Interactive Tablets: Catalyzing Engaged Science Learning in English Instruction

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Abstract

Schools in Thailand are increasingly using tablet computers for active learning. As interactive technology is increasingly used in the classroom, teachers are becoming more concerned about it. This qualitative study explores using a tablet computer as an interactive tool for active learning in teaching science in English. The research study involved three classes with ninety-three Grade 8 students from a demonstration school in Southern Thailand. The study was carried out for three weeks in all three classes. The classroom implementation was recorded and analyzed. Ninety-five percent of the students used tablet computers for class participation, while five percent used phones. The results showed that students used their tablet computers to search for different body parts in English, words that described the body parts and the meaning of the words. They learned independently and at their own pace to complete the classroom tasks. The results suggested that tablet computers are an excellent interactive tool to support active learning in teaching science in English in Grade 8 classrooms.

Keywords: active learning, digital technology, English, self-regulated learning (SRL), tablet technology

1. Introduction

In recent years, active learning has become more prevalent in schools in Thailand (Waluyo, 2020). Many schools are starting to use tablet computers as interactive tools for active learning in the classroom. What is active learning? How does the use of tablet computers support active learning in school? Studies demonstrating the positive use of interactive technologies are well documented (Couse & Chen, 2010; Haugland, 1992; Stephanidis et al., 2019). However, there have been ongoing debates about whether and how tablet computers should be used in the classroom (Clements & Sarama, 2003), and there have also been concerns about the use of technology by young children (Cordes & Miller, 2000). In this paper, we explore how the tablet computer supports active learning in teaching science in English in Grade 8 classrooms in Southern Thailand. The following research questions guided this study:

1. What is the teacher's role in supporting active learning in teaching science in English in Grade 8 classrooms in Thailand?
2. How do Grade 8 students use the tablet computer in the classroom to learn science in English?
3. How does the tablet computer serve as an interactive tool to support active learning in teaching science in English in the Grade 8 classroom in Thailand?

1.1 Significance of the Study

This study investigated tablet computers as an interactive tool to support active learning in teaching science in English in the Grade 8 classroom. The results of classroom observations and informal conversations with students may help determine the benefits of using tablet computers to teach science in English in the classroom. This study may provide useful information to promote active learning in teaching science in English in classrooms in Thailand using tablet computers.

2. Review of the Literature

2.1 Active Learning

According to Ren et al. (2021), active learning engages students in a learning process through classroom activities and/or discussions. It emphasizes higher-order thinking and often involves group work. It requires students to think about what they are doing in class while engaged in their learning (Bransford et al., 2000). Approaches that promote active learning focus on developing students' skills and exploring their attitudes and values (Amjad et al., 2023; Bonwell & Eison, 1991). These activities may include case studies, collaborative learning, debates, drama, role-playing, simulations and peer teaching (Bonwell & Eison, 1991). Active learning, therefore, requires students to actively construct their knowledge (The National Survey of Student Engagement and The Australasian Survey of Student Engagement, reported by Carr et al., 2015). The three common techniques used in active learning are project-based learning (PJBL), problem-based

learning (PBL) and scaffolding. Their study conducted with colleagues (Dole et al., 2017; Henard & Roseveare, 2012; Ren et al., 2021) concluded that students who engaged in active learning performed better in exams than those who learned through traditional lectures (Amjad et al., 2023a). Several quasi-experimental studies reached similar conclusions (Hsu et al., 2015; Karacalli & Korur, 2014). In the study conducted in Turkey (Karacalli & Korur, 2014), fourth-Grade science students were found to retain knowledge and perform better academically than PBL students. These studies also reported increased knowledge retention, good study habits, student achievement (Abid et al., 2023; Akram et al., 2021; Gallagher, 1997; Norman & Schmidt, 2000) and positive learning attitudes (Vernon & Black, 1993; Norman & Schmidt, 2000; Prince, 2004) in the treatment groups. In a study conducted in the United States (Hsu et al., 2015), the treatment group had better scientific knowledge, counterarguments and rebuttal skills. Chan (2008) reported that 10- to 11-year-old students outperformed the control group's synthesis skills on science exploration tasks using technology. Another study in Oman (Al-Balushi & Al-Aamri, 2014) concluded that 11th-Grade female students performed better in the environmental knowledge test and the science attitude survey. Johnson et al. (1998) also indicated that students benefited academically, emotionally and socially when learning together.

2.2 Tablet Computer as an Interactive Tool

Interactive technology can impact the lives of young children. The meaningful integration of interactive technology into the classroom can serve as a powerful tool for creativity, self-expression and experimentation for young children (Amjad et al., 2024; Char, 1990). The tablet computer has several interactive features that can contribute to student motivation and participation (Cordero et al., 2018). Students enjoyed reading with the tablet computer because it was interactive; they could watch the characters and turn a page with their finger on the touch screen (Delacruz, 2014; Iyare et al., 2018; Ohme et al., 2022).

Fourth-Grade students easily navigated the tablet computer while reading individually and in small groups (Hutchison et al., 2012; Gerard et al., 2012). Studies have found that meaningful integration of the tablet computer could transform reading and writing instruction (Hutchison & Reinking, 2011). According to D'Agostino et al. (2016), student motivation in letter recognition increased in the experimental group with the tablet computer compared to students with physical magnetic letters.

Speed was another reason students liked to use tablet computers (Dunn & Sweeney, 2018). Students enjoyed the responsiveness of the devices and how quickly they could see their digital work in color (Flewitt et al., 2015). Immediate feedback increases student motivation and interest in learning (Flewitt et al., 2014). The students became motivated and wanted to take their digital work to a higher level using their creativity (Dunn & Sweeney, 2018; Flewitt et al., 2014).

2.3 Tablet Computers as a Technology for Self-Regulated Learning (SRL)

Self-regulated learning (SRL) is an active, constructive process (Pintrich, 2000) that requires support, scaffolding and explicit instruction as individuals develop their self-regulatory practices (Aslam et al., 2021; Qates, 2019). Tablet computers can be a promising interactive tool for SRL if students are guided to use them meaningfully in the classroom. The teacher can create the opportunity for SRL by tablet computers as an interactive tool in the classroom. One such approach is inquiry-based work (Brand & Moore, 2011). Self-regulation skills can be taught and learned through purposeful participation (Qates, 2019). Students who learn to set goals and achieve them using SRL can adapt their learning methods (Winne, 1997). SRL is beneficial for lifelong learning (Dignath & Buttner, 2008). Studies have found that children and adolescents with higher levels of SRL are more likely to excel than those with lower levels (Dignath & Buttner, 2008; Zimmerman, 2002). Teachers, therefore, have a critical influence on student engagement in the classroom (Darby, 2005). Autonomy-supportive teachers were able to help students develop SRL through topic selection and the use of technology in the classroom. Students became motivated, their interest in learning increased (Sierens et al., 2009) and they completed more self-directed research projects (Richardson et al., 2014). In numerous studies (Delacruz, 2014; Fabian et al., 2018; Iyare et al., 2018; Palaigeorgiou & Papadopoulou, 2019), students reported that they understood topics better because they had the opportunity to learn using their digital devices. Students value their learning more because they can learn at their own pace with tablet computers (Palaigeorgiou & Papadopoulou, 2019). They felt they could learn faster and more efficiently with tablet computers (Halloluwa et al., 2018; Fabian et al., 2018; Palaigeorgiou & Papadopoulou, 2019). Learning with their tablet computers was useful and fun (Delacruz, 2014; Moon et al., 2016).

3. Methodology

3.1 Description of the Study

This study was conducted in three Grade 8 classrooms over three weeks. 95% of the students own a tablet computer and 5% use their cell phones as interactive technology. Students are generally familiar with various apps and the use of these interactive technologies. One of the most popular apps is Canva, an Australian graphic design platform used to design graphics for social media, presentations, posters, documents and other visual content. Most students are well-versed in Canva. Students can use any application or Google engine to complete the task. The topic of the lesson was "Types of Body Parts." The topic and activities were done in the same order in all three classes. Each class met with the teacher three times a week. Each lesson was 50 minutes long. The lessons were conducted in twenty-seven class periods for a total of 1,350 minutes.

In the first week of the study, students learned about body parts and the words used to describe the different types of body parts. The students formed groups of five or six. They were asked to list as many body parts as possible on the whiteboard. Each group assigned a member to write. Meanwhile, the other group members used tablet computers to search for body parts in English. They helped their classmates spell the words and write them on the whiteboard. Then, a new member was assigned the second task. In the second task, students were asked to write

the words that describe the different body parts on the whiteboard. Students used Google Translate to search for some words such as "thick," "light," "heavy," "large," "tiny," "slender," "slim" and "bony" with their tablet computer. Learning science in English is quite challenging for Thai students because their first language is Thai. They also checked the spelling of the words using their tablet computer. The students then returned to their seats. The teacher checked the words on the whiteboard. Finally, the students wrote the body parts and different types of body parts on their tablet computers.

The teacher prepared six short reading passages for the students in the next lesson. Each passage consisted of five to six sentences. Each sentence is a short description of a monster with different types of body parts. The teacher randomly selected six students to read a passage in the classroom. The teacher instructed the students to use tablet computers to check the passage's meaning. The teacher then explained the task to the students. Each student was allowed to choose any passage. As described, the students were to draw the monster based on their imaginations. Most of the students worked with Canva on their tablet computers. Some used their cell phones to search for references and drew with pencils and colored pens on paper. In the third lesson, the students worked independently on the assignment.

In the second week, the teacher distributed a word list of body parts and the different types of body parts she had compiled from the students in the classroom. The teacher explained the new task to the students, saying they should create a chosen figure and write four to five sentences about it using the word list. The teacher showed the students pictures of mythical creatures to give them ideas for a figure. The teacher encouraged the students to use their creativity and imagination to create an original figure. The students used tablet computers throughout the next three class periods to complete the task. They used their tablet computers to search for references for their figure. They used Google to translate Thai words into English to describe their figure. They made decisions about their work independently and at their own pace. The teacher was only there to facilitate and assist as needed.

Although it was an individual assignment, the teacher allowed the students to discuss and share. Some students joined groups of two and three to discuss their figures by looking at the images they found on Google on their tablet computers. Teacher support was minimal as students independently worked in small groups using their tablet computers. The students submitted their digital work in the LINE group. Students who chose to draw their work by hand took photos of their work and submitted them digitally to the LINE group. Figure 1 shows some examples of the drawing activities conducted by those students. In the third week of class, each student delivered an oral presentation of their work.

Figure 1. Some Examples of Students' Drawing Activities

3.2 Settings

The demonstration school is located in Southern Thailand. It is affiliated with a university and is located on the university campus. The demonstration school was selected for two reasons. First, it enabled us to use random sampling. Second, like other demonstration schools in Thailand, this demonstration is designed as a testbed of pedagogical practices (Cadias, 2018). The demonstration school is attended by approximately 299 high school students in Grades 7, 8, 10 and 11. The study was conducted in three Grade 8 classes, with 31, 30, and 32 Grade 8 students in each class. Each Grade 8 class meets three times a week for their classes, each lasting 50 minutes per class.

Students generally sit individually in their assigned seats at a table. For pair or group activities, students arrange their seating in groups in the classroom. Sometimes, students work in groups on the floor. The spatial structure of the classroom provides the teacher and students with sufficient space for various activities. Upon entering the classroom, there is a whiteboard, a large screen and a projector. There is a desktop computer and two desks for the teacher. In the back of the classroom are lockers where students can store their belongings, such as textbooks, jackets, bottles and stationery.

3.3 Participants

Each class has a regular teacher, a subject teacher and two English teachers. One teacher teaches students science in English while another English teacher teaches students English as an International Language. In science in English, students learn basic science concepts and

science-related vocabulary in English. The teacher has over ten years of teaching experience in preschools and secondary schools. She has some experience with tablet computers. The information about the class and teachers is only for background purposes. We formulated the selection criteria based on their studentship, class and ICT experiences. A simple random sampling technique was used to select the sample of ninety-three students (fulfilling criteria), the Grade 8 secondary school students in the demonstration school in Southern Thailand.

These students were selected using random sampling. All students in these classes had attended at least six years of elementary school (Grades 1 through 6) and one year of lower secondary school, Grade 7, before entering this class. Some students completed Grade 7 in the same demonstration school. Some students were new to the demonstration school. The students had to take an entrance test to enroll in the demonstration school. Students who successfully participate in the demonstration generally show strengths in various areas such as science, math, sports, dance, languages and etc.

Of the ninety-three participants, only a few were from the Mini English Program (MEP). In the MEP, students learn Math, English, Science and Health in English. Students who participated in MEP during their elementary years demonstrate better English skills. MEP is only offered in some demonstration schools. Students without MEP backgrounds are exposed to English in English subjects only for certain periods during the week. It is important to note that English is taught as a foreign language in schools in Thailand. Most students in Thailand need much support to understand classroom instructions in English. Classroom instructions are often given in both English and Thai. This study does not consider student demographic data, educational background, family background or English proficiency.

4. Findings

This study was conducted as a qualitative study with multiple case studies (Yin, 2008). The implementation in the classroom was videotaped. Data were collected through classroom observations, student digital work samples, student responses in classroom activities, presentations and informal conversations with students. An inductive approach was used to analyze the qualitative data (Creswell, 2007; Thomas, 2006). The researcher used open coding to look for meaningful recurring themes for categorization (Maxwell, 2012). A consistency check of the subthemes was conducted to ensure the accuracy of the data interpretation. Finally, the data were analyzed for coding. The data analysis resulted in three themes described in the results section.

4.1 The Role of the Teacher in Using Computer Tablets as an Interactive Tool for Self-Regulated Learning (SRL)

Consistent with other studies (Pintrich, 2000; Sierens et al., 2009), our study found that the teacher played an important role in selecting the topic and using technology in the classroom to create opportunities. The teacher was instrumental in creating a conducive learning environment where students could acquire knowledge (Rabo, 2022). The English teacher chose the topic 'Types of Body Parts' to pique students' learning interests and introduce different types of body parts in the classroom. She chose 'monsters' as she knew that the students were fascinated by monsters (based on her prior knowledge of the students). She encouraged students to practice SRL with a game in which students used their tablet computers to search for different types of body parts. During the game, the students supported their classmates by explaining the words and their correct spellings based on the answers they found on Google using their tablets. Students with divergent learning styles can get information and structure their learning through educational games (Ong et al., 2020; Yildiz, 2021). Students began SRL using Google search on their own. They typed in the Thai words, translated them into English and shared the information with their classmates.

During an activity where students were given a wordlist of types of body parts, SRL took place in phases in which students used their tablet computers to search for the meanings of words new to them. The students wrote the meaning in Thai next to the words on their tablet computers. Teacher support was minimal. The students were independent and used their tablet computers at their own pace. They adapted their learning methods (Winne, 1997), self-directed their learning, became more confident and acquired more knowledge (O'Connor et al., 2014). The next task required the students to draw a monster based on a given passage of text. The students translated the short English passage into Thai using their tablet computers to ensure they understood the meaning correctly. Students asked the teacher to clarify whether the work should be presented in a landscape or portrait format. This finding indicated that the students had a goal in mind and wanted to ensure it was met within the specific guidelines. The following digital work samples (Figures 2 & 3) were created on a tablet computer using Canva. They were selected based on their creativity and originality, which showed the different body parts of a monster.

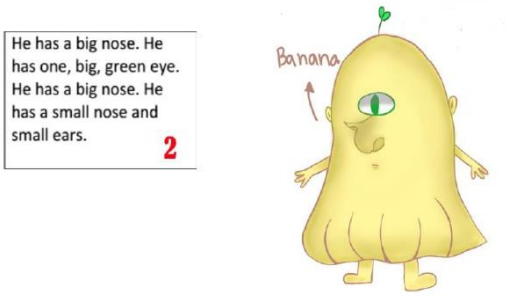

Figure 2. Example of Student Digital Work Based on Passage 2

Figure 3. Examples of Two Students' Digital Work Based on Passage 3

The study results suggest that tablet computers may be a promising interactive tool for SRL to teach science in English in the classroom with an autonomy-supportive teacher.

4.2 Computer Tablets as Symbolic Machines

Young children identify the tablet computer as a symbolic machine with which they can represent and manipulate different symbol systems (language, mathematics, and music) and create different symbolic products (storylines, mathematical expressions, and songs) (Sheingold, 1986). The results of our study indicate a similar observation to those of Nichols (1990) and Tierney (1989), in which upper elementary and high school students created their multimedia compositions using HyperCard software. In the second task, which was assigned to students individually, they initially saw themselves as artists as they created their figures using Canva on their tablet computers. Many students went to great lengths to compose their figures on their tablet computers, referencing other figures on the Internet. Some students sketched on paper with pencils, markers and colored pens. They also referenced numerous figures from the Internet with their digital phones. The students took on the " author " role once they were satisfied with the figure and composition. They became the story's author and created their texts in the digital environment of the tablet computer (Goodman, 1986). Canva was the most popular app for students to draw figures and compose text. Students choose from various templates, fonts, sizes, colors and different writing tools. Digital writing was purposeful for the students. They made decisions about adjective choices, writing style and content. Some students excitedly talked about their work as they sketched figures on the tablet computer: "I am going to draw a girl with a spider body," "I am going to draw a mermaid with a long tail on the back of a horse," and "I am going to draw Big Foot." Here is an example (Figure 4) of one student's digital work showing a girl with a spider's body.

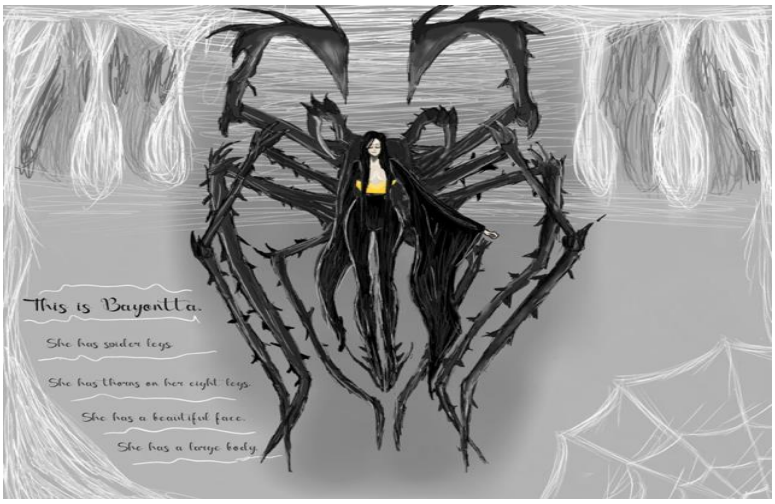

Figure 4. Example of Student Digital Work of A Spider with A Girl's Body

The results of the study contained an interesting observation. Two students decided to use their faces as figures. They first took a picture of their faces with their tablet computers. Then, they began outlining their faces in thick black ink using the Canva app. One student added a mustache, pointed ears and curly black hair to his appearance on the tablet computer. He completed the figure with a high-necked vampire outfit (Figure 5). Another student had a very long mustache on his face on the tablet computer. He added pointed ears, two red tongues and a third eye to make him look like a Chinese god (Figure. 6). In these cases, tablet computers provided the students with an outlet, a fantasy world to explore, think about what they already intuitively know and express their creativity (Bamberger, 1983). By strategically choosing topics that match students' interests and the symbolic machine concept of the author, teachers can encourage curiosity and motivation in their students.

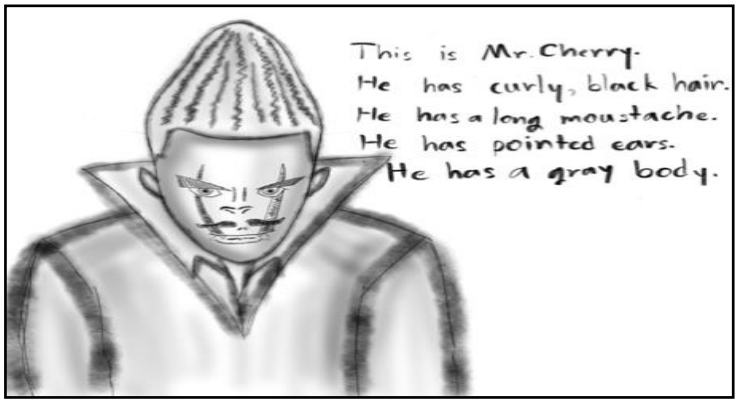

Figure 5. Example of Student Digital Work of Himself as A Vampire

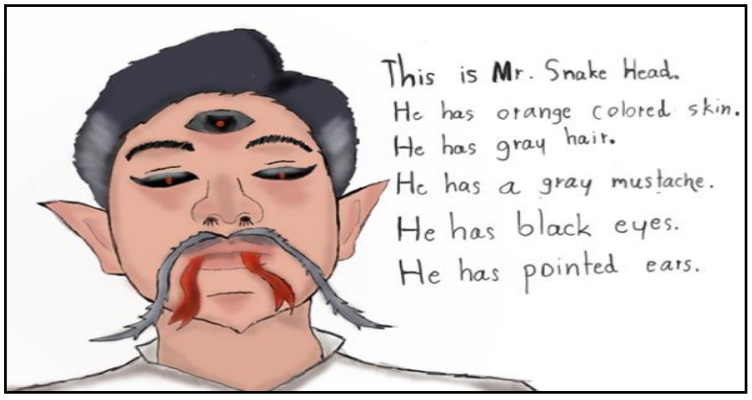

Figure 6. Example of Student Digital Work of Himself as A Chinese God

4.3 Tablet Computers as an Interactive Tool for Social Interaction and Collaborative Learning

The mobility of the tablet computer allowed students to move freely around the classroom. Students could carry the tablet computer around while asking for opinions and sharing ideas. The tablet computer can be a powerful interactive tool for social interaction and collaborative learning in the classroom especially when learning science in English. Like the findings of other studies (Char, 1990; Miyazaki, 1988), our study also suggests that the use of tablet computers in the classroom supports the social dynamics of student interactions in the classroom. The researcher found that even when students worked individually with a tablet computer, they engaged in meaningful conversations with their friends in the classroom. They asked questions like 'What are you going to draw?' 'Are you going to draw a girl with a long body?' 'Is that a mermaid on the back of a horse?'

There was often a lively exchange of ideas and conversations among students, including those working with their tablet computers in the classroom. The researcher found that the students were eager to show their work to their classmates to get feedback. They often asked, 'What do you think of my work?' Sometimes, some students would look at their friend's work and respond with a grin. Students also supported and helped each other. Students with better English skills often helped their friends check sentence structure, grammar and spelling using Grammarly on their tablet computers. One girl even helped a friend write new sentences when he got stuck in the middle of the writing task. Students with better science knowledge also shared ideas with their friends. One student helped her friend add some arms and legs to the figure on the tablet computer to make it interesting. This robust integration of science and language has important implications for science education because it emphasizes the importance of student participation in meaning-making (Molle & Huang, 2021).

Furthermore, students were more eager to learn using tablet computers because they could help their peers (Halloluwa et al., 2017). One student helped to color the figure on the tablet computer to meet the deadline. Consistent with the findings of a study conducted by Guven and Uyulgan (2021), students enjoyed their learning more when they were given the opportunities to put their work into action and act collectively. In this exercise, the researchers noticed that students were actively involved in learning when they were self-assessed and peer-assessed. During the final week, the students presented their work on their tablet computers in the classroom. The students acknowledged the work of their friends by clapping and cheering them after each presentation. One of the potential benefits of using tablet computers to learn science in English in the classroom was to promote social interaction and collaborative learning among students. The tablet computer has shown encouraging results and offered several possibilities for supporting active learning in English language science classrooms, making it a promising educational tool. Educators must guide students to use it wisely in the classroom to achieve a goal for their benefit and the class's.

5. Conclusions

Considering the advantages of the tablet computer as an interactive tool to teach science in English, using digital technologies in the classroom should be encouraged. This case study shows that students can learn independently and at their own pace using the tablet computer. They can Google at will and learn new vocabulary using their tablet computer. They can apply their newly acquired knowledge in their work. The tablet computer offers unique opportunities to acquire scientific knowledge and science-related English vocabulary in the classroom. Students can read, write, show and talk about their work using the tablet computer.

In addition, tablet computers can be used as an interactive tool for learning science in English in pairs or groups. Using tablet computers has become a social activity for students as they talk, discuss and work with each other. Given the many encouraging results and possibilities the tablet computer offers as an interactive tool to support active learning in teaching science in English, it could become a promising teaching tool for classroom instruction and learning. Students must be guided to use it wisely to achieve a goal in the classroom for their benefit and that of the class.

6. Limitations and Future Studies

Although this study has shown the many advantages of the tablet computer as an interactive tool to support active learning in teaching science in English in the classroom, there are also limitations. First, the researcher is actively involved in classroom implementation and observations. The researcher also has prior knowledge of the students' background, scientific knowledge and English language skills. The researcher could be biased in her interpretation and analysis of the data. Second, the study participants were a mixed group of MEP and non-MEP students. It would be beneficial to conduct a comparative multiple case study in a setting with two different groups of students. Third, 95% of the study participants owned a tablet computer while 5% used their cell phones for active learning. It would be interesting to find out what the 5% think or feel about owning a tablet computer and using it as an interactive tool to learn science in English in the classroom. However, the study results are useful because they provide some clues about using the tablet computer as an interactive tool to support active learning in science in English in the classroom. Future research could focus on using the tablet computer as an interactive tool for collaborative learning in science or STEM projects in the classroom.

7. Pedagogical Implication

The study highlights pedagogical implications for integrating tablet computers as hands-on tools for SRL in the classroom. Teacher involvement is crucial in efficiently utilizing technology to generate captivating learning experiences. Teachers may encourage curiosity and motivation by strategically choosing topics that correspond with students' interests, such as exploring the topic of 'Types of Body Parts' via the perspective of monsters. Promoting the use of tablet computers among students for independent research and collaborative learning activities fosters SRL and caters to a wide range of learning preferences. The progressive transition of teachers' assistance from proactive

facilitation to restricted involvement enables students to take responsibility for their learning process, promoting independence, self-assurance and enhanced information acquisition. Furthermore, the students' aptitude for translating and combining material using their tablet computers indicates their linguistic expertise, focused approach-and attention to assignment instructions.

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Authors contributions

ODJ was responsible for the study design, drafting the initial manuscript, and subsequent revisions. ODJ also handled data collection. SA revised the manuscript before the initial submission. AIA revised the manuscript following the first review. All authors have read and approved the final manuscript.

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Data sharing statement

No additional data are available.

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