Embedding teacher scaffolding in a mobile technology supported collaborative learning environment in English reading class: students' learning outcomes, engagement, and attitudes

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Abstract: As one of the effective strategies, teacher scaffolding in technology supported language learning needs more exploration considering the advance of technologies and the needs of students. This study implemented an innovative reading program that integrated teacher scaffolding into a mobile technology supported collaborative learning environment to engage students of English as a foreign language in reading activities and to develop motivations in reading. The program was supported by a learning management system of Edmodo, and was conducted in a local secondary school. During implementation, multiple data such as reading test results, log data and interview data were collected to examine student learning outcomes, engagement, and attitudes. The findings confirmed the positive impacts the program made on students' reading performance. The study also identified the effective features of the learning system and the provision of teacher scaffoldings, which will inform future design of school-based language learning programs supported by mobile technologies.

Keywords: mobile technology supported collaborative learning; teacher scaffolding; Edmodo learning management system; English reading; English as a foreign language.

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1 Introduction

The practices of reading help construct linguistic knowledge by exposing students to authentic language use, and the improvement in reading literacy as a critical language skill contributes to language competency and fluency (Ahmed, 2017; Ferrer and Staley, 2016). In alignment with curriculum innovation in 2001, the Hong Kong Curriculum Development Council initiated the 'Reading to Learn' program that encouraged and supported school-based practices for developing reading skills of students of English as a foreign language (EFL students) (HKCDC, 2017). Focusing on the Key Learning Areas mapped out in the English Language Curriculum Guide published in 2018, local schools have developed many programs to foster reading literacy of EFL students. Despite the efforts, Hong Kong students' English reading literacy has been declining based on the Progress in International Reading Literacy Study in 2016 (NCES, 2018). In addition to compromised achievements in learning, the extent to which these students participated and engaged in English reading and comprehension was also reduced (Tse, 2016). The issue might be attributed to the dominance of Chinese as the replacement of English as the medium for instruction in many schools after the sovereignty exchange (Choi, 2008) and the English culture is often limited because of the common use of Cantonese in daily life in Hong Kong (Li and Hua, 2015). However, the deeper roots probably lie in the pedagogical design for EFL that failed to motivate and facilitate students to learn (Pang, 2016; Huang and Hong, 2016; Li et al., 2021). As a plausible remedy, information communication technologies (ICT) tools have been increasingly adopted and leveraged in reading classes (Kaoropthai et al., 2019; Reiber-Kuijpers et al., 2021). The embedment of ICT could help create an interactive learning environment that motivates and engages students in language learning (Chen, et al., 2021; Lee, 2008; Wen, and Song, 2021). Reviewing the current research, it pointed out the positive relationship between the effective adoption and adaption of ICT, particularly the mobile technologies in reading class and the development of higher reading literacy that improve student on better vocabulary retention and reading comprehension skills (Jamshidifarsani et al., 2019; Ma, 2019; Song and Ma, 2020).

Moreover, the established research on ICT-supported educational practices for different subjects and disciplines has confirmed and highlighted the important role that teachers should play (Jamshidifarsani et al., 2019; Voogt and Mckenney, 2017). Teacher orchestration, scaffolding, questioning, teacher-student interaction, etc., are all critical

factors of pedagogical design and enactment that can affect students' learning in a profound way, and should be but has not been sufficiently discussed in the domain of mobile technology supported reading for EFL students (Hsieh, 2016; Mahan, 2020; Perrotta and Evanst, 2013; Kobbe et al., 2007). Among them, few studies discussed teacher scaffoldings in a mobile technology supported reading learning environment for EFL students (Mahan, 2020). Particularly, more explorations were needed for exposing teacher-students interaction and students performance considering the yield of mixed results in the current studies (Goh, 2017; Vogel, et al., 2017). Nevertheless, limited studies have been conducted to explore the potentials of facilitating the development of students reading literacy (Kaoropthai, Natakuatoong, Cooharojananone, 2019), especially for exploring the reading process supported by teacher scaffoldings in the computer collaborative learning (CSCL) environment (Dellatola and Daradoumis, 2014; Dillenbourg et al., 2011; Ma, 2017). Teacher scaffolding is defined as a pedagogical support that is provided by others who are more capable, such as teachers or peers, to help students attain educational goals they cannot reach alone (Wood et al., 1976; Shin, Brush, and Glazewski, 2020). According to Suthers, 2012, "computer-supported collaborative learning (CSCL) refers to the activity of peers interacting with each other for the purpose of learning and with the support of information and communication technologies (ICT)".

With addressing the above problems, this study designed and implemented a reading program supported by a learning management system (LMS) with teacher scaffolding to help secondary EFL students develop reading literacy. The analysis could advance our understanding of student learning processes as they read collaboratively in a CSCL environment, an area that has not been adequately navigated (Dillenbourg et al., 2011; Ma, 2017).

2   Literature review

2.1   *Improving EFL students' reading literacy via CSCL*

For students, the improvement in reading skills is significant as it is built on the development of linguistic knowledge, decoding capacity, contextual understanding, as well as cultural consciousness (Luo, et al., 2019). Students are expected to participate in dynamic and systematic comprehension processes where logics and vocabulary are integrated (Mbau and Sugeng, 2019). In CSCL English reading, there are ample opportunities for students to interact with peers and communicate with the teacher (Su et al., 2018). Supported by diversified collaborative tools of group-setting, wikis, blogs, shared working space etc., students can explore, review, and reflect upon reading materials dialectically and collectively, and can helps transform their verbal analysis of the reading into written demonstrations that provide the basis for further discussion and modification (Rudman and Bruwer, 2016; Lai and Gu, 2011; Lee, 2015). Additionally, the embedment of argumentation tools in the CSCL environment enables and encourages students to externalise thinking and cognition with the support of visualisation (Ludvigsen et al., 2016), and to construct knowledge step by step (Lu et al., 2010). The combinative use of online concept maps and structured diagrams tends to provoke high-level discourse and structured thinking, and this facilitates the processes of comprehension and knowledge creation (Hsieh, 2017). With all these affordances, CSCL

can provide a conducive environment for EFL students to cultivate and develop reading literacy.

2.2 *Teacher scaffolding in CSCL as an effective strategy to facilitate learning*

Scaffolding is a pedagogical process during which a more-knowledgeable person helps the learner perform tasks that he or she cannot do independently (Lu et al., 2010). Scaffolding enables learners to realise their potentials via the provision of timely assistance based on situated needs and state of progress, and will fade away gradually when learning occurs and they gain more control of the learning content and activities (Lajoie, 2005; Pea, 2004).

In CSCL research, teacher scaffolding offered via both online and off-line is a focused area of research. One stream of studies have explored the impacts teacher scaffolding could make on students learning. In a CSCL writing program, Donato (1994) designed and integrated teacher scaffolding to help students co-construct ideas, conduct peer assessment, and edit compositions collectively. The findings indicated the positive role that teacher scaffolding would play in empowering collaboration and learning. Besides facilitating student collaboration, individual scaffolding, the guidance and feedback that teachers provide to individual students, also contributes to language learning (Swain, 2010). Effective teacher scaffolding in CSCL assists students in acquiring literacy skills via learning from their more capable peers, and timely communication with and feedback from their teacher. In CSCL programs, more than 60% of the collaborative dialogues occurred are supported by the teacher, and teacher scaffolding is critical to effective group discussion and the generation of group ideas (Helsh, 2017; Rienties, et al., 2012). Such interactive talks often inspire high order thinking and could be empowered by collective and individual scaffolding (Fischer, 2018).

Recognising the significance of teacher scaffolding to student learning in CSCL programs, another stream of research focuses on identifying principles and strategies for effective design and enactment of teacher scaffolding (Joyce-Gibbons, 2017). In Leeuwen et al., (2012), three types of teacher scaffolding were integrated in a CSCL environment. Type 1 was for facilitating students' cognitive activities; Type 2 included examples, multi-media content, and other materials from the teacher that may motive the students to learn; and Type 3 focused on group work. They revealed that effective teacher scaffolding should encompass three layers of teacher action including:

1   diagnosing needs of the learner

2   offering corresponding assistance

3   evaluating the effectiveness of the intervention, and that teachers need to modify their scaffolding strategy frequently.

In addition, teacher scaffolding should ensure the active interplay with the students, and at the same time leave them adequate space for independent exploration. Some cognitive strategies can be provided to students to help establish step-by-step thinking patterns and develop logic thinking (Bjønness and Kolstø, 2015). Basing on student performance and feedback, teacher need to adjust the frequency, scope, and nature of scaffolding flexibly throughout the overall learning cycle (Birjandi and Jazebi, 2014; Van de Pol et al., 2019).

2.3   *Facilitating teacher-student interaction via learning management system*

In terms of learning management system (LMS), it stands for one integrated system, which integrates various online learning tools. Typically, a specific 'social software' is contained in LMS for education purposes that the network tools enable both learners and teachers to learn together while retain their control over study materials, learning activities, and other online learning tools (Dalsgaard, 2015; Laflen and Smith, 2017). The LMS like Moodle, Google Classroom, Edmodo, etc. under CSCL, they share the standard features, including synchronous communication for multiple users in the learning curriculum. For the individual learners, they can take its interactive advantage to share their learning results and get a comment from counterparts and their instructors instantly (Limongelli, et al., 2016; Koroneou et al., 2014). Recently, most of LMS support different devices either computer or mobile devices.

When it comes to Edmodo, one of the most comprehensive e-learning systems, it has widespread use worldwide, as well as in Hong Kong. Recent studies has proved its incorporating features to encourage student participation and responsible learning (Unal, Uzun, 2021). Unlike old-school language learning, Edmodo realises blended learning experience for learners that they can have peer sharing with a variety of learning materials (Cobanoglu, 2018).This powerful platform also makes online assessment available for teachers to keep track of own language teaching process. After they have checked the submitted quiszes or other worksheets by students, the results can be generated automatically. And they can also leave some additional annotations for individual learner. As a student-centred learning platform, learners would follow their performance report and get feedback from their teachers as well (Ekmekci, 2016; Al-Naibi e t al., 2018; Yagci, 2015). Edmodo manages to bring one holistic language learning process for students to keep track of their study all the time. While for teachers, they can delivery teaching content with many forms and set assessment on a regular basis to evaluate their teaching and thus to do some adjustment accordingly. Its functional features could serve for design and developing a CSCL reading environment supported by computers or mobile devices; meanwhile, it enables the teachers to provide scaffolding either in collective or individual ways. In particular, the mobility of Edmodo learning environment would support teacher –student interaction anytime anywhere, this is an important feature for the students to benefit from teachers' timely supports (Khoo, et al., 2018). In this study, we would like to seek for the impacts of teacher scaffolding supported by Edmodo on students' English reading literacy in CSCL environment.

3   Research questions

In this study, two research questions were answered:

1   To what extent did students improve in reading literacy after experiencing the Edmodo-supported reading program?

2   To what extent were students engaged in the Edmodo-supported reading program?

3   How did the students perceive the Edmodo-supported reading program?

4 Methodology

4.1 Participants

14 3rd-year students (age from 13-14 years old) from a junior secondary school in Hong Kong participated in this reading program. The student participants with 6 female and 8 male students were selected following three criteria. First, they possessed strong willingness to attend the program. Second, the students were in the same class where English was the medium of instruction, and their English proficiency was relatively good. Third, they had the necessary skills to use the online learning platform of Edmodo, which was a dominant learning management system in local schools. The consent approval had been obtained from participants, their parents and their school principal. All of the students had developed basic ICT skills via school-based lessons on ICT use, and had some experience in using computers and iPads for learning and collaboration. Thus, their familiarity with and rich experience in technology-supported learning provided the basis for their smooth operation of Edmodo, which was the main learning management system in this project.

4.2 The context of reading program

Two researchers and one English teacher were responsible for designing this reading program supported by Edmodo. There were two lessons in each week, with 30-40 mins for each lesson. The whole reading program lasted for four weeks. During the reading sessions, students were instructed to read the selected passages either individually or collaboratively, and to gradually master three key reading strategies, including:

1 figuring out the meaning of unfamiliar words (vocabulary skills)

2 clarifying the passage structure and the logic flow

3 locating the required information (The Curriculum Development Council, 2017).

To ensure the validity and reliability of the activities and contents included in the reading program, the researchers consulted expert teachers of EFL from the school as well. After several rounds of iteration, the lesson plan was confirmed to achieving the above learning objectives. Table 1 shows the key activities and learning objectives.

4.3 The provision of teacher scaffoldings in reading program

Systematic, structured teacher guidance could provide a conducive environment to learning in which EFL students manages to keep exploring the reading rather than stop at the literal understanding of the context (Yu and Liu, 2018). Scaffolding can thus bring transcendence, from the generalisation of present knowledge to one more profound comprehension (Birjandi and Jazebi, 2014). Further, with teacher instruction and feedback, student interaction and collaboration become smoother and more effective, and they become more reflective and autonomous in learning, which in turn, further empowers the effectiveness of learning. Therefore, the teacher scaffoldings was utilised for each lesson. Informed by existing research on teacher scaffolding, different types of teachers scaffolding for multiple purposes were designed and enacted in the program (e.g., Bjønness and Kolstø, 2015). There were three kinds of teacher scaffoldings adopted

in this reading program: instructional scaffoldings, individual/collaborative scaffolding, and metacognitive scaffoldings. As Table 2 shows, starting with the instructional scaffolding at the beginning of each lesson, it included some explanations and demonstrations of some essential functions of Edmodo as well as conceptualised students about the expected learning outcomes with tasks in structural ways (Nadolski et al., 2005; Rasku-Puttonen, et al., 2006).

Table 1   Lesson design of the reading program

Lesson	Learning activities	Learning objectives
Week 1: Lesson 1	• Pre-test	• Understand Edmodo and the CSCL reading program
	• Get to know the reading program	
Week 1: Lesson 2	• Trail use of Edmodo: understand the essential functions of the system such as downloading learning materials, posting questions to teachers, etc.	
Week 2: Lesson 1	• Read the passage given and learn how to figure out the meaning of unfamiliar words so as to develop some basic understanding of the passage	• Develop a general idea of the selected paragraphs and passage based on the understanding of the unfamiliar words
Week 2: Lesson 2	• Watch the video of a popular song (Crook) and try to figure out the meaning of unfamiliar words in the lyrics and the song based on the clues provided	
	• Read the passage given and try to understand the passage structure based on the linking words	
Week 3: Lesson 1	• Revision	• Understand the structure and logic flow of the passage in CSCL environment
	• Group work in Edmodo: students work in groups to analyse the structure as well as the logic flow of the passage given	
	• Group work in Edmodo: students work in groups to discuss and share the general idea of each paragraph of the passage	
Week 3: Lesson 2	• Group work in Edmodo: students work in groups to discuss and share the general idea of each paragraph of the passage given	
	• Teacher explanation and elaboration on the structure and logic flow of the passages studied	
Week 4: Lesson 1	• Revision	• Locating the required information
	• Teacher instruction and guidance to help individual students locate the requested information in the passage given *(adverbs + conjunctions)*	
Week 4: Lesson 2	• Tutorial to individual students on 'locating the requested information' *(adverbs + conjunctions)*	
	• Post-test	

Table 2   Teacher scaffolding of the proposed CSCL reading program

Scaffoldings	Week 1	Week 2	Week 3	Week 4
Instructional scaffolding	• Introduce the reading program and the learning objectives of each lesson • Demonstrate the essential functions of Edmodo for teaching, learning, and collaboration	• Guide students to download the passage for Week1 and finish the questions • Introduce the learning objectives of Week 2	• Guide students to finish the revision test and do corrections • Divide students into four groups to learn collaboratively • Introduce the learning objectives of Week 3	• Guide students to finish the revision test and do corrections • Introduce the learning objectives of Week 4
Individual/coll aborative scaffolding	*Individual Scaffolding*: Guide students to get familiarised with Edmodo and the diversified functions – log in, managing learning materials and files, completing in-class activities, etc. *Collaborative Scaffolding:* Divide students into groups based on the pre-test results and guide them to finish the preview of Passage 1 collaboratively	*Individual scaffolding:* • Whole class teaching: guide students to figure out the meaning of unfamiliar words • Encourage students to list the suffixes and prefixes they commonly see and use	*Collaborative Scaffolding:* • Guide student groups to develop a general idea of the selected paragraphs • Provide student groups with pre-reading questions or key words to help them understand the structure and logic flow of the passage	*Individual Scaffolding*: Provide 'fill-in-the-blank' questions to support individual reading *Collaborative Scaffolding:* Divide students into different groups based on their stage of progress and learning outcomes (as implied in the revision tests) and offer differentiated guidance
Meta-cognitive scaffolding	• Encourage students to write down their expected learning outcomes • Provide tips for students to figure out the meaning of unfamiliar words and develop general understanding of the selected paragraphs and passage	Summarise the commonly used suffixes and prefixes in English as well as their implications Summarise *Reading Strategy I: Figuring out the word meaning from its word root or the given context*	Encourage students to work in groups and discuss the logic flow of the selected paragraph Summarise *Reading Strategy II: Clarifying the structure and logic flow of the selected passage*	Encourage students to create reading a 'Mind Map' to organise the shared documents Summarise *Reading Strategy III: Locating the required information*

Figure 1 shows the examples of teacher's instructional scaffolding in Edmodo.

Figure 1   The teacher instructional scaffoldings in Edmodo (see online version for colours)
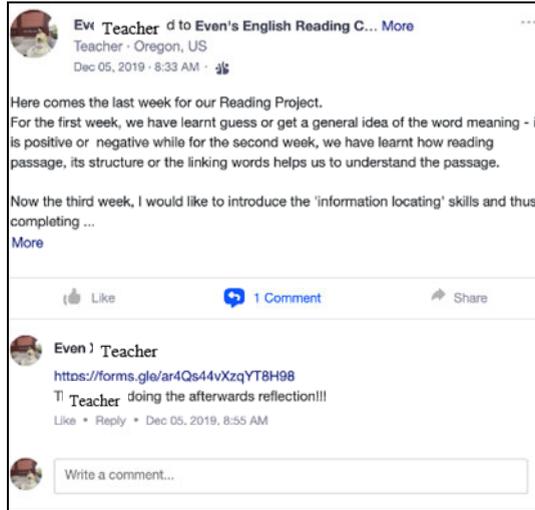
As the lessons unfolded, catering to a distinctive teaching strategy to enhance students' reading skills, the teacher offered both individual and collaborative scaffoldings to facilitate students to accomplish the designated learning activities in and out of classroom. Individual scaffolding was the main vehicle via which the students navigated complex reading tasks and progressively attain the objectives of reading and learning by themselves (see Figure 2 and 3).

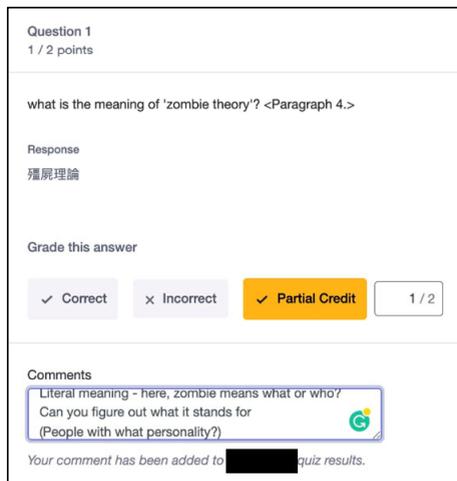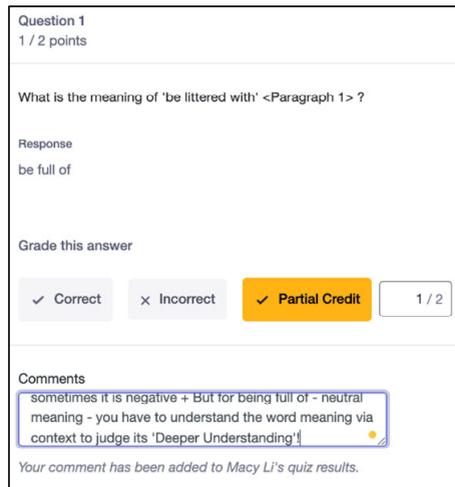**Figure 2**   Individual scaffolding 1 (see online version for colours)

Figure 3   Individual scaffolding 2 (see online version for colours)

In collaborative scaffolding, the teacher would guide students to engage in group work, to analyse and comprehend the reading materials in an interactive, collaborative manner (Figure 4). She modelled the reading and thinking processes desired in a group, and later the students could adopt a similar strategy to proceed (Molenaar et al., 2010). The clarification or further explanation was offered to individual students if misunderstanding or misconceptions occurred, and additional guide to student group work to facilitate their collaboration and exploration (Lin et al., 2015) (see Figure 5).

Figure 4   Collaborative scaffolding (see online version for colours)
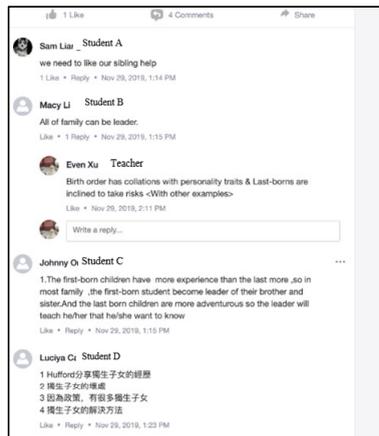
At the concluding stage of each lesson, the teacher offered meta-cognitive scaffolding further interpret and clarify on the targeted strategies to help improve students' cognitive structure (Molenaar e t al., 2010).

Figure 5   Reading guide for students (see online version for colours)

4.4   *Data collection*

In this study, triangulation data collection methods were adopted, as it would leads to more comprehensive understanding of the targets or phenomena (Hastings, 2012). It has been widely use in the relevant studies (Hammond and Wiriyapinit, 2005; Pratim et al., 2015; Sun et al, 2020). Therefore, multiple sources of data were collected and analysed to explore students' learning performance. A pre- post-test design was used to measure students' progress in English reading after their participation in reading program. To uncover student engagement in the program, student actions and activities performed in the learning system of Edmodo were recorded and investigated (Lin, 2012). At the end of the program, all the participants were invited to an interview during which they further shared their views on the design of the program, the affordances of the learning system, and the effect of teacher scaffolding.

1   *Pre-and-post tests*

To measure the effectiveness of the reading program, a pre-test and a post-test of students' reading literacy using an identical set of questions were conducted before and after the program respectively. The reading materials used in the tests was on 'catch-up sleep', a life-related topic rather than scientific or political matters that is suitable for foreign language instruction (Shahbaz and Khan, 2017). It was shortened from a news article from the New York Times. In the adapted version, the original five-paragraph structure and most of the vocabulary of the original article were left unchanged. The questions included focused on the three reading strategies instructed in the reading program, and were sequenced into three batches following the flow of reading recommended by the National Reading Panel (2000). In the first batch of questions, the students were required to infer the meaning of unfamiliar words based on the context provided. In the following 5 questions, the students were requested to locate the requested information and write down the clues they used. The last batch of questions were on the identification of the general idea of each paragraph. Following through the steps of vocabulary development, key information identification, and overall comprehension of the structure and content, students could

understand the passage fluently and systematically. The full score of the test was 20 points. In each round of the tests, students were given 15 minutes to finish the reading and the questions independently.

2 *Student activity performance in Edmodo: weekly participation and reflection quiz*

In technology-supported learning, the frequency, scope, and purpose of student actions and activities would provide legitimate evidence on student participation and engagement and the state of progress (Prinsen, et al., 2008), and could be readily captured in the learning system. In terms of the validated participation, as long as students had made peer interaction or leave feedback to their leading teacher via Edmodo, it could be counted as one validated attendance for each participant (Authors, 2020). The instances when students interacted with their peers or the teacher by raising questions or leaving comments/answers/responses were considered as valid, legitimate participation of the students, and were counted and recorded (Sinha et al., 2015). Such process-based, descriptive data, on the one hand served as indicators for student participation and engagement level, and on the other revealed the extent to which the students had mastered the reading strategies included, and could inform the teacher to adapt their instruction and scaffolding accordingly. The individual reflection quiz posted on the Edmodo, which contained three to four questions was administrated in Week 2 and Week 3 so that students could apply the reading strategy under various formats. Both two weekly reflection quizzes kept the similar difficulty level, so it could record student reading performance from a continuous process. The exemplar reflection quiz questions are as follows:

• What is the meaning of 'Zombie theory' in Paragraph 4? (short answer)

• The first borns tend to become leaders while the last borns are likely to take advantage and risks in their lives. (True/false)

3 *Students' perceptions and attitude toward reading program*

After implementation, all the students were invited to an interview session during which they further elaborated their perceptions and attitude of the reading program. The interview was semi-structured with 9 open-ended questions on overall learning experience, teacher scaffolding in the CSCL sessions, and perspective improvements (Dikko, 2018). To ensure the validity and reliability of the questions, expert opinions from the school teacher of English and some experienced researchers of learning sciences were engaged. For questions on learning experiences, students were encouraged to share their viewpoints on the affordances of Edmodo based reading activities. The second batch of questions were on the effectiveness and preferences of teacher scaffolding. The students were asked about whether the way the teacher facilitated their learning and collaboration was effective, and their preferred type of teacher scaffolding based on the time of provision and the knowledge/skills in target (Kim et al., 2018).

4.5 Data analysis

In this study, both quantitative and qualitative approaches were adopted to analyse and triangulate the multifaceted data. For the pre-test and post-test results, a paired sample t-

test were carried out to investigate whether the students had improved in reading literacy after participating in program. Due to the limited sample size of 14 students, a nonparametric test was run to verify the significance of difference in student mean scores of pre and post-tests. For analysing students' engagement, the frequency of students' participation (i.e. postings of comments, feedback or answers) were counted, and the score of weekly reflection quizzes were marked (Prinsen et al., 2007). The mean scores of the first and second reflection quizzes were compared. The interview data collected was analysed in a qualitative way based on two themes: student's perception of Edmodo-based reading activities, and students' perceptions and attitude toward teacher scaffolding during reading activities. Thus, rich evidence was presented in qualitative way, which could find somethings that quantitative research would miss through quantifying collected data.

5   Results

5.1   Students reading achievements in English

Overall, the CSCL based teacher scaffoldings could facilitate students reading performance in general. Descriptive analysis of the pre- and post-test results implied students' improvement in English reading after attending the reading program (Figure 6). Compared to the mean score of the pre-test (M=10.43, SD=1.69), there was an increment of 5.93 points in the post-test (M=16.36, SD=2.43), with a growth rate of 56.9%.

Figure 6   Mean scores of the pre-test and post-test
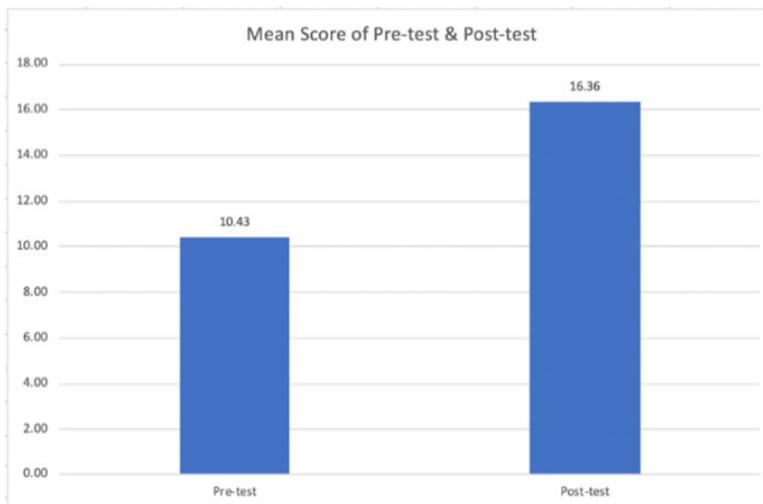
A one-tailed paired samples *t* test was conducted to further examine the impact of the reading program. As displayed in Figure 2, there was significant difference in the scores students obtained in the two rounds of tests (p=0.00<0.05), which means in the post-test, the students performed significantly better than they did in the pre-test. Such evidence, to some extent, substantiated the effectiveness of the program for enhancing reading literacy of EFL students.

Table 3 The result of paired sample t-test

	Mean	Std deviation	Std error mean	95% confidence interval of the difference		t	df	Sig. (one-tailed)
				Lower	Upper			
Pretest-posttest	5.93	2.89	.77	4.25	7.60	7.66	13	.00

In addition, the result of One-Paired Wilcoxon Signed-Ranks Test (Table 4) further affirmed the observed improvement in the post-test (p=0.001<0.05). With such statistical results, despite the limited sample size, the effectiveness of the design and implementation of the reading program could be concluded with confidence.

**Table 4** Result of one-Paired Wilcoxon signed-rank test

Z	−3.302[a]
Asymp. Sig. (one-tailed)	.001

Note: [a]Based on negative ranks.

5.2 Students' engagement in reading activities

The process data collected and calculated revealed that in general the students participated in the program in an active way. As showed in Figure 7, even though the students were fresh to the lesson design and the system in week 1, they could follow through the learning tasks and contributed their ideas proactively from week 1 to week 4.

Figure 7 The result of student participation from week 1 to week4 (see online version for colours)
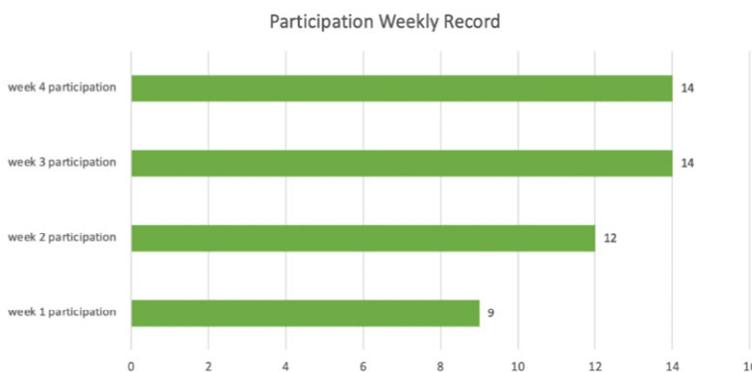
As Figure 7 shows, in the first two weeks, 9 and 12 students participated in the reading activities, while all students participated in the activities at last. Based on calculating students postings in Edmodo in the form of answers, feedback and teacher-student interaction, student-student interaction (i.e. peer feedback), on average, they initiated 8 legitimate actions that demonstrated and contributed to active learning. Students posted their answers in total of 30 in week 1 and 2. Along with the group week in week 3 and week 4, there were 82 legitimate actions generated with 32 instances in week 3 and 50

instances in week 4. For an average student, there were 6 instances of actions of interaction and peer feedback in the group work. In the group reading activities in Edmodo, the students were willing to share their understanding of the reading materials and feedback to each other's ideas. Figure 8 presents two exemplar screenshots of student' postings generated in an individual learning session and a group work session in Edmodo).

Figure 8   Snapshots of student postings in individual and collaborative learning sessions (see online version for colours)
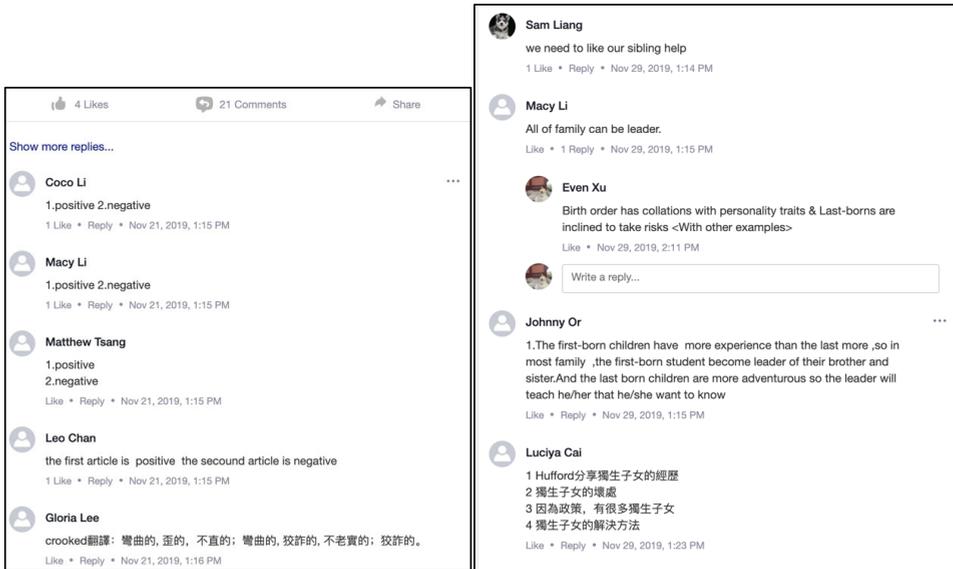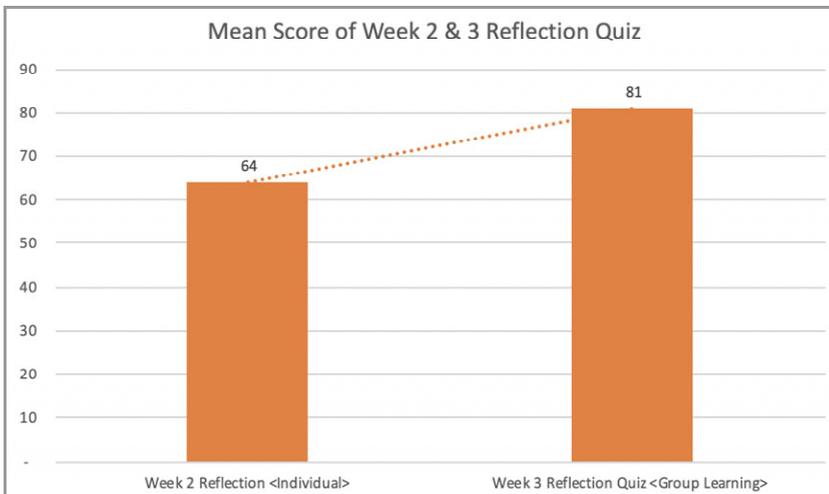

Figure 9   Mean score week 2 and 3 reflection quiz (see online version for colours)

As Figure 9 shows, the mean score of the weekly reflection quiz has witnessed a 26.6% increase, from the second week to the third one. Then the absolute value of the increment is 17, from 64 to 81. Moreover, teacher feedback was provided for students' responses in reflection quiz. There were 16 teacher feedbacks in the form of hints, challenging questions, instructions, and explanations to incorrect responses recorded in system.

This modest growth tends to explain the effective teacher scaffolding during the project assisted student participants to perform better in their English reading literacy (). Below are some exemplars:

- Can you be more specific, like support and ideas –may need more explanations

- Just translate the literal meaning seems not workable here

- Here seems the opposite meaning, cannot be just google it from the dictionary, how do you understand the metaphor

- Decoy effect, how do you link it with later context-deceive? please check it.

5.3 Interview results

5.3.1 Student perceptions and Attitudes toward the reading program

After the four-week reading project, all student participants were invited to share more individualised opinions on their experience of this reading program. The first aspect of the interview was analysed from three perspectives centering on the CSCL, which was represented the chosen LMS - Edmodo. They were Edmodo functions, its advantages, and its deficiencies. According to the majority of the students, they appreciated the interactions and collaborations empowered by Edmodo learning environment. For Student N, the delivery of "reflection quizzes via Edmodo was more direct and efficient than the traditional paper ones" as "the teacher could evaluate their responses and provide feedback with ease and convenience". Student A said: they can raise questions to the teacher directly and wait for her instant feedback. Alternatively, they could also pose questions to each other".

Comparing with the traditional classroom, student G stated that "unlike the old-school mode of teaching and learning, in which we have to follow the teacher step-by-step while going through the learning content, we can share our ideas or raise questions whenever we want (in Edmodo)". Student B reflected that "in the traditional classroom, we just do our sharing randomly in the group. The online platform enables us to share and discuss with each other easily and conveniently we can share our ideas. We can also see what our classmates understand about a particular topic and 'Comment' on their ideas. ". These reflections showed that the students recognised and acknowledged the significance of interacting with the teacher and peers for more ideas and feedback, and that they perceived Edmodo based reading as a good supporting tool for this regard.

5.3.2 Student Perceptions and Attitudes toward Teacher Scaffolding in Edmodo

The data showed that, most students felt the teacher scaffolding provided for facilitating individual learning or group collaboration, was effective, and could help them understand and apply the reading strategies instructed. In individual scaffolding, the teacher provided specific tips and constructive feedback to individual students based on their quiz results

and reading performance, and such micro, detailed guidance facilitated them to read and learn better. For instance, Student M recalled that "the teacher gave students individual and specific comments based on the quiz results or facial expressions in class. In the online system, we could avoid face-to-face consultation sessions with the teacher (which was usually embarrassing). We could simply type our questions in the chat-box and then wait for the teacher's reply. The teacher also left us 'private messages' she deemed necessary". With regard to collaborative scaffolding, the students in general held a positive attitude as well. The teacher provided guiding questions to help student groups clarify the flow and structure of the reading, and to encourage them to further digest the passage with finer granularity.

Compared to the scaffolding offered in the traditional classroom, teacher scaffolding in the program was extensive, targeted, and differentiated. In the CSCL program, the processes of teaching and learning were prolonged and extended into after-class, extracurricular time, which provided ample opportunities for both the teacher and the students to make further retrospections and improvements. In addition, as there was greater learner anatomy, the students could manage and adjust their own pace of reading and learning. This spared time and effort of the teacher to provide differentiated instructions that catered to the distinctive needs of students of different competency levels (Popov et al., 2019). Just as Student K shared "(in the program), the teacher helped the less competent students with more assistance. She would chat with us to check our learning progress, and make extra annotations and notes on our answers to facilitate our revision work after class". Yet for more competent students, the teacher would instruct and encourage them to work on more challenging tasks on their own.

In the interview, the students were also questioned about the most effective type of teacher scaffolding with regard to its provision of time. According to the data, more than 50% of the students believed that teacher scaffolding offered 'during reading' was the most significant and effective. Alternatively, 3 out of the 14 students opted 'before-reading' scaffolding as the most effective. According to them, such 'heads up' would help them clarify the goals and tasks of learning, and activate the knowledge and skills developed previously. For instance, Student I stated that "I prefer the guidance and tips given before reading. In the reading program, the teacher would give us some pre-reading tasks before the class and further elaborate and clarify the tasks at the beginning of the class to ensure our understanding. This helped us to relate and form a complete picture". Last but not least, the remaining three students most appreciated their interactions with the teacher after class as it could extend their learning. The sharing from Student D was most representative of this batch of students. As he stated, "We could ask questions after the face-to-face instruction. Meanwhile, via the online platform the teacher could provide further elaboration to consolidate our understanding and application of the reading strategies".

In the reading program, three different reading strategies were included and instructed to facilitate reading. As reflected in the interview data, integrating and instructing diversified reading strategies in reading classes was indeed necessary because different students should have different pain-points when it comes to reading in a foreign language. Of the 14 students, eight found vocabulary skills were the most fundamental to comprehension, and could help enhance their confidence and interest in reading. They also believed the way teacher guided and facilitated them to guess the meaning of unfamiliar words based on word roots and the context in the program was very effective. According to many students such as Student F, "Without knowing the meaning of new

words, we cannot understand the passage at all. Teacher scaffolding on this strategy was useful and I need it more. When I do the reading, especially on my own during the test, I hope I can understand the unfamiliar words as much as possible. Otherwise, I will not be able to finish the passage, which lowers my confidence".

For another five students, clarifying the structure or logic flow of the selected passage was more essential and critical. For instance, Student K highlighted, "passage flow seems more important to me. If I can get the general idea of the passage, at least I know what the passage is about, I can more or less understand the passage". However, form the perspective of an examination-taker, the last three students considered "locating the information required" the most important, and teacher scaffolding on this regard was most useful. As Student G pointed out, "being examination-oriented, I think 'locating information' is essential as most of the questions are related to it. I think this skill will help me attain a higher score. Additionally, many students appreciated this strategy as it could be applied to the learning of other subjects as well.

6   Conclusions and implications

In this study, although limitations of sample size and time constraints, with triangulation data, both quantitative and qualitative data on student learning outcomes and experiences were collected and analysed to answer the three research questions proposed. To conclude, empirical data obtained this study affirmed the positive impact that CSCL reading programs that harness LMS and teacher scaffolding can bring about to language learning by improving student learning outcomes and engagement in the language classroom. As the comparison of student test scores in the pre-test and the post-test indicated, the Edmodo-supported reading program that highlighted teacher scaffolding served as an effective approach via which EFL students could improve in reading performance. These would help to answer the research question 1. To answer the research question 2, students engagement in this reading program was demonstrated by their responses to the readings tasks in Edmodo. Meanwhile, analyses of the student interview data suggested that the students, in general, held positive attitude toward their experiences in the program, this helped to answer the research question 3. With triangulation data, the impact of the CSCL reading program on students learning was further exposed in qualitative way. Through observing their activity performance (i.e. students participation, posts, answers in quiz, peer feedback) in Edmodo learning system, they performed engaged and reflective throughout the processes of learning, and their learning was well supported and strengthened with the affordances of the Edmodo and the scaffolding from the teacher. The students recognized and appreciated the effectiveness and efficacy provided by this innovative approach of reading activities in the interview. The finding echoed previous research that online learning platforms such as Edmodo are efficient applications for teachers to organise interactive language teaching and learning (Luo et al., 2017). More importantly, the analysis results substantiated the critical role the teachers should play in scaffolding and supporting student learning and development in CSCL reading programs as relevant studies discussed (Cindy et al., 2011; Lin and Reigeluth, 2016). As reflected in the student interview, only with teacher guidance would the students utilise innovative tools such as LMS in their future study.

The study brings the following implications:

1   Unlike emphasising test-taking skills merely, teachers shall consider the information era contemporarily and render more scaffolding to nurture critical thinking logic and language acquisition of students (Zeng and Fan, 2017). Throughout the processes of learning, the teacher helps to ensure the students are on the right track and encourage them to further explore and analyse the reading task in a critical way (Birjandi and Jazebi, 2014; Stahl and Hakkarainen, 2020).

2   Systematic, structured teacher guidance could provide a conducive environment to learning in which EFL students manages to keep exploring the reading rather than stop at the literal understanding of the context (Yu and Liu, 2018). Scaffolding can thus bring transcendence, from the generalisation of present knowledge to one more profound comprehension (Birjandi and Jazebi, 2014).

3   Although we didn't focus more on the mobility and ubiquitous nature of the mobile technology supported collaborative learning in EFL reading (Lan et al., 2007), more insights could be obtained from our study that Edmodo supported reading activities could have great potentials for facilitating teacher-student interaction and students collaboration in various learning contexts including both formal and informal learning contexts.

In summary, with teacher instruction and feedback, student interaction and collaboration become more smooth and effective, and they become more reflective and autonomous in learning, which in turn, further empowers the effectiveness of learning. In the further study, more specific observation and analysis of student-teacher interactions in the context of teacher scaffoldings in mobile computer supported collaborative learning (mCSCL) will be conducted. The study will borrow the key ideas from CSCL with the design and implementation of mobile technology supported collaborative learning activities, and with the combination of the merits of mobile learning (Dalb et al., 2020).

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