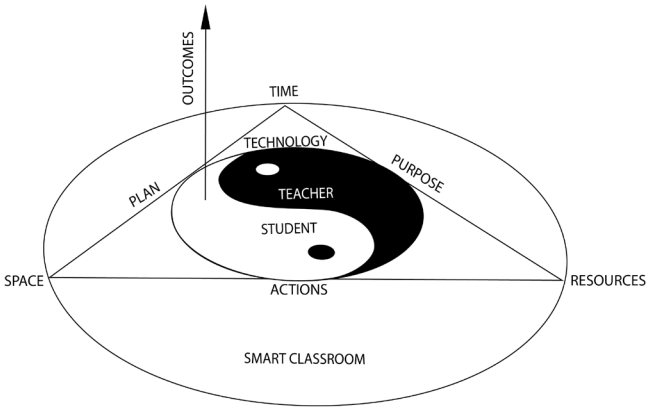

Figure 4. Plan, purpose and actions

as access and distribution. The three themes are dynamically interconnected through the seamless use of technology, automating various tasks and transforming the space into a smart classroom.

Participant's Initial Thoughts

Roberta saw technology as a tool to solve teaching and learning challenges related to space and time as well as the creation and distribution of resources. She revealed her intentions in relation to the place and the role of technology in her career right from the beginning "I'm always very keen to know how I can use [technology], whether it can improve the student learning, whether it can improve my teaching." As indicated in **Figure 4**, Roberta appeared to be driven by a strong desire to empower her students to achieve the impossible through a transparent plan, a clear purpose and continuous actions within the smart classroom to raise academic outcomes.

She emphasised that teachers "have to have the mindset … that these children can be expert at anything providing that they believe they can." Roberta brings the same enthusiasm to her adoption of new technologies in her classroom.

Although Roberta adopted technology very early in her career, the integration of the 1:1 devices at her latest school and the introduction of the Beacon technology to transform her class into a smart space had a fundamental impact on her teaching and the students' learning. She openly admitted to "absolutely love [the 1:1 devices]." Indeed, Roberta thought it was the "best learning tool." She was also very excited when she first heard how Beacon technology could be embedded in her classroom to automate routine tasks. Roberta explained why, "I was keen to know how I could use it, whether it can improve the student learning, whether it can improve my teaching. Roberta also confessed, "I didn't, in the beginning, understand how much time

it would save me." Roberta was not aware that using this technology, she could make available multiple learning resources on a digital pin-board that could automatically be pushed to her students when entering the classroom. It was evident that the more Roberta used the new technology, the more excited she became with the new possibilities. According to Roberta, the novel learning space had an immediate impact on students' engagement. She claimed, "the boys are so excited when they come now that they walk in, and the first question is what's new?" And after a couple of weeks, she added, the students "had the proximity map up before they even entered the classroom, and they were very keen to see what new things I'd put on there."

Resources – Past challenges, new solutions

Roberta recalled the challenges related to the manual creation and distribution of learning resources to students before the arrival of the new technologies, "I would produce the resources, photocopy all the resources or print them off and have them over here and the kids would come in and collect their resources, paste them into their books." It was clear that the absence of the current technologies made Roberta's work more time consuming; moreover, even after completing the task, often students worksheets would,

> fall out of the books; they would lose them. I would photocopy more, "oh, we've run out, there's none there." They didn't have access to it until I could get to a photocopier to photocopy the next one. If the photocopier was out of action or the printer ran out of ink, we were in trouble.

The smart space offered several new opportunities for learning. The most commonly used learning resource in the past was in the form of paper, a useful medium, but limited compared to the possibilities of new technologies. One of Roberta's strategies involved creating video tutorials explaining concepts and skills students were required to master and automatically having these resources pushed on the students' screens as they entered the classroom. The advantage, explains Roberta the video "will only get done once and then [students] can access it."

Roberta elaborated further on her video tutorial strategy, "once that explanation had been done the first time, I didn't do that again. So, as each student got to that point in the exercise, their explanation was there." Indeed, she discovered how technology could free up time and empower students to control their learning by using technology to regulate the flow of information. As Roberta puts it, students "can rewind [the video clip], they can look at it as many times as they like." Furthermore, Roberta curated YouTube video clips relevant to the art concepts being studied. Teachers, she commented, that students "have access to real artists at the touch of a finger." These video clips are timely available "as exemplars for [students] to strive for in their work." Roberta re-emphasised that "technology has brought the world to their fingertips, it's brought experts to our fingertips. We can show [students] the best of everything." This specific strategy ensured that students had access to high-quality resources created by real artists worldwide. She added that "on all of those videos, the artists are talking to the students as well." Roberta provides an example related to how she was

> able to QR [Quick Response] code a video of a Japanese artist who explained to [the students] how we got the movement in the fish, how we did the tone and actually drew a fish in front of them and shaded it in front of them.

According to Roberta, the system was "giving [students] more class time, more access to the artists working the artwork and every section of it."

Space – Extending the physical environment through digital technologies

Creating and learning resources and timely pushing them to the learners solved the problem of students missing out on teaching segments when they attended music tuition or were absent or late to class. Roberta explains the solution:

> I no longer have to address the needs of a student who's gone to a music lesson or a student who's come back after being ill. Everything is there for them. It's purely and simple matter of when I give a demonstration, a student videos it [and] it's there for everybody to see.

The smart classroom allowed Roberta to seamlessly and timely distribute learning resources to her students and extend the learning space beyond the classroom's physical boundaries. According to Roberta, if students "were absent, they can do that part at home. So, if they are sick, there's no reason why they need to get behind in this class." When delivering lessons, Roberta also noticed that her strategies resulted in additional benefits,

> it's no longer an embarrassment for the student who takes a bit longer to have to put his hand up and say, "Can you do that again for me please?" because often they won't do that, and you only find out they didn't understand it when you look at the piece of work, and then you give them another demonstration. Now, they can just rewind [the video] with the demonstration.

Time – Increasing efficiency in the delivery of resources and execution of lessons

Roberta clarified that by using these strategies, "we don't have any slow students anymore, because they can go back straight away and see what we're doing." She clarified further, "we're catering for the different learning styles, we're catering for the disorganised student, we're catering for the student with special needs, we're catering for the student who is advanced and needs to move on quickly."

Roberta elaborated on how the smart classroom increased efficiency in her art classes. That is, "[students] have access to every explanation, detailed demonstration, all the materials without looking for it." She also noted that using the smart classroom leads students "to the best [resource] without them having to go through the worst of it first." Roberta appeared to have solved another common problem related to students being distracted by irrelevant information on their devices while completing tasks. The solution, according to Roberta, is "to direct the learning and take away any chance of [students] being distracted." Roberta also noted that the smart environment allowed her to become the virtual significant other always available to her students,

> it just makes more efficient use of the resources that I'm already producing and the resource that I am for the students. Because as a resource myself, they have access to me whenever they need me now. They don't have to wait for me to have time to give them another demonstration.

Roberta noted that her role as a teacher in this new environment shifts from teaching the whole class to a more individualised approach. She clarifies the shift, "my class time is now spent individually working around each table, helping students to improve their artwork, giving them feedback." She pointed out that teachers "will never get [good] results by just sitting kids down in front of a video. You've got to be giving them feedback all the time." This was made possible as the smart classroom "is giving [students] more class time, more access to the artists working the artwork and every section of it", while she paid attention to the needs of individual students around the class. Roberta felt proud that now students "know what they're up to next and they move to that table because it's set up. There's no downtime." Her classes became more time-efficient. Students accessed everything in one spot through their devices and did not have to go looking for resources and "wasting time." Apart from the video tutorials, which explained every step of the lesson, Roberta also used the smart classroom to push to the students "the design brief, their assessment rubric, a QR coded video that they can access of an artist working on ceramics and everything else that they need in terms of theory." For Roberta, the benefits of the smart classroom were clear, "[it has] streamlined the whole lesson to the point where absolute maximum time is student work time. That gives them so much more time to work on it … therefore, the quality of what they do … is better."

Roberta emphasised that she is “value-adding by making sure that every student’s needs are catered for, there is no downtime, there is no wasted time.” She remarked, it “was like a new world … it saved me so much time” and most of “[my] time is spent giving [students] positive feedback, giving them feedback on how to improve.” According to Roberta, the students responded accordingly, “they are engaged by technology. It also empowers the kids because they are now in charge of what they’re doing when they’re doing it … how they’re doing it, and they don’t have to wait for me.”

DISCUSSION

For Roberta, engagement with the new and emerging technologies seamlessly embedded in her classroom underpins her strong desire to enact change, increase student engagement, and improve outcomes. According to Dumont and Istance (2010), “making desirable change happen requires a major step including through posing the question: how can we foster effective learning and what inspiring models exist from which others might learn?” (p. 20). At the heart of any desire to effectively use technology in education are the issues associated with the complex nature of teaching and learning and the variations from one setting to another. In this study, issues of access and fluency in the use of existing and new technologies were no barriers for the teacher concerned, who could strategically adopt the latest technologies to address three main challenges related to time, space and resources. Technologies “empower learners to become active in shaping their own learning environments” (Dumont & Istance p. 25).

Roberta approached the smart classroom with an open mind and a strong focus on improving her teaching effectiveness and students’ success in learning. Roberta did not show any signs of distress associated with problems related to the technology or its use. Indeed, she viewed the smart space as a potential solution for increasing student engagement, optimising teaching and learning strategies, and improving outcomes. This phenomenon is contrary to several research findings, which note the difficulties in establishing a clear connection between technology and learning outcomes because of the number of factors that may influence results, including but not limited to: teaching effectiveness, quality of digital resources, time on task and effective feedback (Adedokun-Shittu & Shittu, 2011; Lei & Zhao, 2007; Papadakis et al., 2020). In this instance we note that it is not a case of technology but a whole system working in harmony as one, including the actors. Even Roberta’s belief that her students could become experts at anything, if they believed they could, appears to play a role in her students’ success. She saw herself as the person responsible for creating a learning environment that fostered students to believe in their abilities and to experience success beyond personal expectations by exposing them to high quality digital multimodal resources and by providing timely feedback (Atkins et al., 2010; Galligan et al., 2010; Valiente, 2010). Another crucial factor to success appeared to be her willingness to adopt and adapt new technologies to seamlessly optimise the effectiveness of learning spaces, in which timely and strategic interactions between teacher, student and available digital played a significant role in achieving her goals (Dumont & Istance, 2010).

For Roberta, the smart classroom was a happy confluence of time, space and resources resulting in an enhanced learning environment that positively contributed to teaching and learning processes. We note that Roberta felt well supported technologically during the smart classroom trial. She did not encounter any issues working in the smart classroom. For her, teaching in the smart space was a very positive experience. The new classroom set up allowed Roberta to solve several teaching and learning challenges related to:

creating, storing and distributing resources to students,

scaffolding student learning,

providing timely feedback,

catering for students who were late to classes, absent or pulled out for music lessons,

addressing students’ ability to absorb, process and apply new knowledge, and

achieving the lesson intentions within specific time limits in a physical space alongside new technologies.

Roberta valued the smart learning space for supporting students' needs and their variation in progress rates. The lessons were more engaging, meaningful, efficient and effective. Her teaching approach worked in harmony with the smart learning space and the students. New concepts were taught once and captured as video tutorials, saved directly to the cloud server and pushed on students' devices. The students absorbed the information at their own pace as needed, for part of the session, self-regulated their learning, gradually completing given tasks at a high standard. Indeed, according to Roberta, the students achieved results beyond personal expectations within the fifty minutes timeframe (Papadakis et al., 2021). This smart classroom paradigm functioned as a unified system where the actors knew when and how to use digital technologies (Hannafin & Land, 1997).

Roberta's positive mindset towards technology appears to be another significant contributor to creating an effective technology-rich learning space. She saw technology as a critical instrument for developing students' knowledge and skills (Moses et al., 2013; Teo, 2011). Initially, the smart space acted as a hook attracting and engaging students with new learning resources as they entered the classroom. Within a short time, Roberta adopted the smart learning classroom to solve existing challenges related to time, resources and space, demonstrating an in-depth understanding of how and when to use technology to support teaching and learning and achieve set goals (Adedokun-Shittu & Shittu, 2011).

Challenges and Digital Solutions Related to Time and Pace

Before introducing the recent technologies, Roberta used a printer and a photocopier to distribute learning resources to her students. This process was not efficient because it required more time for preparation, creating hard copies, and extra time for the students to collect and paste the worksheets in their exercise books which often went missing. With an increase in expectations for higher student performance, the weaknesses in traditional approaches became more prominent. The introduction of the new technologies made teaching and learning more efficient (Vaiopoulou et al., 2020). The smart classroom enabled her to distribute information in digital format to all students efficiently and timely. Moreover, to increase productivity and learning efficiency, Roberta incorporated multimodal files to the list of learning resources for the students to access and use as needed at any time and pace. To save more time when creating and distributing these resources, Roberta captured key teaching moments while delivering her lessons and saved these as video tutorials to be pushed to students as they entered the classroom. This strategy was significant due to students missing lessons and the variations in their ability to process information. Students could now regulate their learning in class and beyond as required (Atkins et al., 2010; Yang et al., 2021). Indeed, Roberta had accomplished several teaching and learning goals concurrently. Namely, teaching specific concepts through explicit instruction, producing multimodal resources on the go and creating opportunities for students to self-regulate their learning (Galligan et al., 2010; Li et al., 2010).

The impact on how the students accessed and processed information was almost immediate. The smart classroom allowed students to learn from explicit face-to-face teaching and the multimodal resources pushed on their devices. This blend of strategies demonstrates the significance of both the more knowledgeable other and the seamless use of current and emerging technologies to increase teaching and learning effectiveness (Atkins et al., 2010). The students to assumed control of their learning while the teacher, after the initial explanation, could concentrate more on providing individual feedback, which is one of the essential strategies in effective learning environments (Hattie & Timperley, 2007; Smeets, 2005; Wiliam, 2010). An additional benefit of the way Roberta ran the smart classroom is that every student had access to the same high-quality explanation from the teacher or the recorded video clips when arriving late to class or even when away from school. She had managed to create a more flexible and efficient smart learning environment with extra possibility for any pace and "on-demand opportunities for learning anytime and anywhere" (Atkins et al., 2010, p. 21).

Challenges and Digital Solutions Related to Production, Storage and Distribution of Resources

A key strategy related to efficient and effective learning spaces includes providing a range of quality resources on-demand for individual consumption. Roberta substituted traditional paper resources such as rubrics,

design briefs and written instructions with digital files. She also recorded parts of her lessons while teaching, then saved these videos for students to use when and if required. Roberta enriched this strategy by including real artists' tutorial clips as exemplars for students to view and model in their work. She also employed apps designed to reinforce specific skills and concepts for students to access as resources.

Furthermore, Roberta saw herself as an essential resource in the smart learning space. She was the person who set up high expectations for learning, knew the students and was responsible for orchestrating all resources according to the students' prior knowledge and make visible the purpose and requirements of the tasks to be completed (Harris et al., 2020). Roberta recognised the need to address individual needs and strategically used the smart environment to implement her teaching plans and achieve her goals.

The students used the technology tools embedded in the smart classroom as well as mobile devices, apps and quality resources at any time, space and pace. Technology also served as a window of opportunity to publish students' work to local and global audiences; thus, giving students real-life incentives for producing high-quality work and at the same time creating a bridge between school and the outside world (Atkins et al., 2010). Educational resources were stored on the cloud and made instantly available to students as a playlist to scaffold individual learning (Vesin et al., 2018; Wu et al., 2021). Roberta had managed to construct a flexible learning environment where all students could work independently by using a plethora of resources to achieve the goals of the lessons. The strategic use of these resources allowed the teacher to advance students' knowledge by considering their individual learning needs (Reed & Bower, 2011). The students had access to all the necessary resources designed to expand their knowledge and skills. They received digital support related to what needed to be completed at each stage of the lesson, a fundamental requirement of intelligent learning environments (Wu et al., 2021). `

Challenges and Digital Solutions Related to Space

The combination of technologies selected by Roberta, the video tutorials and everything that the Internet has to offer appeared to impact teaching and learning during visual art classes. The technologies and resources facilitated the creation of novel learning spaces within the physical environment, extending into digital spaces. Students used these spaces seamlessly with minimum assistance from the teacher to scaffold their learning and complete tasks (Daniela, 2019). Their devices became the one-stop for almost everything allowing students to enter and exit the learning spaces to complete given tasks at any time. Moreover, the smart classroom brought the real world into the learning space and students were exposed to high-quality works created by real artists and the techniques they used. Simultaneously, the teacher's role expanded to a significant other, guiding and facilitating learning as required (Reed & Bower, 2011). A delicate and balanced orchestration of teaching instructions, learning resources and technological tools allowed Roberta to maximise teaching and learning effectiveness while "being sensitive to individual differences in abilities, needs, and motivations among learners" (De Corte, 2010, p. 53). Students no longer had to wait for the teacher or ask 'embarrassing' questions in front of their peers. Their active interaction with the learning space, which included the teacher, more knowledgeable others, digital multimedia resources and tools, and the freedom to regulate information flow, appeared to impact learning outcomes positively. In line with previous studies, Roberta knew that technology by itself was not enough to create a highly engaging learning space; "to sustain student engagement in learning requires designing rich, authentic tasks that provide meaningful learning experiences for students" (Garcia & Lock, 2011, p. 1496).

Moreover, the smart learning environment became efficient and flexible at minimising students' chances of being distracted by incoming messages or temptations to switch from one task to another (May & Elder, 2018). In this smart environment, the students focused on the core business of learning, and the teacher concentrated on planning, teaching, providing meaningful feedback and guiding every student to success. From Roberta's perspective, the young artists appear to be immersed in their artwork within the smart learning space, enjoying the flow of experiences, controlling their learning, being free from public criticism and creating whilst surrounded by like-minded peers (Wu et al., 2021).

As indicated in **Table 1**, in this smart learning space, the teacher and the students know why, how and what tools to use to optimise time, space and resources.

Table 1. Using smart learning spaces to optimise time, space and resources

Using smart learning spaces to optimise time, space and resources		
Why	How	What
To achieve what was not possible before the introduction of smart classrooms. For students to actively participate in lessons and regulate the flow of information according to their needs.	Teacher Knowing the students Building on prior knowledge Explicit teaching of new concepts Providing ongoing feedback Setting high expectations Challenging students Addressing individual needs Making real-life connections Creating meaningful resources Gathering resources from around the globe Using the smart space to automate routine tasks Fostering a supportive and collaborative learning space Students Actively engaging in their learning Spending more time on task Regulating the flow of information Learning from information saved on machines from each other and experts Reflecting on their learning Using digital resources and specific tools to complete certain tasks Creating artwork for a real audience	Mobile devices Beacon Cloud server for storage digital pin-board Teacher created content Internet resources Apps YouTube video tutorials Design briefs Clear goals Exemplars Rubrics Real-life audience

CONCLUSION

Roberta was eager to work in a smart learning space and excited by the new potential for improving teaching and learning practices, which had been a career-long quest for her. Studies in this field suggest that the potential of technology is directly related to the effective use by both the teacher and the students (May & Elder, 2018; Ross et al., 2010; Valiente, 2010). In this case study, two significant phenomena contributed to teaching and learning effectiveness. Firstly, the harmonious and balanced use of the smart classroom system by both the teacher and the students. Secondly, their proactive, positive attitude and perceived usefulness and easiness of operating in this new environment. These factors allowed Roberta to focus on what mattered most for her; the explicit teaching of art concepts, guiding students step by step, providing individual feedback and encouragement for the maximum time possible while technology acted as a seamless enabler for better teaching (Vesin et al., 2018).

On the other hand, the students could self-regulate their learning and accomplish the program's objectives regardless of their abilities. The smart classroom made it easy for the students to control their learning, stay connected, access experts, and learn from resources at their fingertips. A process that may contribute to empowering learners to make smarter choices (Dron, 2018).

We note that Roberta did not identify any drawbacks related to teaching and learning in a smart classroom. However, it was evident through her reflections that without prior preparation, purpose and planning about how to best harness the potential of this new system for teaching and learning, the smart classroom would have been of no use to both Roberta and her students. Indeed, it was Roberta's actions that made the smart space a useful educational system. She combined different ideas and strategies to create practical solutions to specific challenges related to the limitations posed by time, physical space and resources, demonstrating that a smart classroom, like any other digital tool, by itself has no impact on teaching and learning (Adedokun-Shittu & Shittu, 2011; Dron, 2018). Roberta seized the opportunity, created by the smart classroom, to concentrate more on the direct teaching of small groups and individuals as needed. She appeared to have

worked out a balanced and efficient approach between routine tasks automated by the technology-fueled classroom and those manually carried out by herself and the students.

This study revealed that smart learning spaces could be used to address educational challenges related to time, space and resources provided teachers and students know why, how, when and what tools and resources to use to complete specific tasks. In the context of this study, we define smart classrooms as the convergence of face-to-face and asynchronous teaching and learning spaces. It is not the case of one over the other. The smart learning space pushes learning resources to students as a playlist, in the presence of the teacher, who carefully guides them to success.

Roberta remained a key player, engaging in explicit instruction of specific concepts, providing targeted feedback, setting up high expectations, and designing, creating, and curating digital content and tools that matched the students' needs. The students had more choices related to the resources, the tools and the strategies that best suited their needs. As an expert teacher, Roberta had a positive mindset and was determined to use the smart classroom to develop highly achieving, self-regulated learners. According to (Dron, 2018, p. 17), "a smart learning environment is one in which the main criterion for adaptational success is successful learning."

LIMITATIONS

We acknowledge that this is a single study focusing on the lived experiences of a visual and technological fluent art teacher delivering lessons in a smart classroom that combines several digital tools and resources to automate routine tasks. Her reflections are mainly from her experiences with a group of students who are well behaved and well supported technologically. As such, this case study cannot be generalised to other settings under different conditions. More studies are required to include students with behavioural and learning difficulties as well as the incorporation of other emerging technologies in the smart classroom, such as artificial intelligence, big data and augmented reality.

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