A Systematic Review of Technology-Enhanced Self-Regulated Language Learning

Yin Yang[1], Yun Wen[2] and Yanjie Song[1*]

[1]Department of Mathematics and Information Technology, The Education University of Hong Kong, Hong Kong // [2]National Institute of Education, Nanyang Technological University, Singapore // yyin@s.eduhk.hk // yun.wen@nie.edu.sg // ysong@eduhk.hk

[*]Corresponding author

(Submitted September 23, 2021; Revised April 16, 2022; Accepted April 25, 2022)

ABSTRACT: The role of self-regulated learning in language learning has been widely acknowledged, and there is a growing number of studies on technology-enhanced self-regulated language learning (SRLL). This systematic review aims to provide a holistic picture of existing studies in this area by identifying the characteristics of published studies, the research methods used to evaluate SRLL effectiveness and the role of technology in SRLL. The review covered 34 empirical studies focusing on SRLL that were published from 2011 to 2020. The results showed varied characteristics of technology-enhanced SRLL studies, dominance of the use of quantitative methods, greater focus on examining students' SRLL outcomes instead of their processes, and the role of technology in supporting the performance phase of students' SRLL instead of the entire SRLL process. These findings have implications for using technologies to facilitate and examine the holistic process of students' SRLL.

Keywords: Systematic literature review, Technology, Self-regulated language learning (SRLL)

1. Introduction

Online learning systems, especially mobile applications, are widely used in many educational contexts, including language teaching and learning. The boundaries between formal and informal language learning, classroom-based learning and out-of-classroom learning activities have become blurred and interconnected with the rapid development of wireless communication networks and mobile devices (Sharples et al., 2016). As this new environment provides unprecedented opportunities for language learning, learners should develop self-regulated learning (SRL) skills to succeed. They must set goals and schedule efficiently while participating in online learning activities (Yeh et al., 2019; Zhou & Wei, 2018).

SRL refers to an active, constructive process through which learners set learning goals and then attempt to monitor, regulate, and control their cognitive and metacognitive process and learning behaviours (Pintrich, 2000). It is also an essential component of lifelong learning to cope with the challenges of the twenty-first century (Lehmann et al., 2014; Zheng et al., 2018). Many studies have shown that SRL is positively related to students' learning outcomes (Chen et al., 2014; Lai et al., 2018). Zimmerman (2002) posited that self-regulatory processes are teachable. To improve learning outcomes, students must engage in effective SRL processes in planning and setting goals, monitoring their learning process and evaluating their whole learning performance (e.g., Azevedo et al., 2018; Lai et al., 2018). Interventions are necessary to support students in developing SRL (Yang et al., 2018; Yeh et al., 2019). In recent years, the number of studies on SRL in online learning environments has soared. In these works, researchers have focused on trends in measurement and intervention tools for SRL (Araka et al., 2020), the correlation between SRL strategies and academic achievement in online higher education (Broadbent & Poon, 2015), approaches to supporting SRL in online learning (Wong et al., 2018), the relationship between SRL and mobile learning (Palalas & Wark, 2020) and the relationship between SRL and learning analytics in online learning (Viberg et al., 2020). However, reviews of technology-assisted self-regulated language learning (SRLL) are scarce.

Preliminary studies in the field of language learning have investigated SRLL mediated by technologies, such as in reading (e.g., Chen et al., 2014; Zheng et al., 2018; Serrano et al., 2018), writing (e.g., Ducasse & Hill, 2019) and vocabulary learning (e.g., Chen & Hsu, 2020). By contrast, papers on the learning effectiveness of SRLL have had various foci, such as language learning outcomes (Chen et al., 2019), SRL strategies (Chen & Lee, 2018) and SRL skills (Yeh et al., 2019). A number of studies have shown that technology-enhanced learning environments can provide technological affordances for improving language learning outcomes and fostering SRL skills (Hromalik & Koszalka, 2018; Shyr & Chen, 2018; Woottipong, 2022). According to other studies, technology is not positively related to language learning outcomes (e.g., Chen & Lee, 2018) or SRL skills (e.g.,

Seifert & Har-Paz, 2020). This inconsistency in findings may be caused by the design of technology-assisted learning environments. A well-designed technology-enhanced learning environment can help learners regulate their learning, determine where and when to learn, cultivate their SRL behaviours and sustain their interest in SRL (Shih et al., 2010).

Therefore, in addition to exploring the characteristics of empirical SRLL studies in terms of the publication years and learner types, this review study explored how SRLL effectiveness was investigated and the role of technology in these SRLL studies. To understand the trends of SRL in language learning and the potential of using technology to cultivate language learners' SRL skills and improve their learning performance, this systematic review examined technology-enhanced SRLL studies published in the past 10 years with the following questions:

RQ1: What were the characteristics of SRLL studies in terms of their publication years and learner types?
RQ2: What research methods were adopted to examine SRLL effectiveness in the reviewed studies?
RQ3: What role did technology play in supporting SRLL in the reviewed studies?

2. Method

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was applied to guide this systematic review (Moher et al., 2015) to ensure the rigour and quality of the review process. The search strategy, selection criteria and data coding and analysis in this review are presented below.

2.1. Search strategy

First, the major relevant terms used in the literature, including synonyms and alterative spellings, were identified. The following search string was then used to search for relevant articles: ("self-regulated" OR "self-regulatory" OR "self-regulation") AND ("language learning" OR "reading" OR "writing" OR "speaking" OR "grammar" OR "vocabulary") AND ("technology" OR "computer" OR "mobile" OR "tablet" OR "phone"). The data for this study were selected from the following academic journal databases: Educational Resources Information Centre (ERIC), Web of Science (WOS), Wiley and ProQuest. These databases are widely used in educational studies (Bano et al., 2018; Lee, 2019; Lin & Lin, 2019). The search only involved peer-reviewed articles that could be retrieved online to ensure a high quality of the selected articles (Hung et al., 2018). Endnote was used to track each identified citation and to manage and document the imported databases throughout the search process.

2.2. Selection criteria

Inclusion and exclusion criteria were applied to eliminate irrelevant studies. As illustrated in Table 1, the study had to be (1) published in English, (2) dated from 2011 to 2020 inclusively, (3) an empirical or case study, and (4) in a technology-enhanced language learning environment. Only articles from peer-reviewed journals were selected. Other types of publications, such as theses, book reviews and conference papers, were not included. This criterion is widely used in other literature reviews to maintain a high quality of selected papers (e.g., Lin et al., 2019; Shadiev & Yang, 2020; Zainuddin et al., 2020; Zou et al., 2019). In addition, special needs education research, including studies involving participants with dyslexia, was eliminated for the following reasons. First, such studies are commonly excluded from literature reviews related to technology-assisted language learning environments (e.g., Bano et al., 2018; Zou et al., 2019). Second, special needs education should be approached carefully and that technologies for individuals with autism spectrum disorders or cognitive disabilities are complex and deserve further investigation. During our literature search, we observed an increase in the amount of attention paid to SRL with technology in the field of special education (e.g., Ben-Yehudah & Brann, 2019; Hughes et al., 2019).

The search of online databases resulted in 466 articles. A total of 345 articles remained after the removal of duplicates, and their titles and abstracts were scanned. Two researchers were involved in the selection process to avoid selection bias. All articles were examined by both researchers; researcher A found 136 articles to be relevant, and researcher B considered 122 articles relevant. The titles of these articles were documented in Excel by two authors and compared one by one. In total, 136 articles were selected for further analysis.

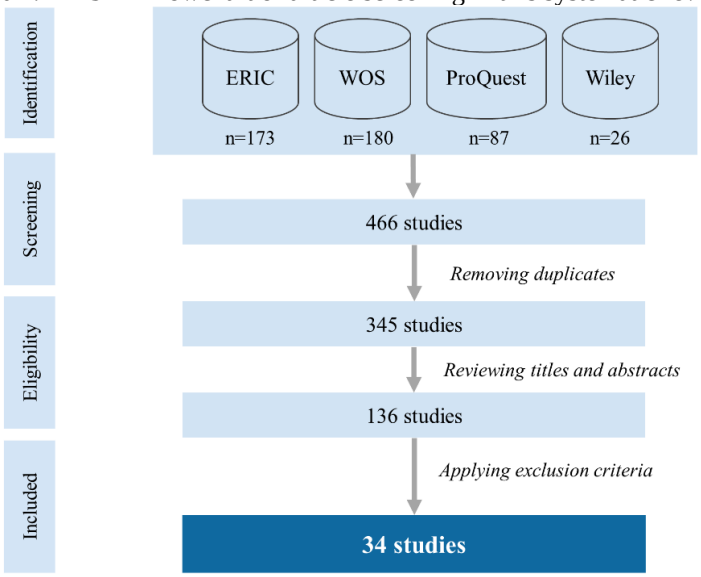
Table 1. Exclusion and inclusion criteria

Inclusion criteria	Exclusion criteria
• Published in English • Published from 2011 to 2020 • Empirical studies and case studies • In technology-enhanced language learning environments	• Published in other languages • Not in technology-enhanced learning environments • A thesis/editorial/book review/conference paper • Inadequate information on research design and data analysis • Literature review and conceptual studies in nature • Special needs education research

The three researchers applied inclusion and exclusion criteria (see Table 1). The first author applied these criteria to all papers for study selection. The second author randomly checked the results by examining twenty papers. All questions related to article selection were resolved by the three authors together in a discussion. This process was guided by Bano et al. (2018) and Shadiev and Yang (2020). Finally, 34 papers were deemed eligible for the review. Among the cases included by Llorens et al. (2016) and Serrano et al. (2018) in their multi-case studies, only those related to this review were selected.

To sum up, the study selection process, which was based on PRISMA (Moher et al., 2015), is illustrated in Figure 1. A total of 34 articles (see Appendix A) were considered eligible for the review.

Figure 1. PRISMA flowchart of article screening in this systematic review



2.3. Data coding and analysis

All the selected papers were coded and analysed using content analysis. The first research question concerned the characteristics of the SRLL studies' publication years and learner types. As for the publication years, the distribution of the selected papers in 2011–2020 was analysed. About the learner types, due to the weakness in metacognition of young learners (van Loon & Roebers, 2017), SRL cultivation might be sensitive to age. Researchers have different opinions on whether children younger than six years can use metacognitive strategies (Dignath & Büttner, 2008). There are also studies suggesting that children aged 7 to 8 years self-evaluate less compared with those aged 11 to 12 years (Paris & Newman, 1990). Paris and Winograd (1999) state that children's metacognition develops during schooling from the age of 5 to 16 years (Paris & Winograd, 1999). On this basis, in addition to categorising learners in terms of educational levels, we distinguished lower and higher primary school students. Hence, learners were classified into six sub-categories: (1) 6 years old and below, (2) 7–9 years old, (3) 10–15 years old, (4) 16–18 years old, (5) undergraduate and/or postgraduate, and (6) workplace adult learners.

The research methods used to evaluate learning effectiveness were coded and analysed to address the second research question. These approaches were categorised as quantitative, qualitative, and mixed methods. The durations of the studies were classified into the following categories, which were adapted from Hwang and Fu (2019): one session, short term (< 10 weeks), intermediate term (11 weeks to 4 months) and long term (> 4

months). The evaluation of SRLL was divided into four categories: (1) assessing student language learning outcomes, (2) assessing students' SRL (e.g., self-efficacy, attitudes, SRL strategies used, SRL skills behaviours) (Ardasheva et al., 2017; Panadero et al., 2016), (3) assessing both language learning outcomes and SRL, and (4) exploring the technology-enhanced SRLL profiles of students.

As for the third research question, first, technology was categorised as self-developed or third-party technology. The former referred to technology explicitly designed by researchers to investigate its use in teaching and learning, whereas the latter meant commercial software or technology that was developed by a third party. The types of technology were coded as mobile devices (e.g., mobile phones and iPads), desktop personal computers (PCs), and multiple devices. Multiple devices referred to the presence of more than one type of device in the study. Second, the learning settings, which referred to the contexts in which these technologies were employed, were divided into the following categories, which were based on Bano et al. (2018): formal settings, informal settings, multiple settings and not specified. Formal settings referred to traditional learning environments, such as institutionalised settings (e.g., public schools and universities); informal settings included learning spaces apart from formal learning settings, such as homes, subways, gardens and supermarkets; multiple settings referred to combinations of formal and informal learning experiences; not specified meant that no specific learning context was indicated in the study. Lastly, the role of technology in supporting SRLL processes was coded in terms of Zimmerman's (2002) SRL model, which is widely acknowledged in the field (Dignath et al., 2008; Panadero, 2017). According to Zimmerman (2002), SRL processes consist of the following phases: forethought, performance and self-reflection. The forethought phase involves task analysis (e.g., goal setting and strategic planning). In the performance phase, students monitor their processes. Finally, the self-reflection phase includes self-judgment and self-reactions to learning performance and outcomes. These phases were used to analyse and address the third question.

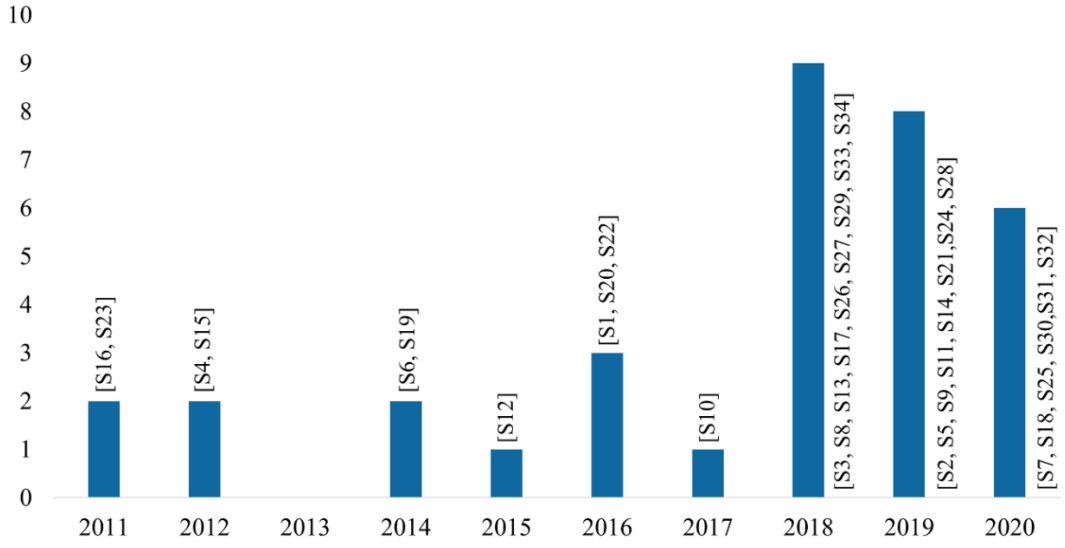
In piloting the coding scheme, two researchers coded eight articles together and discussed the coding results until a consensus was reached. After that, the same two researchers independently coded the 26 remaining articles. Cohen's kappa, which was calculated to measure the inter-rater reliability about the role of technology in terms of Zimmerman's (2002) SRL model, was 0.91, which was considered perfect (Stemler, 2004). In finalising the coding results of the 34 selected articles, the three researchers discussed any discrepancy by conducting face-to-face discussions and by rechecking points of disagreement until a consensus was reached.

3. Results

3.1. Study characteristics in terms of the publication years and learner types

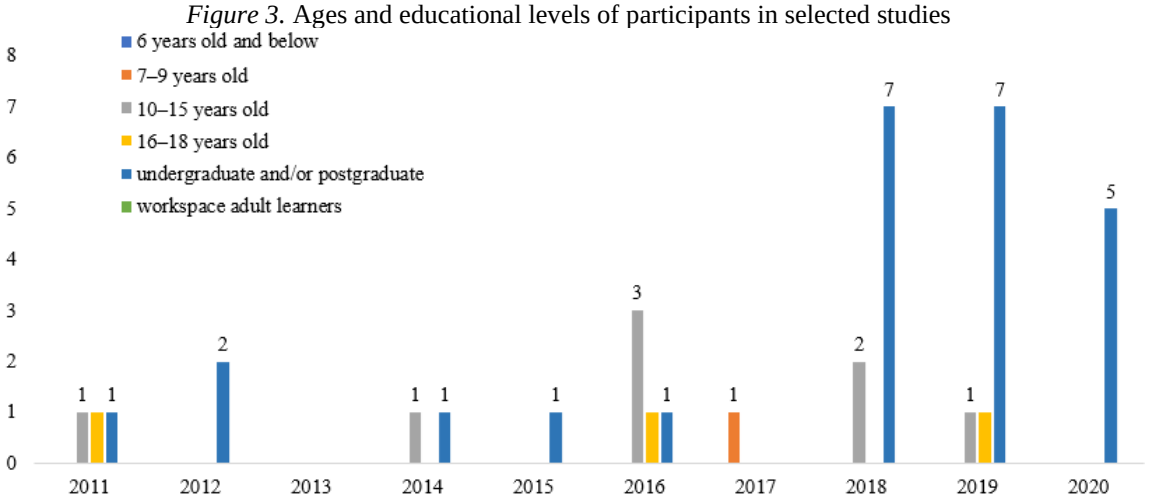
Figure 2 shows the distribution of the publication years of the 34 selected articles over the past 10 years (2011–2020). The number of empirical research papers dramatically increased from 2017 to 2018 but declined between 2018 and 2020.

Figure 2. Distribution of publication years of selected studies



As for the learner types, Figure 3 shows that approximately 73.5% of the studies were conducted in higher education. Eight studies involved participants between the ages of 10 and 15 years, followed by three studies conducted among participants between the ages of 16 and 18 years. Only one study focused on participants aged 7 to 9 years. No study involved participants aged below 6 years or workplace adults.

Figure 3. Ages and educational levels of participants in selected studies



3.2. Research methods adopted to examine SRLL effectiveness

The SRLL learning effectiveness was examined in the selected studies via different research methods. Eighteen studies (53%) primarily adopted quantitative research methods and mainly aimed to investigate the effectiveness of developed mobile applications or learning systems for SRLL. A total of 12 studies (35%) employed mixed research methods and four studies (12%) adopted qualitative research methods to explore students' SRLL experience. Twelve papers (35%) were intermediate-term studies, and eight were short-term studies (23%). Six studies (18%) were conducted in one session each, whereas five (15%) were long-term (longer than four months) studies.

Among the 34 studies, 10 studies adopted non-experimental research designs and investigated students' self-regulated technological profiles. In these studies, students were free to choose and adopt various tools to regulate their language learning. Among these 10 studies, seven described how students used technology to regulate their language learning experience in online environments using closed-ended survey questionnaire (Tao et al., 2020), interviews (Lai & Gu, 2011; Lei, 2018; Wang & Chen, 2020), participant-made videos (Chien, 2019), open-ended survey questionnaires (Lai & Gu, 2011; Su et al., 2019) and reflective journals (Hromalik & Koszalka, 2018). In addition, six studies mainly employed questionnaires and correlational analysis to understand the underlying relationship between SRL factors.

The 24 remaining studies were conducted using experimental research designs. Eighteen studies (52.9%) investigated both language and SRL outcomes, whereas six studies (17.6%) only focused on self-regulation. Detailed information is presented in Table 2. Among the 24 studies, 18 (52.9%) investigated students' language learning outcomes. Quizzes were primarily adopted to assess students' improvement in language learning. Only one study used students' e-portfolios, where students recorded their oral production to assess the progress of their oral performance (Torres et al., 2020).

As for evaluating students' SRL, 20 studies (83.3%) used surveys, including questionnaires, self-reports and interviews. Six studies employed log data to analyse students' SRL-related behaviours while interacting with the studied technologies. For example, Chen et al. (2014) used data recorded on a digital reading annotation system (DRAS) of the achievement index of learning time, effort level, reading rate, concentrated learning and degree of understanding of learned courseware to assess students' SRL skills. Lee and Chan (2018) traced students' behaviours on the My-Pet-Shop system to explore SRL behavioural patterns. Kondo et al. (2012) analysed time spent on Nintendo DS mobile devices. Llorens et al. (2016) mainly analysed students' behaviours recorded online to indicate self-regulation strategies and decision-making; these recorded behaviours were the number of times students decided to revisit text or questions and the decisions made by the students at specific times. Roussel (2011) recorded students' physical movements of the mouse during a listening task to indicate their ability to regulate their listening in language learning. Serrano et al. (2018) measured students' monitoring

accuracy by calculating the number of right or wrong answers in non-search decisions to help them regulate their use of text information in reading. Moreover, four studies involved teachers' observation (Ferreira et al., 2017; Ghufron & Nurdianingsih, 2019; Karami et al., 2019; Torres et al., 2020). Ferreia et al. (2017) considered teachers' perspectives by asking them to rate their students' SRL using a questionnaire. Ghufron and Nurdianingsih (2019) used an observation protocol to document in-class teaching and learning for analysis. In the study of Karami et al. (2019), teachers' field notes were used to triangulate students' surveys in order to understand their SRL in English writing. Similarly, teachers' journals which included observations of students' performance were used by Torres et al. (2020) to explain students' strategy use in developing their English speaking skills.

Table 2. Summary of 24 studies assessing student language-related and/or SRL

Paper ID	Language learning outcomes								SRL			
	Focus						Data sources		SRL ability/strategy	Data source		
	V	W	M	R	S	L	Qz	Others		Survey	Log data	Observation
S1					x				x	x		
S3				x					x	x		
S5	x						x		x	x		
S6				x			x		x		x	
S7			x				x		x	x		
S8	x						x		x	x	x	
S10			x				x		x	x		x
S11		x							x	x		x
S12	x						x		x	x		
S14		x					x		x	x		x
S15			x				x		x		x	
S18		x					x		x	x		
S19	x						x		x	x		
S20			x				x		x		x	
S21		x							x	x		
S22						x			x	x		
S23						x	x		x		x	
S24			x						x			
S25			x				x		x	x		
S26				x			x		x		x	
S27	x						x		x	x		
S31					x			x	x	x		x
S33				x			x		x	x		
S34				x			x		x	x		

Note. *V* = vocabulary; *W* = writing; *M* = mixed language learning outcomes; *R* = reading; *S* = speaking; *L*= listening; *Qz* = quizzes.

3.3. Role of technology in supporting SRLL

Table 3 presents the technologies, devices, tool descriptions and learning settings in the 34 selected papers. A total of 15 studies (44.1%) used self-developed applications or systems. The rest investigated the use of technologies developed by third parties. Regarding the adopted devices, 16 studies (47%) employed desktop PCs, 11 studies (32%) used mobile devices and seven studies (21%) adopted multiple devices. In addition, 10 studies (29%) employed free-to-use technology, but seven of them did not specify Web 2.0 technologies and applications (Al Fadda, 2019; Çelik et al., 2012; Chien, 2019; Hromalik & Koszalka, 2018; Lai & Gu, 2011; Su et al., 2018; Tao et al., 2020).

The majority of studies (55.9%) were conducted across multiple learning contexts (e.g., classrooms and homes). The rest occurred in formal settings (35.3%) or informal settings (Çelik et al., 2012; Lai & Gu, 2011; Zhai et al., 2018). More studies were conducted in informal settings in the first five years (2011–2015) than in the next five years (2016–2020). Overall, the distribution of learning contexts indicated that SRLL research was conducted more frequently in multiple settings.

Table 3. List of technologies, devices, tools descriptions and learning settings in the selected studies

Paper ID	S	T	Devices	Tools description	Learning settings
S1	x		O	automatic speech recognition (ASR)	multiple
S2		x	M	multiple tools	multiple
S3		x	O	multiple tools: dictionaries, WhatsApp, camera, internet search engines, notes, and recorders	multiple
S4		x	M	multiple tools	informal
S5	x		O	EVLAPP-SRLM: an English vocabulary learning app with a self-regulated learning mechanism	formal
S6	x		D	a digital reading annotation system (DRAS): an SRL mechanism combined with useful annotation functionalities that can annotate digital texts in the HTML format	formal
S7	x		O	mobile virtual reality environment (VRE)	multiple
S8	x		D	My-Pet-Shop: an educational game to enhance young children's learning of English vocabulary	formal
S9		x	M	multiple tools	multiple
S10	x		D	an adapted Moodle platform	formal
S11		x	D	multiple tools: Grammarly, Google docs and Microsoft Word.	multiple
S12	x		O	a calibration scheme: using a preview or review process for individual learners	multiple
S13		x	M	multiple tools	multiple
S14		x	D	e-portfolio: Edmodo	multiple
S15		x	O	the Nintendo DS Lite: DS More Training for the TOEIC Listening and Reading Tests	multiple
S16		x	M	multiple tools	informal
S17		x	O	WeChat: free software provided by China mobile	multiple
S18	x		O	the ARCAUW application: using the software Unity for Mobile AR.	formal
S19		x	D	Google docs-Web-based collaboration tool	multiple
S20	x		D	Read&Answer: record students' search behaviour while reading	formal
S21		x	D	computer-mediated discussions	multiple
S22		x	D	podcast	formal
S23		x	D	recorders	formal
S24	x		D	the prompts added in the guidelines of the assignments or reading texts as hyperlinks and opened in small pop-up windows	multiple
S25		x	O	Mobile tools: WhatsApp, Nearpod, Quizlet and Google Apps	multiple
S26	x		D	TuinLECweb: an intelligent tutoring system that teaches monitoring and self-regulation strategies	formal
S27	x		D	Flip2Learn system	formal
S28		x	D	Wikis	multiple
S29	x		D	multiple tools: an online learning system	formal
S30		x	M	multiple tools: a learning management system and other web 2.0 technologies	multiple
S31		x	M	multiple tools: voice recorder, e-portfolio, colour cards, visual dictionaries, google translator	multiple
S32		x	O	YouTube videos	multiple
S33	x		D	biofeedback	informal
S34	x		O	a mobile self-regulated learning system	formal

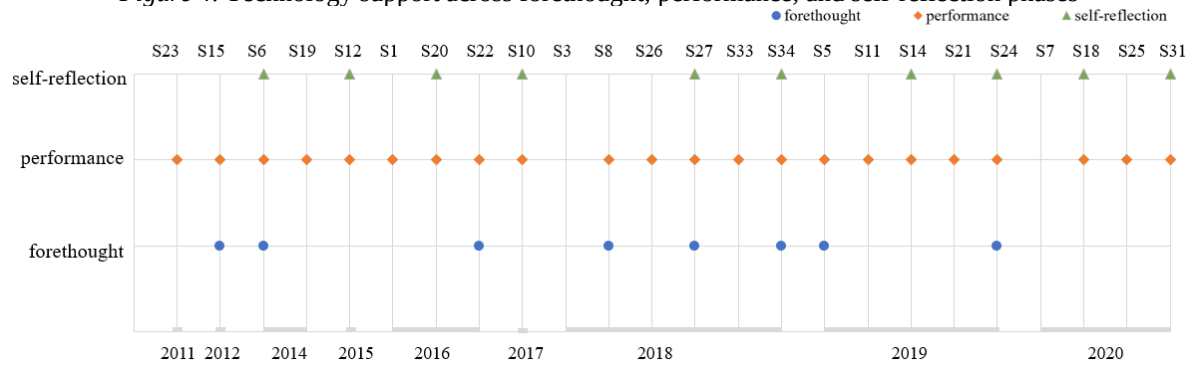
Note. x = Yes; S = self-developed; T = third party; M= multiple devices; O= mobile devices; D= desktop PCs.

As 10 studies did not explicitly define the features of Web 2.0 technologies or mobile applications to support SRLL, only 24 studies could be further analysed by focusing on how they were designed to facilitate students' SRLL processes based on the three phases of SRL (Zimmerman, 2002).

As shown in Figure 4, 21 of the 24 studies adopted technologies that focused mainly on supporting part of the SRL process, such as by providing monitoring affordances in the performance phase, where students could review their learning status. Eight studies highlighted the setting of goals. Ten studies assisted self-regulated

learners in self-reflection. However, only four studies supported the whole process of SRLL (Chen et al., 2014; Saks & Leijen, 2019; Shyr & Chen, 2018; Zheng et al., 2018). Chen et al. (2014) adopted an SRL mechanism with a DRAS to support students' reading. The students set learning goals via a self-monitoring table, and they monitored their performance using radar plots. Students could make a self-evaluation. In Saks and Leijen (2019), prompts were added to the learning assignments to assist students' SRL. In addition, Shyr and Chen (2018) adopted the Flip2Learn system to facilitate university students' vocabulary learning and enhance their self-regulatory skills. Furthermore, Zheng et al. (2018) developed a mobile SRL system to assist university students' reading by helping them set goals, make plans, monitor their learning processes and self-evaluate.

Figure 4. Technology support across forethought, performance, and self-reflection phases



4. Discussion

This systematic review provides a synthesis of key findings on the current research status about technology-enhanced SRLL from 2011 to 2020 in terms of (1) study characteristics in terms of their publication years and learner types, (2) research methods used to evaluate SRLL effectiveness, and (3) the role of technology in SRLL.

4.1. Study characteristics

This review indicates that publications on technology-assisted SRLL generally increased during the 10-year period. Among the 34 reviewed papers, only seven were published from 2011 to 2015; the rest were published after 2015. Nonetheless, the number of publications declined between 2018 and 2020. Moreover, over 60% of the studies were conducted in tertiary education contexts, followed by secondary school and primary school contexts. These results echo previous findings that many studies on technology-enhanced language learning were conducted in universities (Chang & Hung, 2019; Broadbent & Poon, 2015). Papers targeting kindergarten students are rare. This is probably due to the limited metacognitive abilities of young learners (Alvi & Gillies, 2021; Marulis et al., 2020). Furthermore, some studies (e.g., Bohlmann et al., 2015; Pahuriray, 2021) have revealed that young learners' capability is related to their language ability, which is still under development at their age. Nevertheless, some empirical studies have indicated that preschool children already begin developing an ability for SRL (Lockl & Schneider, 2002; Dignath et al., 2008). The effects of SRL training during development among young learners should be examined. Therefore, future technology-enhanced SRLL research can focus more on younger learners, particularly those younger than 9 years.

Additionally, no study on this topic has been conducted on workplace adult learners. The concept of lifelong learning is receiving increasing attention. The results of this study suggest the need to determine how to help workplace adult learners develop SRLL skills with technology.

4.2. Research methods

Over half of the studies (n = 18) mainly adopted quantitative research methods, and the majority lasted less than four months. As for SRLL evaluation, 18 studies analysed both language and SRL outcomes, six studies (17.6%) assessed self-regulation only and 10 studies (29.4%) explored student technology-enhanced SRLL profiles using non-experimental research designs. Technology-enhanced SRLL had a generally positive effect on language learning outcomes, affective/psychological learning outcomes and students' SRL. For language learning outcomes, quizzes were used in most of the studies. Regarding SRL, the measurements heavily relied on self-report data. However, self-report instruments, such as questionnaires and interviews, were usually deployed

before and/or after the treatment; therefore, students might have overestimated their responses (Roth et al., 2016). Although self-report instruments can reveal students' attitudes and feelings, they can be biased, considering that they depend on how learners perceive themselves. As argued by Greene and Schunk (2017), self-report instruments capture students' perceptions of self-regulation but fail to understand how learners change or adapt self-regulation processes while engaging in learning.

Studies on learners' technology-enhanced language learning (e.g., Lai & Gu, 2011; Shyr & Chen 2018; Zheng et al., 2016) have particularly highlighted factors contributing to technology-enhanced EFL learners' SRLL. However, none of these studies examined students' SRL behaviours and the relationship between these behaviours and students' language learning outcomes. Current research on technology-enhanced SRLL pays little attention to specific SRL behaviours or strategies of individual learners (Li et al., 2020), that is, learning patterns that share characteristics with SRLL behaviours. Only six out of the 34 studies traced students' specific behaviours as indicators of SRL. Some studies have acknowledged the value of using log data derived from technology-enhanced environments as SRL indicators (Araka et al., 2020; Azevedo et al., 2018; Panadero et al., 2016; Winne et al., 2019). Thus, future research can apply mixed research methods to elucidate the characteristics of students' SRL behaviours through longitudinal studies, thereby enriching student perceived SRL with real-time behaviour log data.

Four studies involved teachers' observation (Ferreira et al., 2017; Ghufron & Nurdianingsih, 2019; Karami et al., 2019; Torres et al., 2020). The role of teachers in learning design and interpretation of learning analysis drawn from log data is drawing growing interest (McKenney & Mor, 2015; Persico & Pozzi, 2015; Wen & Song, 2020). Researchers state that teachers should be empowered with necessary analytics knowledge to ensure evidence-based learning support (Ndukwe & Daniel, 2020). It would be interesting to understand language teachers' professional development in teacher inquiry and learning analytics. Such an understanding, along with findings on the characteristics of students' SRL behaviours obtained using log data, would be useful in designing and deploying SRLL environments.

4.3. Role of technology

Desktop PCs were the primary devices adopted in the reviewed studies. However, the use of mobile devices increased from 2015 (e.g., Hwang & Fu, 2019; Lin & Lin, 2019). This may be due to the increasing popularity of the use of mobile devices in education in recent years. Because of such proliferation of mobile devices, learning is no longer limited to specific contexts. However, only three studies (8.8%) investigated students' SRLL outside the classroom. Lai (2017) suggested that successful language learners often attribute their success to active engagement with the target language beyond the classroom. The findings of this study indicate that further studies can be proposed to explore self-initiated learning activities beyond the classroom and means of supporting learners' SRLL with mobile technologies in the future.

In terms of the role of technology in supporting SRLL, only four out of the 24 studies examined the entire process of SRLL (Chen et al., 2014; Saks & Leijen, 2019; Shyr & Chen, 2018; Zheng et al., 2018). Many models theorise SRL processes, but they share a common understanding that the regulation process should be cyclical and that different phases can influence one another (Panadero, 2017; Zimmerman, 2000). Researchers can design a more systematic tool for supporting all phases of SRL in the context of language learning.

5. Conclusion

The findings of this review identify critical research gaps and have implications for future studies on technology-enhanced SRLL. First, this paper presents a systematic review from an analysis of 34 studies published from 2011 to 2020 that focused on investigating SRLL in technology-enhanced learning environments. Most of these studies were conducted in tertiary education contexts. Thus, future research may target younger learners, particularly those below the age of 9 years. In addition, the majority of these studies were conducted among undergraduate students. Little is known about postgraduate students' SRLL in technology-assisted learning environments. Second, this study sheds light on capturing log data to understand the dynamic nature of SRLL and develop technology to support the whole process of SRLL. Log data can trace individual events in sequence but cannot explain why learners act in the observed ways and how they characterise their cognitive and metacognitive strategies (Bernacki, 2017). Therefore, comprehensive measurements are needed to understand students' SRLL in future research. Prospective studies should utilise technologies to assist students' entire SRLL and examine their SRLL behaviours. Third, the findings show that technology has been adopted to support the

performance phase of students' SRLL more than the two other phases (forethought and self-reflection). More attention should be given to examining students' SRLL outcomes than their SRLL behaviours.

This review has several limitations. First, the review was not exhaustive; only English-language papers were selected, and data were obtained from only four databases. We will include the Scopus database in our future systematic literature review. Second, in view of the exclusion rate in the study selection in this review, we will specify the subject domains (e.g., language learning, education, and technology) and set the article types (e.g., peer-reviewed articles, workshop papers, and conference papers) when searching databases in the first stage, which may help lower the exclusion rate. Finally, our coding scheme may not be the only possible approach to addressing the research questions. It is therefore suggested that more comprehensive ways of reviewing studies should be investigated and applied in future studies.

Acknowledgement

The study was funded by the General Research Fund (Ref. 18611019), Research Grants Council, University Grant Committee, Hong Kong.

References

Al Fadda, H. (2019). The relationship between self-regulations and online learning in an ESL blended learning context. *English Language Teaching, 12*(6), 87-93.

Alvi, E., & Gillies, R. M. (2021). Self-regulated learning (SRL) perspectives and strategies of Australian primary school students: A Qualitative exploration at different year levels. *Educational Review*, 1-23. https://doi.org/10.1080/00131911.2021.1948390

Araka, E., Maina, E., Gitonga, R., & Oboko, R. (2020). Research trends in measurement and intervention tools for self-regulated learning for e-learning environments—Systematic review (2008–2018). *Research and Practice in Technology Enhanced Learning, 15*(1), 6. https://doi.org/10.1186/s41039-020-00129-5

Ardasheva, Y., Wang, Z., Adesope, O. O., & Valentine, J. C. (2017). Exploring effectiveness and moderators of language learning strategy instruction on second language and self-regulated learning outcomes. *Review of Educational Research, 87*(3), 544-582.

Azevedo, R., Taub, M., & Mudrick, N. (2018). Understanding and reasoning about real-time cognitive, affective, and metacognitive processes to foster self-regulation with advanced learning technologies. In *Handbook of self-regulation of learning and performance* (pp. 254-270). Routledge/Taylor & Francis Group.

Bano, M., Zowghi, D., Kearney, M., Schuck, S., & Aubusson, P. (2018). Mobile learning for science and mathematics school education: A Systematic review of empirical evidence. *Computers & Education, 121*, 30-58.

Ben-Yehudah, G., & Brann, A. (2019). Pay attention to digital text: The impact of the media on text comprehension and self-monitoring in higher-education students with ADHD. *Research in developmental disabilities*, *89*, 120-129.

Bernacki, M. L. (2017). Examining the cyclical, loosely sequenced, and contingent features of self-regulated learning: Trace data and their analysis. In *Handbook of self-regulation of learning and performance* (pp. 370-387). Routledge/Taylor & Francis Group.

Bohlmann, N. L., Maier, M. F., & Palacios, N. (2015). Bidirectionality in self-regulation and expressive vocabulary: Comparisons between monolingual and dual language learners in preschool. *Child Development*, *86*(4), 1094-1111.

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education, 27*, 1-13.

Çelik, S., Arkın, E., & Sabriler, D. (2012). EFL learners' use of ICT for self-regulated learning. *Journal of Language and Linguistic Studies, 8*(2), 98-118.

Chang, M.-M., & Hung, H.-T. (2019). Effects of technology-enhanced language learning on second language acquisition. *Educational Technology & Society, 22*(4), 1-17.

Chien, C.-W. (2019). Taiwanese EFL undergraduates' self-regulated learning with and without technology. *Innovation in Language Learning and Teaching, 13*(1), 1-16.

Dignath, C., & Büttner, G. (2008). Components of fostering self-regulated learning among students. A Meta-analysis on intervention studies at primary and secondary school level. *Metacognition and Learning, 3*(3), 231-264.

Dignath, C., Buettner, G., & Langfeldt, H. P. (2008). How can primary school students learn self-regulated learning strategies most effectively?: A Meta-analysis on self-regulation training programmes. *Educational Research Review*, *3*(2), 101-129.

Ducasse, A. M., & Hill, K. (2019). Developing student feedback literacy using educational technology and the reflective feedback conversation. *Practitioner Research in Higher Education*, *12*(1), 24-37.

Ferreira, P. C., Veiga Simão, A. M., & Lopes da Silva, A. (2017). How and with what accuracy do children report self-regulated learning in contemporary EFL instructional settings? *European Journal of Psychology of Education*, *32*(4), 589-615.

Ghufron, M. A., & Nurdianingsih, F. (2019). Flipped teaching with Call in EFL writing class: How does it work and affect learner autonomy? *European Journal of Educational Research*, *8*(4), 983-997.

Greene, J., & Schunk, D. (2017). Historical, contemporary, and future perspectives on self-regulated learning and performance. In *Handbook of self-regulation of learning and performance* (pp. 17-32). Routledge/Taylor & Francis Group.

Hromalik, C. D., & Koszalka, T. A. (2018). Self-regulation of the use of digital resources in an online language learning course improves learning outcomes. *Distance Education*, *39*(4), 528-547.

Hughes, M. D., Regan, K. S., & Evmenova, A. (2019). A Computer-based graphic organizer with embedded self-regulated learning strategies to support student writing. *Intervention in School and Clinic*, *55*(1), 13-22.

Hung, H.-T., Yang, J. C., Hwang, G.-J., Chu, H.-C., & Wang, C.-C. (2018). A Scoping review of research on digital game-based language learning. *Computers & Education*, *126*, 89-104.

Hwang, G.-J., & Fu, Q.-K. (2019). Trends in the research design and application of mobile language learning: A Review of 2007–2016 publications in selected SSCI journals. *Interactive Learning Environments*, *27*(4), 567-581.

Lai, C. (2017). *Autonomous language learning with technology: Beyond the classroom*. Bloomsbury Publishing.

Lai, C., & Gu, M. Y. (2011). Self-regulated out-of-class language learning with technology. *Computer Assisted Language Learning*, *24*(4), 317-335.

Lee, S.-M. (2019). A Systematic review of context-aware technology use in foreign language learning. *Computer Assisted Language Learning*, *25*(3), 294-318. https://doi.org/10.1080/09588221.2019.1688836

Lehmann, T., Hähnlein, I., & Ifenthaler, D. (2014). Cognitive, metacognitive and motivational perspectives on preflection in self-regulated online learning. *Computers in Human Behavior*, *32*, 313-323.

Li, S., Chen, G., Xing, W., Zheng, J., & Xie, C. (2020). Longitudinal clustering of students' self-regulated learning behaviors in engineering design. *Computers & Education*, *153*, 103899. https://doi.org/10.1016/j.compedu.2020.103899

Lin, J.-J., & Lin, H. (2019). Mobile-assisted ESL/EFL vocabulary learning: A Systematic review and meta-analysis. *Computer Assisted Language Learning*, *32*(8), 878-919. https://doi.org/10.1080/09588221.2018.1541359

Lin, C.-C., Lin, V., Liu, G.-Z., Kou, X., Kulikova, A., & Lin, W. (2019). Mobile-assisted reading development: A Review from the Activity Theory perspective. *Computer Assisted Language Learning*, *33*(8), 833-864.

Lockl, K., & Schneider, W. (2002). Developmental trends in children's feeling-of-knowing judgements. *International Journal of Behavioral Development*, *26*(4), 327-333.

Marulis, L. M., Baker, S. T., & Whitebread, D. (2020). Integrating metacognition and executive function to enhance young children's perception of and agency in their learning. *Early Childhood Research Quarterly*, *50*, 46-54.

McKenney, S., & Mor, Y. (2015). Supporting teachers in data-informed educational design. *British Journal of Educational Technology*, *46*(2), 265-279.

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic reviews*, *4*(1), 1. https://doi.org/10.1186/2046-4053-4-1

Ndukwe, I. G., & Daniel, B. K. (2020). Teaching analytics, value and tools for teacher data literacy: A Systematic and tripartite approach. *International Journal of Educational Technology in Higher Education*, *17*(1), 1-31.

Panadero, E. (2017). A Review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology*, *8*, 422. https://doi.org/10.3389/fpsyg.2017.00422

Panadero, E., Klug, J., & Järvelä, S. (2016). Third wave of measurement in the self-regulated learning field: When measurement and intervention come hand in hand. *Scandinavian Journal of Educational Research*, *60*(6), 723-735.

Pahuriray, V. G. M. (2021). Self-regulating capacity in language learning and English academic achievement. *Globus Journal of Progressive Education*, *11*(2), 82-86.

Palalas, A., & Wark, N. (2020). The relationship between mobile learning and self-regulated learning: A Systematic review. *Australasian Journal of Educational Technology*, *36*(4), 151-172.

Paris, S. G., & Newman, R. S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25*(1), 87-102.

Paris, S. G., & Winograd, P. (1999). The role of self-regulated learning in contextual teaching: Principles and practices for teacher preparation. In *Contextual teaching and learning: Preparing teachers to enhance student success in and beyond school* (pp. 219-252). ERIC Clearinghouse on Teaching and Teacher Education, AACTE.

Persico, D., & Pozzi, F. (2015). Informing learning design with learning analytics to improve teacher inquiry. *British Journal of Educational Technology, 46*(2), 230-248.

Pintrich, P. R. (2000). The Role of goal orientation in self-regulated learning. In *Handbook of self-regulation* (pp. 451-502). Academic Press.

Roth, A., Ogrin, S., & Schmitz, B. (2016). Assessing self-regulated learning in higher education: A Systematic literature review of self-report instruments. *Educational Assessment, Evaluation and Accountability, 28*(3), 225-250.

Saks, K., & Leijen, Ä. (2019). The Efficiency of prompts when supporting learner use of cognitive and metacognitive strategies. *Computer Assisted Language Learning, 32*(1-2), 1-16.

Shadiev, R., & Yang, M. (2020). Review of studies on technology-enhanced language learning and teaching. *Sustainability, 12*(2), 524. https://doi.org/10.3390/su12020524

Sharples, M., de Roock, R., Ferguson, R., Gaved, M., Herodotou, C., Koh, E., Kukulska-Hulme, A., Looi, C.-K., McAndrew, P., Rienties, B., Weller, M., & Wong, L. H. (2016). *Innovating pedagogy 2016: Open University innovation report 5*. Institute of Educational Technology, The Open University.

Shih, K.-P., Chen, H.-C., Chang, C.-Y., & Kao, T.-C. (2010). The Development and implementation of scaffolding-based self-regulated learning system for e/m-learning. *Educational Technology & Society, 13*(1), 80-93.

Shyr, W. J., & Chen, C. H. (2018). Designing a technology-enhanced flipped learning system to facilitate students' self-regulation and performance. *Journal of Computer Assisted Learning, 34*(1), 53-62.

Stemler, S. E. (2004). A Comparison of consensus, consistency, and measurement approaches to estimating interrater reliability. *Practical Assessment, Research, and Evaluation, 9*(1), 4. https://doi.org/10.7275/96jp-xz07

Su, Y., Zheng, C., Liang, J.-C., & Tsai, C.-C. (2018). Examining the relationship between English language learners' online self-regulation and their self-efficacy. *Australasian Journal of Educational Technology, 34*(3). https://doi.org/10.14742/ajet.3548

Tao, J., Zheng, C., Lu, Z., Liang, J.-C., & Tsai, C.-C. (2020). Cluster analysis on Chinese university students' conceptions of English language learning and their online self-regulation. *Australasian Journal of Educational Technology, 36*(2), 105-119.

Torres, M. C. C., Salamanca, Y. N. S., Cely, J. P. C., & Aguilar, J. L. B. (2020). All we need is a boost! Using multimodal tools and the translanguaging strategy: Strengthening speaking in the EFL classroom. *International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT), 10*(3), 28-47.

Viberg, O., Khalil, M., & Baars, M. (2020). Self-regulated learning and learning analytics in online learning environments: A Review of empirical research. In *Proceedings of the tenth international conference on learning analytics & knowledge* (pp. 524-533). https://doi.org/10.1145/3375462.3375483

van Loon, M. H., & Roebers, C. M. (2017). Effects of feedback on self-evaluations and self-regulation in elementary school. *Applied Cognitive Psychology, 31*(5), 508-519.

Winne, P. H., Teng, K., Chang, D., Lin, M. P.-C., Marzouk, Z., Nesbit, J. C., Patzak, A., Raković, M., Samadi, D., & Vytasek, J. (2019). nStudy: Software for learning analytics about processes for self-regulated learning. *Journal of Learning Analytics, 6*(2), 95–106.

Woottipong, K. (2022). Facilitating learners' self-regulated learning skills and self-efficacy to write in English using technologies. *Acuity: Journal of English Language Pedagogy, Literature and Culture, 7*(1), 101-122.

Yang, T. C., Chen, M. C., & Chen, S. Y. (2018). The Influences of self-regulated learning support and prior knowledge on improving learning performance. *Computers & Education, 126*, 37-52.

Yeh, Y. C., Kwok, O. M., Chien, H. Y., Sweany, N. W., Baek, E., & McIntosh, W. A. (2019). How college students' achievement goal orientations predict their expected online learning outcome: The mediation roles of self-regulated learning strategies and supportive online learning behaviors. *Online Learning, 23*(4), 23-41.

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The Impact of gamification on learning and instruction: A Systematic review of empirical evidence. *Educational Research Review, 30*, 100326.

Zhai, X., Fang, Q., Dong, Y., Wei, Z., Yuan, J., Cacciolatti, L., & Yang, Y. (2018). The Effects of biofeedback-based stimulated recall on self-regulated online learning: A Gender and cognitive taxonomy perspective. *Journal of Computer Assisted Learning, 34*(6), 775-786.

Zheng, L., Li, X., & Chen, F. (2018). Effects of a mobile self-regulated learning approach on students' learning achievements and self-regulated learning skills. *Innovations in Education and Teaching International, 55*(6), 616-624.

Zhou, Y., & Wei, M. (2018). Strategies in technology-enhanced language learning. *Studies in Second Language Learning and Teaching, 8*(2), 471-495.

Zou, D., Huang, Y., & Xie, H. (2019). Digital game-based vocabulary learning: Where are we and where are we going? *Computer Assisted Language Learning*, 1-27.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into practice, 41*(2), 64-70.

Appendix A. List of selected studies

S1	Ahn, T. Y., & Lee, S. M. (2016). User experience of a mobile speaking application with automatic speech recognition for EFL learning. *British Journal of Educational Technology, 47*(4), 778-786.
S2	Al Fadda, H. (2019). The relationship between self-regulations and online learning in an ESL blended learning context. *English Language Teaching, 12*(6), 87-93.
S3	Alzubi, A. A. F., & Singh, M. K. A. P. M. (2018). The impact of social strategies through smartphones on the Saudi learners' socio-cultural autonomy in EFL reading context. *International Electronic Journal of Elementary Education, 11*(1), 31-40.
S4	Çelik, S., Arkın, E., & Sabriler, D. (2012). EFL learners' use of ICT for self-regulated learning. *Journal of Language and Linguistic Studies, 8*(2), 98-118.
S5	Chen, C.-M., Chen, L.-C., & Yang, S.-M. (2019). An English vocabulary learning app with self-regulated learning mechanism to improve learning performance and motivation. *Computer Assisted Language Learning, 32*(3), 237–260.
S6	Chen, C.-M., Wang, J.-Y., & Chen, Y.-C. (2014). Facilitating English-language reading performance by a digital reading annotation system with self-regulated learning mechanisms. *Educational Technology & Society, 17*(1), 102-114.
S7	Chen, Y.-L., & Hsu, C.-C. (2020). Self-regulated mobile game-based English learning in a virtual reality environment. *Computers & Education*, 103910. https://doi.org/10.1016/j.compedu.2020.103910
S8	Chen, & Lee, S. Y. (2018). Application-driven educational game to assist young children in learning English vocabulary. *Educational Technology & Society, 21*(1), 70-81.
S9	Chien, C.-W. (2019). Taiwanese EFL undergraduates' self-regulated learning with and without technology. *Innovation in Language Learning and Teaching, 13*(1), 1-16.
S10	Ferreira, P. C., Veiga Simão, A. M., & Lopes da Silva, A. (2017). How and with what accuracy do children report self-regulated learning in contemporary EFL instructional settings? *European Journal of Psychology of Education, 32*(4), 589-615.
S11	Ghufron, M. A., & Nurdianingsih, F. (2019). Flipped teaching with Call in EFL writing class: How does it work and affect learner autonomy? *European Journal of Educational Research, 8*(4), 983-997.
S12	Hong, J. C., Hwang, M. Y., Chang, H. W., Tai, K. H., Kuo, Y. C., & Tsai, Y. H. (2015). Internet cognitive failure and fatigue relevant to learners' self-regulation and learning progress in English vocabulary with a calibration scheme. *Journal of Computer Assisted Learning, 31*(5), 450-461.
S13	Hromalik, C. D., & Koszalka, T. A. (2018). Self-regulation of the use of digital resources in an online language learning course improves learning outcomes. *Distance Education, 39*(4), 528-547.
S14	Karami, S., Sadighi, F., Bagheri, M. S., & Riasati, M. J. (2019). The impact of application of electronic portfolio on undergraduate English majors' writing proficiency and their self-regulated learning. *International Journal of Instruction, 12*(1), 1319-1334.
S15	Kondo, M., Ishikawa, Y., Smith, C., Sakamoto, K., Shimomura, H., & Wada, N. (2012). Mobile assisted language learning in university EFL courses in Japan: Developing attitudes and skills for self-regulated learning. *ReCALL, 24*(2), 169-187.
S16	Lai, C., & Gu, M. Y. (2011). Self-regulated out-of-class language learning with technology. *Computer Assisted Language Learning, 24*(4), 317-335.
S17	Lei, Z. (2018). Vocabulary learning assisted with smart phone application. *Theory and Practice in Language Studies, 8*(11), 1511-1516.
S18	Lin, V., Liu, G. Z., & Chen, N. S. (2020). The effects of an augmented-reality ubiquitous writing application: A comparative pilot project for enhancing EFL writing instruction. *Computer Assisted Language Learning*, 1-42.
S19	Liu, S. H. J., Lan, Y. J., & Ho, C. Y. Y. (2014). Exploring the relationship between self-regulated vocabulary learning and web-based collaboration. *Educational Technology & Society, 17*(4), 404-419.
S20	Llorens, A., Vidal-Abarca, E., & Cerdán, R. (2016). Formative feedback to transfer self-regulation of task-oriented reading strategies. *Journal of Computer Assisted Learning, 32*(4), 314-331.
S21	Man–Kit, L. E. E., & Evans, M. (2019). Investigating the operating mechanisms of the sources of L2 writing self-efficacy at the stages of giving and receiving peer feedback. *The Modern Language Journal, 103*(4), 831-847.
S22	Naseri, S., & Motallebzadeh, K. (2016). Podcasts: A Factor to improve Iranian EFL learner'self-regulation ability and use of technology. *Educational Technology & Society, 19*(2), 328-339.
S23	Roussel, S. (2011). A computer assisted method to track listening strategies in second language learning. *ReCALL, 23*(2), 98-116.

S24 Saks, K., & Leijen, Ä. (2019). The efficiency of prompts when supporting learner use of cognitive and metacognitive strategies. *Computer Assisted Language Learning, 32*(1-2), 1-16.

S25 Seifert, T., & Har-Paz, C. (2020). The effects of mobile Learning in an EFL class on self-regulated learning and school achievement. *International Journal of Mobile and Blended Learning (IJMBL), 12*(3), 49-65.

S26 Serrano, M. Á., Vidal-Abarca, E., & Ferrer, A. (2018). Teaching self-regulation strategies via an intelligent tutoring system (TuinLECweb): Effects for low-skilled comprehenders. *Journal of Computer Assisted Learning, 34*(5), 515-525.

S27 Shyr, W. J., & Chen, C. H. (2018). Designing a technology-enhanced flipped learning system to facilitate students' self-regulation and performance. *Journal of Computer Assisted Learning, 34*(1), 53-62.

S28 Su, Y., Li, Y., Liang, J.-C., & Tsai, C.-C. (2019). Moving literature circles into wiki-based environment: The Role of online self-regulation in EFL learners' attitude toward collaborative learning. *Computer Assisted Language Learning, 32*(5-6), 556-586.

S29 Su, Y., Zheng, C., Liang, J.-C., & Tsai, C.-C. (2018). Examining the relationship between English language learners' online self-regulation and their self-efficacy. *Australasian Journal of Educational Technology, 34*(3).

S30 Tao, J., Zheng, C., Lu, Z., Liang, J.-C., & Tsai, C.-C. (2020). Cluster analysis on Chinese university students' conceptions of English language learning and their online self-regulation. *Australasian Journal of Educational Technology, 36*(2), 105-119.

S31 Torres, M. C. C., Salamanca, Y. N. S., Cely, J. P. C., & Aguilar, J. L. B. (2020). All we need is a boost! Using multimodal tools and the translanguaging strategy: Strengthening speaking in the EFL classroom. *International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT), 10*(3), 28-47.

S32 Wang, H.-C., & Chen, C. W.-y. (2020). Learning English from YouTubers: English L2 learners' self-regulated language learning on YouTube. *Innovation in Language Learning and Teaching, 14*(4), 333–346.

S33 Zhai, X., Fang, Q., Dong, Y., Wei, Z., Yuan, J., Cacciolatti, L., & Yang, Y. (2018). The effects of biofeedback-based stimulated recall on self-regulated online learning: A Gender and cognitive taxonomy perspective. *Journal of Computer Assisted Learning, 34*(6), 775-786.

S34 Zheng, L., Li, X., & Chen, F. (2018). Effects of a mobile self-regulated learning approach on students' learning achievements and self-regulated learning skills. *Innovations in Education and Teaching International, 55*(6), 616-624.