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Introducing Tablets to the Classroom: A School Improvement Plan

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Abstract

At a privately owned, fee-paying, international school in Cambodia, parents believe that their children are receiving the best possible education. The school advertises that it uses cutting-edge technology, however, in the primary school this technology is restricted to an out-of-date computer lab. The students at this school are not able to utilize mobile devices, such as tablets, to assist with their learning. The lack of devices has hampered student achievement, especially in the area of the technology skills required for the 21st century. This school improvement plan aims to change the way students at the school learn. This plan will be accomplished by first creating the role of a technology coordinator who will then train the staff on using tablet devices to aid student learning and then obtaining the devices. Several options for how to obtain devices are discussed. The literature review focuses on the academic benefits of using mobile technology in the classroom as well as the benefits the tablets have on student motivation and the classroom atmosphere.

Keywords: tablet-based learning, technology integration, school improvement plan

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The world we live in has become increasingly more digital; devices that connect to the internet have become so ubiquitous that even the youngest learners use devices at home. Schools around the world have adapted the teaching and learning to be more harmonious with the world we live in. According to a study by the UK Department for Education (2021), 97% of English primary schools have interactive whiteboards, 89% of English primary schools provide tablets for teachers to use and 88% of the responding schools in England have tablets for student use. The use of technology in the classroom has contributed to improved academic performance and will continue to do so. Schools that have increased the device usage for their primary students have enabled these students to learn in a way that prepares them for the world of the future. The problem is that at the private school in Cambodia students do not have access to any type of mobile learning; in fact, students' access to computers is limited to the once-weekly computing lesson. Due to this, students are falling behind their international peers in their ability to navigate in the world of today.

Students engaged in 21st-century learning are expected to take a more active role in their education. They become discoverers of knowledge with control and ownership rather than sitting idly as sponges as young students were expected to be in previous generations. In addition to taking a more active role in their learning, students are expected to develop information literacy, media literacy, and technology literacy. With students being restricted to one lesson of computing a week, in a designated computer room, students at the school are not able to progress their skills in these literacies, nor are they practicing the necessary skills of communicating their ideas outside of the walls of the classroom.

The purpose of this school improvement plan is to enable students at a privately-owned, international school in Cambodia the same opportunities for learning through mobile devices, such as iPads, that students around the world are already enjoying. The focus is on improving the access to digital devices, such as iPads, in the primary school classrooms. The hope is that by implementing this school improvement plan, students at the school will have access to iPads to improve their academic performance as well as improve their motivation to learn.

In order to complete this school improvement plan, extensive research was conducted to determine whether tablet devices have indeed improved achievement in mathematics, literacy, and motivation, as well as the influence of tablets on the classroom atmosphere. The research studies included in the literature review were all published within the last ten years with more than eighty percent of them published within the last five years. Several databases housing various respected, peer-reviewed journals were consulted. The studies included in the literature review were conducted over the entire range of preschool and elementary school. The studies were conducted in a variety of locations including various places in the developing world.

Through this extensive research, tablet-based learning was found to enable students to make substantial gains in mathematics and literacy. The classroom atmosphere also changed when tablets were introduced into a classroom. Students became more motivated and engaged in their learning. The focus in the classroom shifted from the teacher and onto the students allowing students to take control of their learning and progress at their own pace.

The research regarding academic performance will be presented first in the literature review. The benefits of tablet use on oral comprehension, reading comprehension, and writing will be looked at under the literacy heading. Mathematics improvement will be featured next. After that, it is important to discuss the added motivation students have for learning when tablets

are used effectively in the classroom. Finally, the literature describing the effect tablets have on the classroom atmosphere will be discussed. This literature review will provide the basis for implementing a plan to introduce tablets into the primary school classrooms at the international school.

Review of the Literature

Benefits of tablet use in literacy

Literature has shown that using mobile devices benefits students who are learning English as an additional language. Ok and Ratliffe (2018) systematically reviewed studies that had previously been conducted and published regarding using mobile devices for teaching English language learners in the United States. They found that it is important to note that mobile devices include phones, tablets, e-readers, and other handheld devices. Through strict examination of eleven studies, which were conducted after 2012 and included over 900 students, they concluded that the results indicated a promising effect on English language development as well as students' ability to engage with content from other subjects. In addition, the studies showed that students using devices spent a long time engaging with the academic content that overall led to improved learning. The researchers examined multiple studies that together indicated improved achievement for English language learners implying that the benefits of the devices outweigh perceived negative effects.

Just as Ok and Ratliffe (2018) researched the effect of devices being used with English language learners, Aldossary et al. (2021) did as well. However, their study focused on preschool children who were learning English as an additional language as they worked with an iPad app under the direction of their teacher. The device was also available for the children's independent use at other times. After nine weeks, the researchers found that the students had increased their active vocabulary as they interacted with each other more. Equally important, the application provided a richer stimulus for conversations amongst the children than traditional methods thus facilitating a greater level of social interaction. This finding contradicts the idea that tablet-based learning will cause students to become more isolated and have increased difficulty with social

interaction. Moreover, the findings seem to indicate that the interaction between the students due to using the app increased the ability of young students to talk about their learning and share their knowledge. The gains made by English language learners in the study by Aldossary et al. (2021) echo the findings made by Ok and Ratliffe.

Studies have been conducted on the benefits of interactive devices on reading skills. D'Agostino et al. (2016) investigated whether an iPad app could help first-grade students who are struggling readers improve their letter identification skills. Students were randomly assigned to work on an iPad or use traditional magnetic letters; the activities conducted with the two groups were designed to be nearly identical. Based on the findings, the groups that used the iPad throughout the 20-week study had significantly higher scores on tests related to letter recognition and identification, an important first step in learning to read. D'Agostino et al. (2016) determined that the use of iPads had a greater benefit than traditional methods when working with students who have been identified as struggling readers.

Research has also been completed on examining the benefits of using devices on reading comprehension. Delacruz (2014) studied this by giving individual tablets to the highest and lowest reading groups in a fourth-grade class. Using the devices, students were able to access an application that contained an e-book created by the teacher as well as poll questions that allowed the opportunity for every student to answer. The application required students to draw their understanding of key vocabulary words and then administered a comprehension quiz. Using the device, every student was able to answer every poll question, which is not the case in guided reading sessions conducted without a device. In addition, the application gave instant feedback to the students about their performance. While findings from this study were related to motivation, which will be discussed later, the findings also determined that the students achieved higher

results on the quiz than they would have done normally. This higher result was especially true of the students who were English language learners. In other words, English language learners were able to construct a higher level of understanding of a text when it was presented using multiple modes through the use of the tablet device. Tablets are an effective way to conduct guided reading groups (Delacruz, 2014).

Comparable results concerning reading comprehension were found by Iyare et al. (2018) when they investigated the extent that which interactive technology would improve third graders' reading comprehension. Students were divided into two groups, one of which was taught using traditional methods and the other that was taught using technology in the computer lab. Both groups studied the same topics and were given the same pre-and post-tests. The findings showed that the difference in reading comprehension between the two groups was significant. The students who were taught using interactive technology scored, as a mean, 50.09 on the post-test compared to 27.83 for those students who were taught using traditional methods. The experimental group also showed a higher percentage of improvement based on comparing the pre-and post-study tests.

Moon et al. (2017) conducted research concerning using iPad apps to improve reading comprehension. In contrast to other studies, Moon et al. (2017) focused on fifth-grade students with the majority of them being native English speakers. The fifth-grade students were paired with university students who guided them through the use of the apps over the course of eight weeks. The apps were not used to introduce a text, instead, the work on the iPad was based on the weekly reading presented in the students' regular textbook. The iPad was used to practice specific literacy skills through the creation of various projects that extended the understanding of the initial text. The projects ranged from creating concept maps to creating comics, animations,

and movie trailers. Students' self-assessment indicated that they believed they understood more of what they read than they did prior to the study. This belief was confirmed when comparing the students' results on pre-and post-study assessments of reading comprehension. Students scored significantly higher on the standardized reading comprehension assessment after the intervention than they had before it. By looking at these results and comparing them to the results from Iyare et al. (2018) the positive influence on reading comprehension can be recognized.

Another fundamental aspect of reading is reading fluency. Mize and Park (2020) evaluated the effect using iPads would have on fourth-grade students with reading difficulties. During each session with an iPad, students read for one minute and were then directed to look up words using the dictionary application. The dictionary application included audio pronunciations to further assist the students. Students read the texts three times, which was tracked using a second application. This second application had a reward component. After reading a text three times, the session concluded by having the student read an unfamiliar text. The number of words read correctly per minute was calculated for each session. By examining the data concerning the number of words read correctly per minute, it was determined that every student showed substantial increases in fluency. While the fluency was greater after rereading familiar texts, this was found to impact the fluency of texts that were presented for the first time. The work of Mize & Park allows direct observation of the effect repeated readings while utilizing a dictionary application have on the ability to increase a struggling student's reading fluency.

iPads have also been found to be a vehicle to improve students' ability to respond to a text across all primary school grade levels in writing as well. In an international study based in Ireland and Northern Ireland, Dunn & Sweeney (2018) investigated the use of iPads for compositional writing. This study was conducted in six classes of students aged 6-7 years old.

Through observation and interviews conducted with the teachers of these classes, it was determined that using the iPad allowed students a greater opportunity for choice in their writing which in turn meant greater creativity. The students were able to add pictures and speech bubbles, they were able to use different colors, and they were even able to record themselves and play it back. All these options meant students had more choice and a greater level of creativity and higher quality. The ability to record themselves and play it back was useful as it allowed them the ability to express themselves and produce longer creative works. This study advocated for a balanced approach to using the devices in creative writing as handwriting and spelling need to be practiced as well. Nevertheless, the use of the iPad in the students' ability to construct creative stories at a higher level makes this a tool worth using in the classroom. Similarly, in a study by Cordero et al. (2018), tablets were used by third-graders at a public school in Costa Rica. Students first read an interactive story in which they were tasked to drag items from the pictures. They were then asked to create a picture related to what they had read. The items that they dragged were displayed to assist them. Finally, students were required to write a narration about their picture. The use of a variety of modes used to access the story -text, still images, and moveable objects- allowed students diverse ways of interacting with the story that allowed students to access it in the mode most related to their learning method and their language ability. Students whose language ability was higher tended to write more creative stories based on the moveable objects while emerging readers and writers used these moveable objects to help them create a retelling of the story. Using moveable objects, which are not as easily created without the use of the devices, students were able to demonstrate their understanding of a text at a higher level. Thus, this increased demonstration of comprehension proves that tablet use can be beneficial not just for obtaining new vocabulary (Aldossary et al., 2021), improving reading

comprehension (Delacruz, 2014; Iyare et al., 2018; Mize & Park, 2020; Moon et al., 2017) but also to facilitate improvement in creative writing.

Benefits of tablet use in mathematics

Preschool students under the age of five begin to identify numbers, shapes, and patterns; they also begin counting and developing problem-solving skills. The effect that an iPad could have on these early mathematical skills was investigated by Disney et al. (2019) in Australia. The 80 children in this study were not given formal instruction via the iPad, rather they played pre-selected game applications using their own initiative over the course of two weeks. The improvements were significant in all five categories assessed. Every child improved their ability to count, 95% percent of the students improved in problem-solving and 50% improved their ability to recognize shapes. The findings indicated that there was more progress made by the 3-year-old children than the 4-year-old children, this may be related to the level of the applications that were chosen. Regardless, the fact that every student made progress simply by playing games at their leisure indicates that these are tools that should be made available to every student.

Outhwaite et al. (2019) conducted a large-scale study in 12 schools in the United Kingdom and involved nearly 400 four and five-year-old student participants. Each group received the regular, whole-class instruction as well as an additional component. One group's additional component was a small group activity, another group's additional component was to utilize a tablet with a pre-installed mathematics application. The final group received both additional components, meaning that they spent more time on the subject than the other two groups. Students using the tablets could work at their own pace but were required to receive a perfect score on an end-of-topic quiz before they were allowed to move to the next topic. Despite receiving extra instruction, the difference in the learning gains made between the group that used

the tablet and the group that used the tablet and had small group instruction was minimal. Both groups made greater gains than the group that did not use the tablet at all. Outhwaite et al. (2019) determined through multiple assessments that these students were at least two months ahead in their learning than students who did not have access to the tablet applications. Using a tablet can replace other activities in the math classroom without requiring additional time devoted to the subject.

Another large-scale study conducted with 365 kindergarten children took place in Greece. Papadakis et al. (2018) investigated whether tablets were more effective than computers when being utilized for mathematics instruction with young children. Both the group using tablets and the one using computers used the same software, while the third group was given manipulatives to simulate the games. While both groups working with the digital software outperformed the control group, the group using tablets scored significantly higher than those using personal computers. Multiple studies have shown that using devices is an effective way to increase young students' mathematical skills (Disney et al., 2019; Outhwaite et al., 2019). While using computers also helps with student achievement, tablets are a more effective way to deliver instruction due to their ease of use and familiarity for young children.

Another study that looked at supplementing the regular mathematics lessons with digital devices took place in a standard level one class in Tanzania (Lee & Choi, 2020). Standard level one is the first year of school, however, students can be between six and ten years old. The control group received eight lessons of math per week and followed the regular curriculum. The experimental group had three standard lessons and five lessons that were conducted entirely on the tablets. During these sessions, students were allowed to choose between the nine math applications installed and work at their own pace. Similar to other studies, the students who used

the tablets outperformed their peers significantly in three of the five tasks assessed. In addition, those using the tablets made substantial gains in all five tasks while the control group only registered gains on two of those tasks. The ability of tablets to allow for self-paced, individualized instruction led to considerably improved achievement.

In contrast, a study was conducted by Carr (2012) that involved more than one hundred fifth-grade students. One group of students utilized the iPads as 1:1 devices for activities in their daily mathematics lessons for nine weeks. When comparing the results of the pre-and post-study assessments, the students in the group that utilized the iPads improved more than the control group. However, the difference in growth between the two groups was minimal enough that it could be considered insignificant. Utilizing the iPads in the way that they were done in this study was ineffective, but at the same time, this study cannot prove that iPads are not beneficial when utilized in other manners. Devices such as iPads can be an excellent teaching tool, but the way they are used can determine how effective they are.

While Carr (2012) suggested that using the devices did not influence mathematical achievement, studies conducted later with improved uses of the technology do not support the earlier research. Further research on using tablets for additional activities in mathematics occurred with students between the ages of nine and eleven. Fabian et al. (2018) conducted their research in Scotland with two classes over eight sessions. Students in both classes worked on the same mathematical concepts but one class used the normal curriculum while the other experienced collaborative, tablet-based activities indoors and outdoors. The group using the normal curriculum also completed hands-on projects of the type normally done in the classroom. The researchers found that there was a significant difference in scores on pre-and post-assessments with the class that used the tablet making substantial gains compared to the other

group. Thus, the use of tablets to provide an extension to the lesson resulted in improved understanding for the students.

Most studies conducted in the last five years recognize that the student participants are likely to already have experience with using a handheld device, even preschool children (Disney et al, 2019). However, none of the third-grade students that participated in Halloluwa et al.'s (2018) study in Sri Lanka had ever used such a device before the study. As digital games have been found to help students learn (Disney et al., 2018; Fokides, 2018) it was determined that the mathematical concept would be introduced by the class teacher and then students would be allowed to play games on the devices. After one session, the difference between the two groups was apparent. After a second session with the devices, the difference between the growth of the two groups was substantial. Despite technical issues, the results indicate that learning via tablet-based games is viable even for students with no prior experience using this type of device.

Just as Disney et al. (2019) found remarkable results in mathematical achievement by allowing students to play mathematics-based game applications, Fokides (2018) had previously found comparable results. Fokides (2018), investigated the use of games with primary-aged students rather than preschool-aged children. More than 200 first, fourth, and sixth grades students at three public schools in Greece were separated into three groups. The first group used the devices to access digital games, the second group was taught using a constructivist approach and the final group had their normal lessons. Another contrasting point to the study by Disney et al. (2018) is that the students in this study were given direct instruction about the topic prior to playing the games as well as instruction being embedded into the games themselves. Thus, students only used the devices for part of the lesson. Contrary to what Carr (2012) discovered in similar circumstances, students in this study outperformed students without access to digital

devices. Although the games were of a drill-and-practice nature, the effect was still evident. Those playing the games outscored the students learning in the traditional manner in every aspect evaluated. They outscored those using a constructivist approach in four aspects while the opposite was true in two cases. This use of technology improves students' results even when compared with other modern teaching methods (Fabian et al., 2019; Fokides, 2018).

Direct instruction prior to using applications on the devices influenced gains in mathematical achievement (Fokides, 2019; Halloluwa et al., 2018). However, gains in mathematical achievement are noticeable even without prior direct instruction (Disney et al., 2019) In a large-scale Swedish study involving nearly 300 low achieving second-grade students in 27 classes, no direct instruction was found to be necessary (Hassler Hallstedt et al., 2018). This study also investigated whether training students' working memory had any effect on their results. As every student in this study continued with their regular mathematics lessons as well, every group made progress. The progress between the control and placebo groups was almost identical, as was the progress between the two groups who trained using the mathematics application. There was no statistical difference found between the students who trained their working memory and those who merely trained using the math application. Through multiple modes of assessment, the authors of the study determined that students who used the math application made gains of up to half a year of schooling above those who did not use it. These gains were nominal when the researchers returned to assess the students again one year after the intervention ended. While the use of devices led to increased achievement in mathematical performance, without their continued use, other students were able to narrow that gap within a year. Digital devices can have a positive effect after just one session, however, multiple uses lead

to even greater gains (Halloluwa et al., 2018). Continued use is needed to ensure that those gains are not lost.

The effects of tablet use on student motivation:

It is a well-regarded fact that students are more motivated when they are having fun. Fokides (2017) found that fun played a key role in learning and was a factor in the increased learning outcomes exhibited by the students. Based on a study by Iyare et al. (2018)**,** learning is more fun when the learner is actively involved; fun is increased when learning is assisted by technology. When students were asked, they stated that using devices for learning was not only fun but also useful (Dunn & Sweeney, 2018; Fabian et al., 2018). The introduction of devices into the classroom made students enthusiastic about learning (Palaigeorgiou & Papadopoulou, 2018). Students self-reported that their enjoyment of mathematics had increased by using technology (Fabian et al., 2018). Additionally, teachers observed that the students were motivated because the students found the activities to be fun rather than academic (Dunn & Sweeney, 2018; Mize & Park, 2020).

Another way that students were motivated while engaged in device-based learning was through the use of games. Games attracted the students and motivated them to learn more (Fokides, 2017). The games also added an element of friendly competition (Halloluwa et al., 2017)**.** This competition motivated students to learn the course material so they would not make mistakes (Delacruz, 2014). The games were rated as one of the most positive experiences and contributed to students' engagement (Cordero et al., 2018).

Additionally, the range of interactive features motivated and engaged the students. Interactivity was considered to be the most significant reason children enjoyed the sessions using the devices (Cordero et al., 2018). Even small instances of interactivity such as the movement

required to turn the page helped to motivate students (Iyare et al., 2018). Between the interactivity and the ability to watch the characters, students preferred reading using the devices **(**Aldossary et al., 2021**;** Delacruz, 2014; Iyare et al., 2018). The interactivity of the touchscreen features used while reading on a tablet transferred over to students' engagement and motivation in writing on the table (Cordero et al., 2018). In research from D'Agostino et al. (2016), teachers noted that the iPad increased student motivation in letter identification work even when compared to students using physical magnetic letters. Working with devices, especially those with touchscreens, afforded students the possibility to be actively engaged in their learning, thus, the students were more motivated.

Another feature that motivated students when using the devices was the speed at which the devices showed the results of the work being done (Dunn & Sweeney, 2018). Children in the study by Flewitt et al. (2014) reported that they enjoyed the responsive nature of the devices and how quickly the devices showed results when trying to color a picture digitally. In addition to the speed at which the devices completed the work, student participants were motivated by how quickly the devices assessed their work and gave feedback (Delacruz, 2014; Fabian et al., 2018; Palaigeorgiou & Papadopoulou, 2018). The immediate feedback motivated children and kept them engaged in their learning (Flewitt et al., 2014).

The feedback that was given by the applications led students to be more motivated to complete their final products. Students recognized that the use of devices allowed them to create final products that could not have been done using traditional methods **(**Dunn & Sweeney, 2018; Flewitt et al., 2014; Moon et al., 2016)**.** Creating final products that were at a higher-level motivated students to show more advanced skills and students were even willing to do more work to show these skills (Flewitt et al., 2014). While students may find writing on paper boring,

the devices helped them enjoy writing and take pride in the work they produced (Dunn & Sweeney, 2018). Both teachers and students commented on the choices that students were able to make while implementing device-based learning (Dunn & Sweeney, 2018). The ability to use their own creativity motivated students to complete their products to a higher level (Dunn & Sweeney, 2018; Flewitt et al., 2014).

Students of all ages know that they learn at a different pace than their peers. Some students learn faster while others require more time. Too often in a classroom, students are slowed down to allow others to have the material repeated for them. The feeling of waiting for other students can be detrimental to the motivation level of the students in the class. Students enjoyed the ability to learn at their own pace when using devices (Palaigeorgiou & Papadopoulou, 2018). Students in the same study by Palaigeorgiou & Papadopoulou (2018) found it motivating to be able to reread a text or redo an activity when they needed to; they also appreciated that they could move faster if they were able. This appreciation of working independently and at their own pace motivated students (Flewitt et al., 2014).

Students lose motivation while waiting for other students to catch up, concurrently, those students who need more time to complete work also lose motivation for learning. The use of devices in the classroom allows everyone to work at their own pace. Teachers reported that during the lessons that used devices they saw shy children become more engaged (Flewitt et al., 2014). Teachers also reported that the first time they had seen certain reluctant students participate at all was during lessons with devices (Palaigeorgiou & Papadopoulou, 2018)**.** Teachers saw evidence that the students were motivated when the teachers realized that the work submitted by normally reluctant writers was of a higher quality than usual (Dunn & Sweeney, 2018). Teachers investigating the use of devices on reading also found that the devices motivated

struggling readers (Mize & Park, 2020). Students were eager to learn when using the devices as they were then able to help their peers (Halloluwa et al., 2017).

Not only do children work at different speeds, but students in a classroom possess different ability levels. While students may need more support to succeed other students need less support. Teachers who implemented device-based learning in their classrooms found that every student achieved a level of success due to the digital scaffolding easily available through the applications used (Cordero et al., 2018; Dunn & Sweeney, 2018). Students also recognized that they were given assistance through the applications when they made mistakes. The assistance was especially apparent when students were writing. The use of predictive text and autocorrect motivated students so they were not stuck on a word and could proceed with their ideas easier (Dunn & Sweeney, 2018). Dunn & Sweeney (2018) also found that students were motivated by how easy it was for them to edit their mistakes and amend their work.

Students are less motivated and less enthusiastic about learning when the experience is unrelated to their daily lives. When the classroom learning reflects the society in which students live, they are more motivated to learn (Cordero et al., 2018). The first widely released, mobile, touchscreen device, the iPhone, is older than current primary students. They have never lived in a world without these devices. Using mobile, touchscreen devices in the classroom is more relevant to students' lives thus they are more motivated when device-based learning is implemented (Dunn & Sweeney, 2018).

Overall, students were highly positive about the experience in the studies that were examined for this literacy review. In multiple studies, students believed that they understood the lessons better when they had the ability to learn through devices (Delacruz, 2014; Fabian et al., 2018; Iyare et al., 2018; Palaigeorgiou & Papadopoulou, 2018). Other students believed that they

learned quicker or easier using the devices (Fabian et al., 2018; Halloluwa et al., 2017; Palaigeorgiou & Papadopoulou, 2018). Students thought device-based learning was beneficial and more enjoyable (Delacruz, 2014; Moon et al., 2016).

As students believed they learned better and had fun while doing it, students resoundingly preferred learning with the help of a tablet. Cordero et al. (2018) found that 90.2% of the student participants in their study preferred reading from a tablet rather than a book. Fourteen out of 16 students asked in the study by Iyare et al. (2018) responded that they wanted their teacher to use more handheld technology in the classroom. The desire to use more technology as a teaching aid was echoed by the student participants in the study by Palaigeorgiou & Papadopoulou (2018). Students who participated in studies that involved the researchers bringing the devices with them eagerly anticipated the activities and wanted the researchers to return (Fabian et al., 2018; Halloluwa et al., 2017; Moon et al., 2016)**.** Students expressing such interest speaks highly of their desire to continue using device-based learning. The desire to continue with this style of learning emphasizes how fun and motivating the devices made learning.

The motivational benefits of using a device in the classroom did not end at the classroom door. In Dunn's & Sweeney's 2018 study, teachers reported that students asked if they could use the applications at home, suggesting that students enjoyed the work being done and that the students wanted to work on similar activities in their free time. In addition, children self-reported an increase in their enjoyment of recreational reading after previously reading on a device during class (Iyare et al., 2018; Mize & Park, 2020; Moon et al., 2016).

The effect of tablets on the classroom atmosphere

Adversaries of using mobile devices in classrooms refer to the decline of children's attention span. However, children can become more focused on their work when using a device

for learning. Flewitt et al. (2014) noted that even children who usually had short attention spans were able to remain focused for extended periods of time when they were using a device for learning. The teachers in the study observed higher levels of concentration from the students. Teachers in other studies voiced similar observations. Student teachers reported that every student remained focused throughout the activity (Cordero et al., 2018). Other teachers stated that students were more highly engaged and more motivated to complete their work (Fabian et al., 2018; Halloluwa et al., 2017). Even students admitted that they were more focused and reflective (Palaigeorgiou & Papadopoulou, 2018).

While teacher-centric classrooms are becoming less common in the United States, in other areas such as in Asia and developing countries around the world, classrooms are still led by an authoritative teacher who imparts all the necessary information. Authoritative, teacher-centric classrooms are also common in areas with overcrowded classrooms, which leads to struggling students being neglected. When Halloluwa et al. (2017) introduced tablets into an overcrowded, Sri Lankan classroom the whole atmosphere of the classroom changed. The teacher no longer stood at the front of the room, but instead walked around and helped students. Students were noticed to be more willing to ask questions and soon took charge of their own learning. Thus, every student was actively involved in their learning. Overall, teaching and learning in the classroom became modernized and student centric. The teacher in the study remarked that instructing the group using the tablets was not just easier, but also more fun. Teachers are always looking for ways to reduce the workload without allowing students' learning to suffer; the introduction of tablets into a classroom does that.

When tablets were introduced to the Sri Lankan classroom, students also became more collaborative (Halloluwa et al., 2017). Students were no longer chastised for talking, instead,

they were encouraged to talk to their peers and solve problems together. When students are allowed to learn using tablets, the students not only help each other, but the students regularly discuss the learning content without being forced to have the discussion by the teacher (Delacruz, 2014; Halloluwa et al, 2018; Palaigeorgiou & Papadopoulou, 2018). When discussions about the content happen naturally between students, students feel freer in their discussions, experience less stress, and remark that they think more deeply (Palaigeorgiou & Papadopoulou, 2018). Introducing tablet-based learning allows for constant, natural collaboration amongst the students.

Need for Plan

School information

The school is a privately owned, fee-paying international school located in Cambodia. There are three sections of the school spread out on two nearby campuses. The primary campus contains both the early years' section (nursery and kindergartens) and the primary years (years one-six). The primary campus is well equipped with an ICT lab, library, sports field, a toddler pool, and a 25m swimming pool. Students in the primary school section have the choice to study the full day in English following the National Curriculum of England or to study part-time in English following just the core subjects and then study the second half of the day following the Khmer National Curriculum. In addition, the school requires students to study either French or Mandarin for at least one lesson a week.

Enrolment at the school has been severely affected by the pandemic as school closures left parents unwilling to pay the high fees. For other parents, the loss of income due to the lack of tourists meant that the school was no longer affordable. The current enrolment in the three classes of early years is 55 students and there are 129 students spread over the six years in the primary section. Of those in the primary section, approximately 83% of students currently opt to split their time between the English and Khmer curriculum. Prior to the pandemic, the number studying the Khmer language hovered around 31%.

When the school was required to maintain distance learning, parents opted to switch to the Khmer curriculum as they were able to assist their children with those lessons. Compared to before the pandemic, the school enrolment has a higher percentage of local versus foreign students due to expatriates returning to their countries. This higher percentage of local students also contributed to the larger percentage of students following the Khmer curriculum. At present,

only 14% of students do not have at least one Khmer parent, most of these students are from South Korea.

The teaching staff at the primary campus is much more diverse. Currently, teachers covering the English curriculum hail from six countries. There is a local teaching assistant in each classroom as well. There are up to four assistants in each room of the early years' section.

Opportunities for parents to get involved at the school are extremely limited. There is no organization such as a PTA. While parents have been asked to join the ClassDojo page for each of their students, not every parent does. In some year groups, there has been a 90% enrollment of parents, while in other year groups the parent enrollment is as low as 40%. This fluctuation in parent involvement is largely due to many parents not being able to speak English and the inability of the site to translate to the local language. Despite the language difficulties, parent-teacher conferences are well attended with almost 90% of parents attending at least one per year. Teachers are highly respected, and parents accept the decisions made by the classroom teachers.

The school's motto stresses the unity and diversity of the school community. The mission statement of the school is not concise but emphasizes empowering students to be lifelong learners who are respectful and responsible global citizens who value the differences in others.

As the school has had closures due to Covid for the past three academic years, there is no current student learning goal. Previous goals included improving guiding reading and improving students' creative writing. Each was a goal for one year, but teachers had no access to the school-wide data to see if any progress had been made toward these school-wide goals.

Staff turnover is high; teachers regularly leave mid-contract. Those that complete their first contract stay an average of four years. More than twenty teachers between the two campuses

have not completed their contracts in the last three years. Therefore, commenting on teachers' work or instructional strategies would lead to inaccuracies.

Professional development opportunities are near non-existent. Occasionally, informal development occurs during the weekly staff meeting, but these are offered by current staff and are not backed by any professional organization. In the past, topics for these professional development meetings included improving the marking of students' work and child safeguarding.

The curriculum used is the National Curriculum of England. To assist teachers, a turnkey system has been purchased. This system covers the entire curriculum but is intended for use by students in England, therefore, many activities including suggested field trips are irrelevant to the students at the private school in Cambodia. Teachers used to be required to follow the daily lessons and learning objectives quite closely, but in recent years that obligation has been relaxed. All the materials required to teach the turnkey system are accessible on the school network, therefore no textbooks are used in the school.

At the school, primary school students take assessments in mathematics and literacy after each of the three school terms. In mathematics, there are two different assessments administered: the first is a mathematics computation assessment that consists of between 10 and 32 calculations. In this assessment, every question is written in numerical format, none of the questions involve reading, analyzing information, or using higher-level thinking skills. The other assessment administered is the Progress in Understanding Mathematics Assessment (PUMA) offered by a company based in the United Kingdom. These tests are formatted in the same way as the standardized tests used in England and test across the various strands of mathematics as well as problem-solving skills. Similarly, there are two assessments administered each term in

literacy. The first is a creative writing assessment that is set by the individual teachers and scored according to a scale created by the school's former literacy coordinator. The second test is the Progress in Reading Assessments (PiRA). These tests were created by the same company as the PUMA and assess students in reading comprehension, making inferences, and language mechanics. All assessments are marked by the teachers and the raw scores are converted to standardized results that are given in terms of a bell curve. The bell curve is used to compare the students to the average scores earned by the control group the company analyzed. School closures due to the Covid pandemic have impacted the last three school years, thus not all the termly assessments have been conducted.

Based on the data available from the assessments, 18% of students are working below grade level in computation, but 43% are working above grade level. The remaining 40% are working at grade level. According to the results from the PUMA, only 9% of students have not reached the yearly learning objectives, and 28% are working about grade level. PiRA shows that 23% of students are struggling with reading comprehension while 12% are above grade level. In writing, the numbers are quite similar to the reading comprehension scores; 27% are below grade level, and 12% are exceeding expectations. Overall, these results show an impressive level of attainment by students at the school, with the mathematics skills being superior to the literacy skills.

School Improvement Goals

A case can be made that the curriculum and instruction at the school need to be updated. Currently, teachers use either the purchased turnkey system with the plethora of worksheets or materials teachers create themselves and print. While several other countries have created initiatives to give students access to digital devices in the classroom, Cambodia has no such plan.

The school, despite being privately owned and funded, not only does not have a plan to incorporate digital devices in the classroom but currently, such devices are not supposed to be used in the classroom at all. In fact, the only signage on the outside of the classroom doors is a picture symbolizing that no phones are allowed in the room.

Digital literacy, media literacy, and technology literacy are all vital parts of 21st-century learning. In order to teach these literacies effectively, students must have access to devices. The one hour a week that students have a scheduled lesson in the computer lab is barely an adequate amount of time to teach the stand-alone computing curriculum. Adding extra content to that subject will require extra lessons devoted to the subject, which the school cannot accommodate as it would require reduced time for other subjects, whose content is also barely able to be taught in the time allotted. Therefore, adding devices into the classroom would allow these skills to be taught simultaneously with other subject content. Using devices in subjects such as math increases learning in both subjects without taking extra time (Outhwaite et al, 2019).

In addition, the school claims on its website that there is cutting-edge technology available to the students and teachers. Currently, the only technology available to primary school students exists in the computer lab and consists of laptop computers. Laptop computers are no longer considered innovative technology. The addition of tablets, such as iPads, into the classroom, would add validity to that statement while also reinforcing the idea the school puts forth that children must understand how to utilize technology in a broad and balanced curriculum.

During the school closures that affected three school years beginning the 2019-2020 school year, teaching and learning suffered at the school. First, many students only had access to a cell phone. The use of a cell phone for online learning caused multiple problems due to their

small screen and lack of ability to access certain websites. Most classes were unable to use a video-conferencing application for synchronous lessons, so the school adopted the messaging application Telegram as the main platform to deliver lessons. If the school had previously adopted a program to use tablets in the classroom, these could have been lent to students in need.

In addition, because devices were not used regularly in the classroom, students and teachers had no experience with or access to a learning management system (LMS). An LMS facilitates easier use of applications such as Nearpod that assists with learning in every subject and could specifically have been used to continue students learning in guided reading groups (Delacruz, 2014). Additionally, the use of an LMS would have helped students and parents organize their learning as it would have had the capability to show assignments, due dates and if they have been submitted or remained incomplete.

Students had no experience navigating a device for learning. Nor did they have the digital literacy skills necessary to adapt to new applications quickly. The learning of subject knowledge suffered as a result. For students to use technology effectively in a balanced approach, technology needs to be integrated into subject learning.

Accurate data is hard to collect for multiple reasons. First, standardized testing for the 2019-2020 school year was canceled for the last two terms due to closures related to the pandemic. Similarly, in-person schooling and the subsequent standardized testing were canceled for the last term of 2020-2021. Thus, comparing the end-of-year scores with those prior to Covid closures is not possible. Additionally, before Covid, most year groups had a two-form entry, whereas now that is the case with only one. The high departure of students when already dealing with a low sample size makes data collection less valid. Finally, the evaluation measures have changed limiting the ability to use historical data. Using PUMA and PiRA was started in the first

term of 2017, the writing assessment changed during the 2018-2019 school year and the math calculation assessment was only started in the first term of 2019-2020. To complicate matters further, the assessment trackers used, are separated by stages. Therefore, the data collected from years one and two are not carried forward when students enter year three.

For the above-mentioned reasons, two approaches were used to compare the data. First, the test data from every student in year three beginning term one of 2017 was used. According to the average standardized scores for each year, students entering year three in 2021 have the lowest scores since the tests were first administered. The last class to take the tests prior to school closures, only took the tests in term one of 2019. The class average on the PiRA at that time was 97.89 (table 1), while the average score on the PUMA was 106.74 (table 2). These were already the lowest average scores for year three since the school first started administering these tests. However, they were still higher than the results from the students in year three this school year. The latest scores this year on the PiRA and PUMA are 94.64 and 96.52, respectively. While the scores show high academic achievement overall, the decline due to school closures and subsequent online learning is concerning. The decline in test performance indicates that the lack of familiarity with using devices for learning has negatively affected student outcomes.

Table 1

Reading test scores for year 3

	Term 1	Term 2	Term 3
2017-2018	98.83	100.56	104.39
2018-2019	101.81	102.10	107.57
2019-2020	97.89		
2020-2021	100.56	101.71	
2021-2022	94.64	97.30	

Table 2

Math test scores for year 3

	Term 1	Term 2	Term 3
2017-2018	111.75	110.50	113.89
2018-2019	113.86	112.43	115.90
2019-2020	106.74		
2020-2021	108.06	112.86	
2021-2022	103.50	96.52	

Another way the data can be examined is by looking at one class and comparing average results from each year of their schooling. The current year six was selected for this as they are the last class to have an entire year of results that were unaffected by the school closures. The results from previous years show that the year six had reached their highest average scores on both the PiRA (table 3) and PUMA (table 4) the last term they were in class before the Covid closures affected their learning. As with other scores, they are still high above the expected scores, but they have not yet reached their pre-school closure levels. On the last reading test prior to the pandemic, they collectively scored an average of 109.33, on the latest tests, they scored 108.27. This difference is not statistically significant but before the closures they had been progressing, whereas now the scores indicate a lower level of achievement. The scores on the mathematical reasoning tests show a grimmer picture. In term one of 2019, the class averaged 116.05, which is an entire standard deviation above the norm. In the latest tests, taken at the end of term two in 2022 the class averaged 109.53, a significant decline.

Table 3

PiRA results by year for current year 6 class

	Term 1	Term 2	Term 3
Year 3	101.81	102.10	107.57
Year 4	109.33		
Year 5	106.81	105.67	
Year 6	106.86	108.27	

Table 4

PUMA results by year for current year 6 class

	Term 1	Term 2	Term 3
Year 3	113.86	112.43	115.90
Year 4	116.05		
Year 5	111.90	115.29	
Year 6	114.79	109.53	

The negative effect of online learning is more severe when we compare the scores for the internal writing assessment for the same group of students (table 5). In year three, approximately 24% were writing below grade level, that number jumped to 62% at the beginning of year five. According to the latest results, 47% are still writing below the expected level.

Table 5

Number of students achieving each mark in writing

	Year 3			Year 4			Year 5			Year 6		
	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Grade level below	6	5	4	5			13	12			8	
Emerging	5	8	1	9			3	1			6	
Secure	10	8	15	7			5	8			3	
Accelerated	0	0	1	0			0	0			0	
% below expectation	28.6	23.8	23.8	23.8			61.9	57.1			45.5	

Sadly, there is a great deal of missing data that would help to determine how well students are equipped to manage using devices as learning tools. One such piece of data would be what type of device students used while online learning. Students used iPads, iPhones, Android phones, and laptops. Unfortunately, data regarding how many students used each type of device was not collected at a school-wide level. Another piece of data that would be helpful but is non-existent is a measure of students' technological skills. While computing lessons are taught, they are not being done by a specialist teacher and have been done haphazardly. During school closures, these were canceled entirely. Thus, students did not gain the skills necessary to use e-learning platforms.

Analyzing the data shows that learning declined. Multiple factors influenced this decline. However, had students been accustomed to using digital devices for learning the decline could have been prevented. Students would have had the necessary 21st-century skills to adapt to a different type of learning environment.

Plan Implementation

The first step is the most important, it is to convince the stakeholders that bringing devices into the classroom will benefit the students. The research presented in the literature review would need to be condensed and simplified to be presented. The first group that needs to be convinced is the owners of the school and the senior leadership team (SLT). The teachers would then need to be brought on board. Finally, the current parents would need to be convinced.

The owners of the school need assurance that this initiative is not a short-term idea and that any money invested will not be wasted because of changes in learning methods in the near future. The owners will look to the SLT for assistance with this decision. The number of countries that have already adopted a plan to put devices into all schools should help the owners see that this concept is not only a local idea but one that is now being used worldwide. As such, student teachers are now being trained to use such devices in the classroom, in fact, without having devices accessible for learning, the quality of teachers that the school can attract will diminish as newer teachers are already accustomed to having access to devices for teaching and learning. Combining the understanding that newly trained teachers are accustomed to having devices available with the data from the literature review should help to convince the owners and SLT that these are the steps needed to stay competitive in the expanding private school market.

Many of the current teachers have difficulties or an aversion to using technology at all, much less in the classroom. While there are a couple who embrace technology, overall, the current teachers would acknowledge that their skills using a computer are limited to social media and productivity software such as Microsoft Office. Therefore, in order to convince the current teachers that bringing devices into the classroom is beneficial for future learning, they would need to be reassured that they will receive training. In addition, using the data presented in the

literature review concerning the changed atmosphere in the classroom and previous teachers' comments may be of assistance. This group of stakeholders needs to be reassured that the introduction of devices into the classrooms will ease the workload rather than increase it.

Since the pandemic forced schools to be online, parents and caregivers believe that their children have spent too much time online and worry about students' social skills; they worry about students using the devices to play games or watch videos. Parents and caregivers fear that their children will spend the entire day just staring at a screen. Using information from the literature review that focuses on the new ways students collaborate when using devices will help convince the parents and caregivers. In addition, showing the parents and caregivers the added learning benefits will help this group of stakeholders accept the plan.

The second step of the plan would be to appoint a technology coordinator and implement teacher training. The technology coordinator position, while common in schools, does not currently exist at the school. This position would not be a full-time position but could be combined with regular teaching duties in the same way as the current literacy coordinator position. The first duty of the person in this role would be to lead in-service training focusing on two or three applications that teachers could implement easily. The training would take place over the course of several weekly teacher inservice meetings and would allow teachers the chance to become familiar with the applications and how they can use them to increase learning in their classrooms. The technology coordinator would later work with teachers from each grade level on a rotating basis to help those teachers find ways to integrate the devices into their classrooms without causing extra work.

Finally, devices, such as iPads, would need to be obtained. When first implementing this school improvement plan, only fifteen devices would need to be obtained. Fifteen devices would

ensure a ratio of no more than two students to a device and would also leave a device available for the teacher to use. The devices would initially be kept in a secure area and need to be reserved by the teachers in advance. While having shared devices makes logging into different applications more difficult for the younger students, starting with a small number would allow the plan to be implemented without such a large financial commitment. As the devices are used more frequently by teachers with their classes, the owners of the school will feel less reluctant to spend the money as they see they will be used.

Devices could be obtained in multiple ways. First, the school could elicit donations. If that does not work, funding for the devices may come from various sources. First, parents already pay between $500 and $600 a year in fees for registration and materials. A portion of the money from these fees can be diverted for the purchase of the devices. As discounts for purchases of iPads are available for schools this would help with the cost as well. Another option is to impose a one-time ‘technology fee’. A minimal amount such as $50 would net the school enough money to purchase enough devices to be shared amongst the classes. Still, other options would be to apply for grants. Grants for profit-based schools are more difficult to find, however, ISIF Asia, ASEAN Foundation, The Awesome Foundation, and the Michael & Susan Dell Foundation are possible sources of grants.

When these steps -gaining acceptance, introducing the role of a technology coordinator, training staff, and obtaining devices- have been completed, the school will be ready to start implementing device-based learning in the classroom. The goals for a future phase of the project would include obtaining more devices, furthering staff training, and implementing a school-wide learner management system.

Assessment

This school improvement plan focusing on enabling students to have the opportunities for learning through mobile devices in the primary school classroom will be deemed successful once the devices are purchased and being used three times a week in every classroom. Ideally, this level of implementation would be by term three of the 2022-2023 school year.

The first phase of the plan, which is to convince the stakeholders, will ideally take place during term 3 of the 2021-2022 school year. If the stakeholders are convinced prior to the school's summer holiday, the timing of the decision would allow the summer to be used to write grant proposals and secure funding for the initial purchase of devices. After the devices are obtained, training for the teachers can begin. Ideally, this training could happen during the teacher inservice days before the start of the 2022-2023 school year. This timeframe is unlikely and so this training would be held during the weekly inset meetings during term one. By the beginning of term two, teachers should be able to start utilizing the devices in the classroom, at least on a limited basis. As the teachers' confidence concerning utilizing technology in the classroom grows throughout the term, they should begin to implement the devices more frequently. Thus, during term three the devices should be used in each classroom at least three times a week, including at least once each for literacy and mathematics. The third use can be in any subject other than computing. In the last few weeks of the third term, the staff will be asked to submit their feelings and observations regarding the implementation of the plan.

Teachers at the school submit detailed lesson plans every week. Lessons that would use the devices would need to be indicated on these weekly plans. Lesson plans are currently checked for completion by the key stage leaders, so part of ensuring that devices are being used would fall to those leaders. The technology coordinator would also be responsible for ensuring

that the school improvement plan is being followed. As the technology coordinator will teach a reduced schedule, this person would then be able to assist teachers as they first use the devices with their classes, thus helping the class teacher gain confidence and ensuring that the devices are being used effectively. During regular meetings with teachers from each year group, moments in the curriculum that would be improved through the use of the technology would be identified, plans could be created together in the event that the class teacher wants the assistance.

The school has 30 class periods a week, if each class uses the devices three times, this high use will equate to the devices being in near-constant use. At this point, teachers would be asked to give their feedback about the program and would discuss changes they saw regarding the pupils' motivation and the class atmosphere. The PiRA and PUMA results would be analyzed and compared to the previous years' results. These factors would then be used to determine how to move forward with the use of technology in the classroom.

This plan faces multiple obstacles before it even begins. First, the expense is a potential obstacle, however, the use of grants and other funding will help to alleviate that issue. Another potential obstacle is the reluctance of the current staff to implement such a plan. The current staff does not generally feel comfortable using devices, therefore the largest determiner of whether the school improvement plan is successful is the role of the technology coordinator. The person in that role trains and supports the rest of the staff. If the training provided does not instill confidence in the fellow teachers, they will abandon the use of devices at the earliest opportunity. The appointment of the correct person in this role is paramount.

Another obstacle that could hinder the project is the instability of internet access and the maintenance of the devices. While the school has fiber optic cable internet connection, these lines are frequently damaged, resulting in being offline for up to several days while waiting for

them to be repaired. While the devices have hard drives and can be used without the internet, many applications do require internet connections. Thus, if the internet is not available when a teacher plans for it, that teacher may be more reluctant to try again in the future.

Finally, the maintenance of the devices may be a factor in the success of this improvement plan. As the devices should be in near-constant use, if there is a technical issue, it could affect not only the class using the devices at that moment, but the classes scheduled to use them after. The school does employ multiple people in its IT department who are able to fix issues as they arise, this undue stress for the students and teachers may limit the teachers' confidence in using the devices.

Despite the multiple issues that can arise and derail the school improvement plan, there is also a high potential for the success of the plan. The success of the plan requires strong leadership by the technology coordinator and a willingness from the staff to try newer methods of teaching. In addition, the support from the owners of the school is crucial to the success of the plan.

Conclusion

This school improvement project is an attempt to bring tablet-based learning to a private, international school in Cambodia. Although the school purports to teach using cutting-edge technology, at the current time, that technology is restricted to one computer lab. The students deserve better. The students deserve to have access to technology that will improve their learning and help them develop the 21st-century skills necessary to succeed in the future.

The project relies heavily on the literature review that illustrates the academic gains found when devices were introduced to classrooms around the world. The literature review also explains the potential changes in student motivation and the changes in the classroom atmosphere.

The results of the implementation of this project will greatly influence the teaching and learning at the school. First, the teachers will receive training on the tablets that will strengthen their teaching skills and allow the teachers to develop learning activities that are more student-centered. Second, the students will be able to utilize tablets in their learning on a regular basis of at least three times a week. The combination of the training for the teachers and the students having access to tablets will ultimately improve test scores, change the classroom atmosphere, and increase student motivation. Finally, students will begin to develop the 21st-century skills necessary for today's society.

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