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SELF-REGULATED LEARNING THROUGH ePORTFOLIO: A META-ANALYSIS

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ABSTRACT

Purpose: Self-regulated learning (SRL) has been established in the literature as beneficial for students in language learning. It is believed that SRL promotes learner autonomy and successful academic outcomes. Although SRL strategies are quite popular and heavily researched, their functionality through the medium of ePortfolio is uncertain. Therefore, this research analysed how SRL contributes to positive academic outcomes with ePortfolio as a medium.

Methodology: A meta-analysis was carried out to identify the patterns and gaps in this research area. A total of 204 studies were identified based on a keyword search related to SRL and portfolio. These studies were further analysed to fit the criteria set for this research. Only nine studies fulfilled these criteria and were thus selected for the study.

Findings: It was found that all nine studies included in this review emphasised different research methods and reported significant changes in students' academic outcomes. Eight of the studies were quantitative in nature, while only one study was qualitative. Based on our interpretive findings, three themes were discovered, namely metacognition, collaboration and motivation.

Significance: By clarifying the roles played by SRL and how ePortfolio as a tool can promote SRL, this study offers insights to those who wish to use ePortfolio as a medium to foster self-regulated learning. The results of the meta-analysis may also help researchers to explore this area of study and address research gaps in relatable contexts.

Keywords: Self-regulated learning, ePortfolio, meta-analysis.

INTRODUCTION

In today's increasingly digitalised world, acquiring another language in addition to the mother tongue is essential for boosting one's value in gaining employment or in accessing science and technology (Hardman & A-Rahman, 2014). Researching elements that will enhance the learning of a second or foreign language, including teaching and learning strategies, is thus crucial. Studies on strategic learning have revealed that students who employ a variety of learning strategies are more effective learners (Cohen & Griffiths, 2015; O'Malley & Chamot, 1990). It is believed that diverse approaches can contribute to learning efficacy. These range from the number of strategies employed to the manner in which the strategies are used. Awareness of strategy in use is essential in becoming an effective learner (Warburton & Volet, 2012). In fact, successful learning outcomes are consistently found to be highly related to the use of appropriate strategies (Cheng & Chau, 2013).

Self-regulated learning (SRL) is said to be a useful strategy in the development of second or foreign language teaching and learning (Aregu, 2013; Hafizah et al., 2016; Zhang & Zhang, 2019). Zimmerman and Martinez-Pons (1986) define SRL strategies as "actions directed at acquiring information or skill that involve agency, purpose (goals), and instrumentality self-perceptions by a learner" (p. 615). The constructs behind SRL promote learner autonomy in the learning process. Compared with the traditional role of students in learning, SRL empowers students to plan their educational processes and to become responsible for their own learning as well as motivation to learn. The use of SRL strategies is consistently found to be effective and invariably generates a high learning outcome, both within and without a computer-based learning environment (Cheng & Chau, 2013; Nguyen & Ikeda, 2015).

To promote SRL, different mediums have been used in planning lessons, including ePortfolio, which has become a preference with the popularization of computer mediated learning. Several studies have found that ePortfolios help to develop SRL, particularly through reflection (Barrett, 2006). However,

many researchers have not specifically mentioned other constructs in learner self-regulation which might also help, and whether using ePortfolios would consistently yield positive outcomes in language learning. Hence, this research aims analyse other constructs that may exist, and the possibility of promoting SRL in language learning through ePortfolio. It is hoped that this review of SRL within the context of ePortfolio will also aid in identifying gaps in research and establishing opportunities for further study in this area. The following questions guided the review: Do ePortfolios help students to self-regulate? What are the common constructs found in learner self-regulation through ePortfolio?

LITERATURE REVIEW

Key Concepts in Self-Regulated Learning

According to Zimmerman (1986), self-regulated learners are metacognitively, motivationally and behaviourally active participants throughout their learning process. SRL demands that learners be intrinsically motivated to achieve the goals they set for themselves as they self-monitor throughout the learning process (Lutfi, 2013). This requires students to plan, monitor and access their learning independently (Zumbrunn et al., 2011).

In SRL, the keywords are *self* and *regulation* and how these two concepts are connected to *learning*. Following the Socratic model of learning, Tweed and Lehman (2002) view the ‘self’ as responsible for its own learning and that knowledge should be generated by the ‘self’, whereby the learner initiates learning through “overt and private questioning, expression of personal hypotheses, and a desire for self-directed tasks” (p. 93). Wang and Lu (2016), following the Confucian view of ‘self’, emphasise that the ‘self’ is substantially formed by various socio-cultural factors. The “learner must actively work to acquire, understand, and apply essential concepts coming mainly from outside the self. In this sense, Confucian acquisition of essentials occurs not through passive absorption but through constructing within the self the knowledge that the collective considers essential” (Tweed & Lehman, 2002, p. 96). Wang and Lu (2016) further assert that learning is inevitably shaped by values and social contextual factors.

Both the Socratic and Confucian views of ‘self’ learning are applicable in the concept of self-learning for different types of learners, whereby more advanced and able learners are seen as more independent. Such learners can advance their learning through acquired knowledge and require less or no

guidance from a teacher. On the other hand, learners who are considered beginners and in the path of acquiring new knowledge will need some form of guidance (external push) for self-learning before they can emerge as totally independent learners. This concept is similar to the sociocultural construct of zone of proximal development, where learners learn with assistance of other capable peers and later gain the capacity to further develop through mediation and regulation.

According to Zimmerman (2002), regulation is “not a mental ability or academic performance skills [but rather refers to] a self-directive process of transforming mental abilities into learning skills” (p. 65) based on the learners’ effort. It is the learners’ proactive learning process, in which they initiate efforts for themselves through self-thoughts, feelings and behaviour regardless of how such effort is self-driven, as they are aware of their abilities. Ormrod (2009) adds that regulation deals with an ability to control and develop one’s learning. The concept of ‘regulation’ in SRL involves three significant elements: (a) personal regulation, referring to the adjustment of cognitive and affective factors; (b) behavioural self-regulation, which takes into account the process of monitoring oneself and modifying performance; and (c) environmental self-regulation, which involves analysing the learning context and making adaptations to maximise performance (Zimmerman, 2000). According to Zimmerman (2000), the interactions of these components occur in the forethought of task, performance and self-reflection.

Regulation is closely related to the concepts of mediation and internalisation in sociocultural theory. Lantolf et al. (2015) highlight three types of regulation that shape sociocultural theory: object regulation, other regulation and self-regulation. Self-regulation in particular is described as a stage that highlights learners who have internalised the external forms of mediation to execute or complete a task. It can thus be delineated as the process that individual learners undergo to exert their ability to control, think and act for their learning development, which is undertaken with reduced or no reliance on external force or support.

The third keyword in SRL is learning, which is viewed as an active process of knowledge acquisition and skill development through personal engagement with surrounding objects, experiences and conversations (Dewey, 1938; Piaget, 1964; Vygotsky, 1986). Learning involves a cognitive development dependent upon other factors, such as context, prior knowledge, resources motivation, beliefs and attitude. In line with this, Bransford et al. (2000) assert that the theory of learning will influence “approaches to the design of curriculum, teaching, and assessment” (p. 3). The importance of being aware

not only of how learning takes place but also of what it takes to facilitate effective learning is undeniable. Many studies on learning have contributed to the significant amount of information that aids learners in achieving their educational goals. These studies help clarify new ways to access the learning and mastery of specific knowledge and skills. Approaches to learning are likewise dependent upon one's beliefs or theories about teaching and learning, including behaviourism, cognitivism, constructivism or socioculturalism. Based on the three highlighted keywords, SRL as an approach views learning in relation to an individual and his or her independent learning; it is an active process in which an individual learner makes informed decisions and executes the necessary strategies throughout the learning process (Seker, 2016). Pintrich (2000) refers to SRL as the process in which learners set objectives, monitor their work and regulate and control their cognition, motivation and behaviour in line with their goals and environment. Barnard-Brak et al. (2010) add that SRL is closely related to the 'self' in which the individual will be able to decide, make choices (regulate) and monitor their learning. According to Zumbunn et al. (2011), SRL involves "a process that assists students in managing their thoughts, behaviours, and emotions in order to navigate their learning experiences successfully. This process occurs when a student's purposeful actions and processes are directed towards the acquisition of information or skills" (p. 4). In this sense, SRL is intrinsically connected to learners' beliefs. Wang and Zhan (2020) point out that when students are able to regulate their learning and positively believe that they are able to complete the task given, a successful learning outcome ensues.

Learner Beliefs about Learning

Although learner beliefs is a complex construct, learner beliefs in language are highly associated with how learners perceive a matter without any prior knowledge but remain confident to act on it (Wang & Zhan, 2020). A study conducted by Ruohoniemi and Lindblom-Ylänne (2009) to elicit learners' perspectives about learning from 132 undergraduate students in France successfully identified that the learners considered learning as something that was 'happening' to them, and they expected the faculty to take responsibility for ensuring that learning took place. These learners did not view their effort and study skills as essential components of learning.

The results of this study indicated that these learners' "no-responsibility" attitude towards their learning led them to blame their failure in academic achievement on "ineffective instruction" and "irrelevant course material" (Ruohoniemi & Lindblom-Ylänne, 2009). Similarly, Mikroyannidis et al. (2014) revealed that students were typically hesitant about trying new methods

or changing their outlook on learning as they expected their instructors to provide learning materials so that they could pass exams and claim their desired qualification. These phenomena do not cultivate learners who are responsible and self-sufficient in their learning. Malaysian students have also been deemed too dependent on their teachers (Lim, 2013). This could be very much influenced by the way teaching and learning has taken place over the years, which might have developed dependent behaviour in the learning culture. In the case of language learner beliefs, a number of factors that shape them may derive from various sources, including learners' past experiences in language learning, cultural background and personality (Mugra, 2019).

To promote SRL, awareness of learning responsibility must be present among learners. A positive attitude and a willingness to change one's perspectives about learning are also vital; learners are expected to be more independent in their learning towards achieving the set of identified learning goals. Furthermore, with the advent of technology, learning is no longer confined within the four walls of the classroom or even within the school compound. Borderless education demands that learners seek knowledge on their own terms, with minimal guidance from teachers. This signifies the need to foster SRL, which will ensure that learners become capable of mastering a subject by working independently towards accomplishing a task (Aregu, 2013). Nevertheless, this does not mean that teachers can now step back from teaching; their role has changed from being a sole information provider to one that is more facilitative in nature. Learning becomes more meaningful and highly successful when learners can set objectives for themselves and learn via SRL strategies (Zumbrunn et al., 2011).

SRL and ePortfolios

In evaluating the relationship between SRL and the use of ePortfolios, understanding the definition of ePortfolio is essential. An ePortfolio is "a digitised collection of artefacts, including demonstrations, resources, and accomplishments that represent an individual, group, or institution" (Lorenzo & Ittelson, 2005, p. 2). Parallel to this definition, Bekri et al. (2013) describe the ePortfolio as an instructional product that uses information and communication technology (ICT) based e-learning, that acts as a container for storing information in digital form. Some researchers (e.g., Alexiou & Paraskeva, 2010; Cheng & Chau, 2013) claim that an ePortfolio helps a learner to reflect. In fact, Barrett (2006) asserts that reflection is key to SRL. Reflection enables a learner to evaluate his or her learning strategies which, in the case of the ePortfolio, are captured in an online platform. Student-centred learning is seen as a powerful medium for achieving the goal of students becoming active

participants in learning, who are capable of dealing with complex phenomena and solving problems in the most innovative and imaginative ways. At the same time, technology plays an important role in promoting this change. This view is widely shared among scholars (Alexiou & Paraskeva, 2010) who also highlight that the use of ePortfolios enables students to self-regulate their learning process and enhance learner autonomy, thus developing students who are active, reflective, independent and critical of their own work and learning as they are able to construct their own knowledge. Similarly, Banks (2004) points out that ePortfolios encourage quality thinking, especially in a writing classroom. Students involved in ePortfolios are encouraged to assess their own learning and enhance their success and value as learners.

Due to its flexibility, an ePortfolio can be accessed anywhere and at any time, ensuring that learners take charge of their own learning. The reflection component of the learning process is supplemented by more capable individuals such as teachers and peers, who are also a part of the students' achievement in becoming self-regulated learners. According to Wade et al. (2005), the process of reflection is what makes the ePortfolio a platform for life-long learning and professional development, rather than merely a collection of artefacts. They outline several advantages of ePortfolios as an SRL platform. Among the advantages include enabling better illustration of the developmental process of learning, and acting as a medium, especially for at-risk learners whose competencies would be better portrayed through the authenticity of ePortfolio tasks. Learners could reflect on their capabilities and progress, and simultaneously develop their information and communication technology skills through the use of multimedia tools. A well-executed ePortfolio also allows learners to share feedback easily with their peers and teachers. Wade et al. (2005) add that the easy accessibility of the ePortfolio enable learners to complete a given task from a remote distance. Good ePortfolio practices not only helps learners to review their strength and weaknesses but also serves as a single container which could enhance communication not only with peers and teachers but also with parents.

Despite numerous advantages, the use of ePortfolios has not been without criticism, the most common being (a) issues of privacy, freedom of information, copyright and intellectual property when they are used in the classroom; (b) accountability issues; and (c) scepticism regarding the diffusion of innovation (Kinash et al., 2012).

Types of ePortfolios

An ePortfolio has three different purposes: process, showcase and assessment (Abrami & Barrett, 2005). Barrett (2006) defined a process portfolio as a systematic and organised collection of work in which students have completed

the process of reflection and selected their work to show their growth and change. A process portfolio is also defined as “a systematic and organized collection of evidence used by the teacher and student to monitor growth of the student’s knowledge, skills and attitudes” (Cole et al., 1995, p. 9). Barrett (2006) further mentioned that a portfolio based upon a constructivist model can be used to foster learning and document growth over time, and that a learning portfolio is usually a tool for the teacher and learner to create new learning methods, reflect upon learning and assess skills. In fact, “a portfolio that is truly a story of learning is owned by the learner, structured by the learner, and told in the learner’s own voice” (Barrett, 2006, p. 2). A process portfolio also focuses on students’ progress, which includes goal setting, the process of reflection, self-assessment and self-evaluation, collaboration and feedback as the keys for autonomous learning (Nicolaidou, 2012). One of the reasons for the popularity of the process portfolio is that learners can manage their own learning and are encouraged to focus on personal growth and development; at the same time they are committed to a lifelong learning experience as part of their individual improvement (Abrami & Barrett, 2005; Meyer et al., 2010; Zubizarreta, 2004).

A showcase portfolio on the other hand, focuses on final accomplishments (Chang et al., 2013). Also known as a display portfolio, it exhibits the highest level of achievement accomplished which makes students feel proud, especially in a writing classroom, where they would want to display their best poem, written essays, a drawing that they like or even a problem that they have solved (Danielson & Abrutyn, 1997).

An assessment portfolio is an evaluation tool for documenting student learning, while short portfolios are collections of artefacts which allow assessment by exhibiting evidence of specific curricular content that students have achieved (Williams et al., 2013). Other researchers who take the same perspective are Danielson and Abrutyn (1997), who view portfolio assessment as a way to document students’ learning based on what students do and how well they demonstrate the knowledge and skills outlined in the curriculum . According to Farr and Tone (1994):

Portfolios are not just a response to concerns for valid assessment...they are also a realization that good assessment begins with the learners. If any learner is to improve, he or she must be able to self-assess and consider how to improve. (p. 5)

Thus, it is imperative for teachers and learners to adopt and explore portfolios in the writing classroom. This brings us to the question of which portfolio platform is better – paper or electronic.

Paper-Based Portfolios vs. ePortfolios

Although paper-based portfolios demonstrate the same function as ePortfolios, the latter have many added advantages (Van Wesel & Prop, 2009). First, an ePortfolio ensures mobility. A traditional paper-based portfolio usually contains 100 to 150 pages of information, which makes an ePortfolio a better tool in terms of flexibility of access: one can peruse it anytime and anywhere, without the difficulty of flipping pages (Kuczenki & Araj, 2016). Second, an ePortfolio is user-friendly. A study that compared paper-based portfolios with ePortfolios (Driessen et al., 2007) revealed that a web-based portfolio is friendlier than its tangible counterpart. An ePortfolio would be long-lasting as it is less susceptible to environmental dangers such as moisture, and can be conserved in the 'cloud', which offers unlimited data storage (Poole et al., 2018). In addition, the ePortfolio is better alternative to paper-based portfolios, as it does not require investment in physical paper, which can be expensive.

There are many free platforms available with the digital ability to edit, rearrange and format, and which allow hyperlinks to connect documents and also permit collaboration, thus providing an easy tool for learning and assessment (Roberts et al., 2016). According to Buzzetto-More (2006), ePortfolios are dynamic and multimedia driven, which allows greater learner expression and broader access to a larger audience. Cordier et al. (2016) point out that an ePortfolio can be shared and viewed regardless of geographical location. Users could share an ePortfolio with multiple audiences such as peers, groups or external recipients (Buzzetto-More, 2006). Bowman et al. (2016), in a comparative study between paper-based and ePortfolios revealed that although both types of portfolio contributed to student learning, students who used the ePortfolio had heightened levels of metacognition in their learning, career and personal goals.

METHODOLOGY

Database Review

To obtain a wide range of available resources for meta-analysis, both published and unpublished articles and dissertations were located. The search strategy included an electronic literature search through the University of Malaya (UM) database called Interactive Portal, which provides access to online journals, as well as the UM research repository. The electronic search consisted of databases including JSTOR, ERIC, ScienceDirect, Wiley Online Library, SAGE Journals, ProQuest Dissertations and Theses, ASCD and

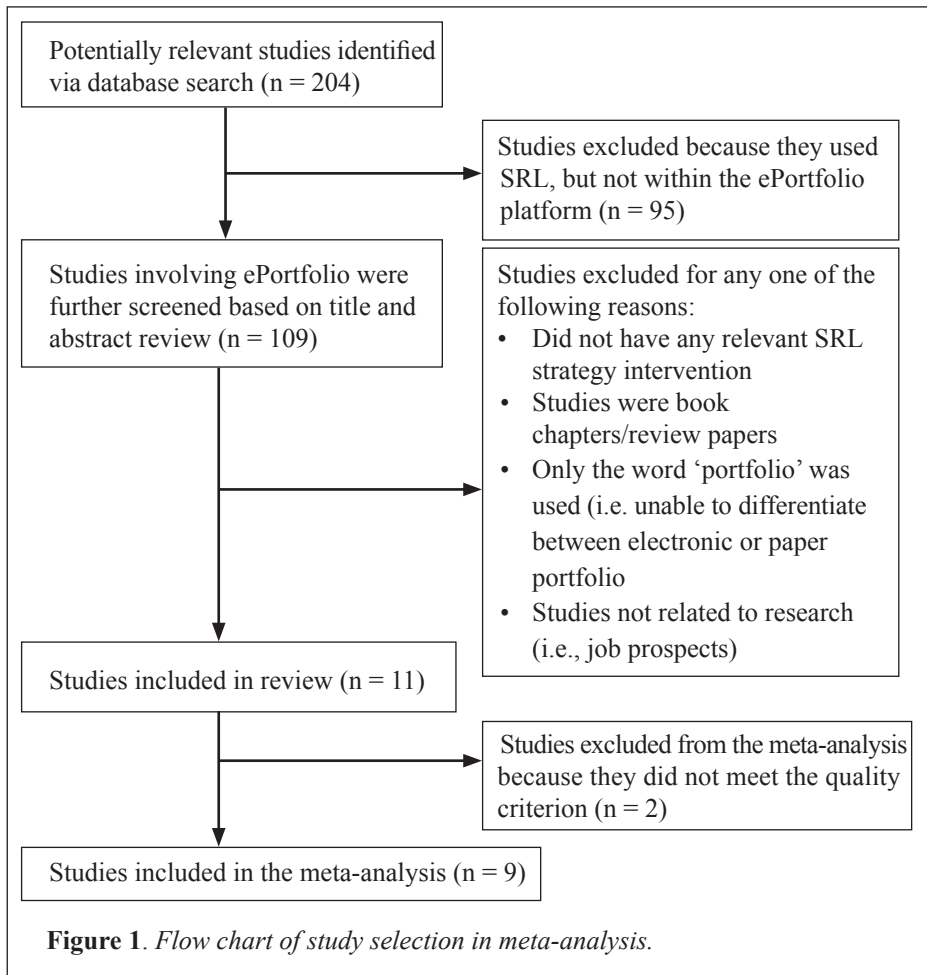
Google Scholar. The primary search terms used were ‘SRL’, ‘SRL in Writing’ and ‘SRL ePortfolio’. A complementary literature search for material not accessible online (i.e., research reports, book chapters, dissertation and theses) was also conducted. This procedure was carried out to minimise the bias threat due to information that might not be available in an online publication (Lipsey & Wilson, 2001).

Analytical Procedures

To capitalise on a broader knowledge base and reflect the large variability in language learners’ backgrounds, the present meta-analysis aimed to integrate studies conducted between the years 2008 and 2019 from around the world in varied combinations of L1/L2/FL contexts. This decision was based on the precedence in technology and language learning (Golonka et al., 2014) and educational psychology (Adesope et al., 2010) research. To capture relevant studies on the effectiveness of SRL, the following inclusion criteria were developed:

- a. Studies must involve an explicit SRL strategy-training intervention involving ePortfolio (i.e., cognitive, metacognitive and/or socio-affective).
- b. Studies must be a primary quantitative investigation to allow for statistical data extraction.
- c. Studies must be a primary qualitative investigation to obtain non-statistical data.
- d. Studies must be presented in English.

The initial search yielded a total of 204 potentially relevant articles. Following a screening of the titles and abstracts, a total of 109 articles were retrieved using the keyword ‘ePortfolio’ from all databases. The next step involved screening all 109 abstracts for strict adherence to the above inclusion criteria, which resulted in the elimination of 90 percent of the studies due to non-usage of an SRL-strategy intervention. Consistency in the inclusion of the articles was assured by having a second coder with an M.Ed. in TESOL examine the abstracts. Of the remaining 11 studies, further screenings were conducted, and 9 studies were ultimately selected. The remaining two studies were excluded as they failed to meet the quality criterion. Figure 1 illustrates the flow chart of the study selection process for this meta-analysis.



Limitations

Only published studies from 2008 to 2019 were deemed applicable for analysis. The word search used in locating the articles was limited to the keywords listed above. Hence, it was possible that other relevant articles were missed because they used different keywords or were discussions of SRL without ePortfolios.

RESULTS AND DISCUSSION

In the following sections, the findings of this review are presented based on the research questions. The first section summarises the findings for SRL across

the ePortfolio platform, while the second discusses the common constructs found in SRL using ePortfolios as a medium.

Research Question 1 : Do ePortfolios help students to self-regulate?

Several past meta-analytic studies across the educational field have yielded the observation that both implementation features and research design might lead to a discrepancy in estimated outcomes. Plonsky's (2011) meta-analytic study stated that although studies with a more robust design (e.g., pre-test and post-test) reported reliability and showed more substantial effects compared to weaker designs, the overall conclusion was that regardless of the design, any study would yield detectable effects. In line with Plonsky (2011), this meta-analysis found that all the nine studies included emphasised different research designs and reported significant changes in the students' academic outcomes (see Table 1).

Table 1

Summary of Meta-Analytic Findings in Research Design

Authors	Context	Treatment Duration	Methodology
Abrami, Wade, Pillay, Aslan, Bures, & Bently (2008)	Elementary schools, Canada	1 year	Quasi-experimental
Acker & Halasek (2008)	High school, USA	1 year	Quasi-experimental
Alexiou & Paraskeva (2010)	Undergraduates, Greece	3 months	Quasi-experimental
Chang (2008)	Junior high school, Taiwan	10 weeks	Experimental
Cheng & Chau (2013)	Undergraduates, Hong Kong	3 months	Correlational
Meyer, Abrami, Wade, & Scherzer (2011)	Elementary school teachers, Canada	1 year	Mixed-method
Nguyen & Ikeda (2015)	Undergraduates, Vietnam	8 weeks	Experimental
Romova & Andrew (2011)	Undergraduates, New Zealand	13 weeks	Qualitative focus group interview
Sasai (2017)	Postgraduates, New Zealand	1 year	Explanatory sequential

Based on the studies included in the analysis (i.e., Abrami et al., 2008; Acker & Halasek, 2008; Alexiou & Paraskeva, 2010; Chang, 2008; Cheng & Chau, 2013; Meyer et al., 2011; Nguyen & Ikeda, 2015; Romova & Andrew, 2011; Sasai, 2017), SRL through ePortfolios was shown to improve students' academic outcomes. Data from these nine studies allowed the conclusion that SRL helped learners to regulate their learning and acquire a basic understanding of the learning process through identifying and interpreting their own errors.

Abrami et al. (2008), which involved a one-group pre-test–post-test design, focused on encouraging SRL through ePortfolios. Results were collected before training and through the use of the ePortfolio Encouraging Active Reflective Learning (ePEARL) software. Questionnaires were distributed again after the teachers had used the platform. Additional qualitative data such as teacher and student focus group interviews were also collected. Finally, samples from 66 students' ePortfolios were analysed. There was a difference between the pre-test and post-test scores on the Teaching and Learning Strategies Questionnaire (TLSQ). The researchers found several positive effects (two-tailed t-test, $df = 16$, $p < .10$), which included students identifying strategies for achieving their goals, students documenting the processes they used when working on tasks, teaching students to identify strategies for achieving their goals, students using portfolios to demonstrate their strengths and students using portfolios to identify areas needing improvement.

Acker and Halasek's (2008) study also showed improvement in students' writing skills; they developed skills such as defining, managing and accessing artefacts and drawing connections through the ePortfolio platform. These students reported that they were responsible for their learning. Comparable positive results were also seen in Alexiou and Paraskeva's (2010) study, despite being experimentally based, with only one group. The results for 39 out of 41 participants indicated that higher levels of cognitive factors were associated with higher levels of motivational and affective factors across all phases of SRL and ePortfolio implementation. In contrast, Chang's (2008) examination of the effect of ePortfolios on self-perceived learning performance (involving computer class students) emphasised that ePortfolios significantly increased the students' self-perceived performance. However, a significant limitation of this study was the lack of verified details of performance, such as self-set goals, self-assessment and peer assessment and reflection.

Cheng and Chau (2013) explored the relationship between undergraduate students' SRL ability and their ePortfolio achievement in a language enhancement programme. Upon completion of the programme, the participants' higher-order cognitive skills (i.e., elaboration, organisation and

critical thinking); metacognitive control strategies (i.e., self-regulation); and collaborative learning strategies (i.e., peer learning) were positively correlated with their ePortfolio achievement. However, the ePortfolio achievement could not be generalised to a broader population because only 26 participants were involved in the study.

An experimental research conducted by Nguyen and Ikeda (2015) on a group of 48 Vietnamese software engineering undergraduate students indicated positive effects, which were reported in 13 out of the 15 scales of the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) used in the study. Six motivational subscales measured intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy and test anxiety, while nine learning strategy subscales measured rehearsal, elaboration, organisation, critical thinking, metacognitive self-regulation, effort regulation, peer learning and help seeking. The results of the correlation analysis subsequently showed a significant improvement in metacognitive self-regulation ($p = 0.001$), critical thinking ($p = 0.002$), elaboration ($p = 0.004$) and rehearsal ($p = 0.028$). These scales are related directly to SRL (Pintrich, 2004), making it reasonable to argue that the system implemented had yielded positive effects on the students' SRL skills. Although not statistically significant, an improvement was also seen in task value ($p = 0.057$) and intrinsic goal orientation ($p = 0.069$). In contrast, two scales showed negative but non-significant effects: help-seeking ($p = 0.452$) and time/study environment management ($p = 0.872$). The weakness of this study was due to two factors: first, the self-regulation strategies were generalised to all students, and second, the learning data of each participant were not analysed concomitantly.

Romova and Andrew (2011) provided the only qualitative research data used in this meta-analysis. The research depicted multiple drafting through ePortfolios, which was reported to be useful in helping students undertake their academic writing tasks. Finally, the study by Sasai (2017) concluded that there was a robust positive relationship between students' SRL skills and the usefulness of online portfolios (.60), with a statistically significant relationship ($p < .01$). The outcomes indicated that students who had high SRL skills were more likely to perceive the online portfolios as useful for their learning across the three phases of the SRL framework, compared with their peers with low SRL skills. Likewise, interview data showed that students with higher SRL not only perceived an online portfolio to be a useful tool to help them regulate their learning, but also had a higher tendency to use it for their personal development. Those with lower SRL skills indicated that using an online portfolio was merely extra work for them and they perceived it as just a storage tool for their work.

The only study in which subjects were not learners was Meyer et al. (2011). This study analysed the patterns of ePortfolio implementation among elementary school teachers in Canada. Although only 46 percent of the teachers used ePortfolios, those who were persistent in using the platform acknowledged its role in promoting a higher level of student engagement, good pedagogical support, easy accessibility and customised features that allowed students to take ownership of their learning.

In brief, this meta-analysis demonstrated that the use of SRL and its impact on student development may be direct, or it may be mediated by the ePortfolio, resulting in significantly positive academic outcomes.

Research Question 2: What are the common constructs found in learner self-regulation through ePortfolio?

This section introduces and describes the themes revealed by the analysis, and presents the findings in an interpretative manner. The significant areas reviewed were metacognition, motivation and collaboration.

Metacognition

Across all the papers reviewed, metacognition was among the most critical components of regulation. John Flavell, a leading figure in the field, described the notion of metacognition, which originated in the 1970s, as “the active monitoring and consequent regulation and orchestration” of information processing activities (Flavell, 1976, p. 232). Metacognition is further delineated as a process in which learners are aware of their thinking. A salient feature of good self-regulated learners is being perceptive of their metacognition, and empirical studies have provided evidence of metacognition in most curricula, especially in writing (Griffith & Ruan, 2005). Metacognition can be regulated and monitored in student learning through knowledge, experiences and actions (strategies).

Metacognitive knowledge is the knowledge of one’s own strengths, weaknesses and skills (Flavell & Wellman, 1977). Metacognitive experiences can include an emotional component (e.g., doubt, confidence and helplessness) under the umbrella of cognitive self-appraisal (Flavell, 1985). For example, when students feel (i.e., have a metacognitive experience) that they do not understand the requirement of a writing task, they may decide to read through it again (i.e., use a cognitive strategy). For ePortfolios, such metacognitive experiences are practised by students when they self-assess their writing and through peer assessment. Based on the feedback obtained, they would make amendments to their task.

Metacognitive strategies are mainly used to monitor progress (Flavell, 1979). Various studies have indicated that direct instruction on metacognitive strategies influences learning (Boulware-Gooden et al., 2007; Palinscar, 1986; Scruggs et al., 1985). Palinscar (1986) noted that students can retain and apply the attained skills whenever necessary once they have mastered the art of knowing the value of what they are learning. To manifest such behaviour, teachers need to guide their students and point out the strategies, steps, rules and directions needed for a task (Ghosh, 2003). The notion of metacognition was explicitly seen in a few of the studies reviewed. In Cheng and Chau (2013), a statistically significant difference was found in metacognitive control strategies ($t = 9.41$, $p=0.001$) between the two groups. This indicated that while constructing an ePortfolio, development processes such as planning, monitoring and regulating routinely entailed the use of metacognitive control strategies. Likewise, in Romova and Andrew (2011), the idea of metacognition emerged when the act of reflection through multiple drafts enabled learners to capture the essence of analysis.

Motivation

Another vital precursor of self-regulation is motivation (Collins, 2009). Several researchers (e.g., Berger & Karabenick, 2016; Gonzalez, 2013; Lavasani et al., 2011) have stated that the critical variable affecting students' SRL is motivation. Learners with higher motivation are believed to engage in more self-monitoring. In this meta-analysis, motivation was not prevalent in Abrami et al. (2008), but was apparent in the assessment by Chang (2008), who described the ePortfolio method as immensely useful for poorly motivated students. Although the effect was statistically non-significant, it showed that motivation does contribute to improving the academic outcome.

Noels et al. (2001) classified the three main types of motivation as extrinsic, intrinsic and 'amotivation'. They assert that an individual who is motivated extrinsically, or by external forces, either fears punishment or needs rewards to perform. In contrast, intrinsically motivated individuals can learn voluntarily without external rewards. The third type of motivation is 'amotivation', which describes the lack of motivation; 'amotivated' learners quit at the initial stages, as they have neither external nor internal motivation. It is crucial to understand how the types of motivation are applied to learning a language and becoming a self-regulated learner. According to Snow (2006), persistence is the most critical factor in acquiring a language. It is easy to see students' motivation waver as the ability to achieve their desired outcome is not immediate, but rather a process that requires persistence. This is echoed by Seker (2016), who mentioned that language acquisition through listening, speaking, reading and

writing skills requires a substantial amount of time. Hence, maintaining a high level of motivation and persistence is vital.

Collaboration

Contrary to the popular notion that self-regulated learners try to accomplish a task on their own, it is inevitable that they seek help when necessary. Thus, the idea of collaboration is made explicit. Smith and MacGregor (1992) stated:

Collaborative learning is an umbrella term for a variety of educational approaches involving a joint intellectual effort by students, or students and teachers together. In a language classroom, it is best learnt through interaction as learners learn to comprehend each other's meanings through negotiation. Usually, students are working in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product. Collaborative learning activities vary widely, but most centre on students' exploration or application of the course material, not simply the teacher's presentation or explication of it. (p.1)

Proponents of collaborative learning have claimed that students engaged in a shared learning environment can become critical thinkers when they can participate in a discussion and take responsibility for their learning (Totten et al., 1991). What distinguishes them from other learners is that they seek advice; by doing so, they are on the path to becoming autonomous learners (Ryan et al., 2001). The idea of collaboration appeared in all of the studies reviewed. In Acker and Halasek (2008), the students appreciated the feedback they obtained from their readers. It was reported that the quality of the feedback obtained during the collaboration contributed to a successful final draft. Although feedback was seen as the main factor in that improvement, ePortfolio provided a platform for the learning environment, particularly by facilitating interaction.

While past researchers have investigated the use of SRL strategies through ePortfolio, very few of these studies have tested the role of SRL in language learning through ePortfolio. Hence, this study adds to the literature on the role of SRL when ePortfolio is a medium in language learning, and in which metacognition, collaboration and motivation serve as mediating variables.

SUGGESTIONS FOR FURTHER STUDIES

It is evident that most of the studies reviewed in this research were quantitative and used multiple analytical methods. Four of the studies explored SRL

through ePortfolio implementation among participants at the undergraduate level, while one study each investigated postgraduates and school teachers. Two studies involved high school students. However, only one study explored SRL among young participants at the elementary level. According to Rogers et al. (2005, p. 385), “ideologies are reproduced and transform at a very young age,” which suggests the need to extend SRL to young learners in school.

Out of the nine studies reviewed, only one was a qualitative study, carried out among undergraduate students. This indicates the need to undertake more qualitative studies using different age groups, as a qualitative approach will enable multiple facets of the phenomenon to be revealed and understood (Baxter & Jack, 2008). Most of the studies examined SRL and ePortfolios, but there were limited studies focusing on a specific language skill. Although there was a study that examined the writing skill through ePortfolio, it was conducted in an L1 setting, which prevented generalisation to the L2/FL context. This points to an area that could also be explored further.

CONCLUSION

Building on the articles reviewed in this meta-analysis, the approach of exploring learners’ use of ePortfolios to promote self-regulated learning is based on SRL theory as a contextualised process. From this review, ePortfolios can be approached as a medium for promoting SRL and thus foster students to become independent learners.

The main themes that pervaded the findings were metacognition, collaboration and motivation in SRL. Research has been consistent in showing that successful SRL learners are able to learn effectively when they can comprehend what they should do with a task and when they should do it, while also understanding how to do it and why they need do it. Such systematic thinking (metacognition) helps learners to understand how language works and allows them to shape their learning through strategic manoeuvres (Zhang & Zhang, 2019). SRL can also be seen as a mechanism to improve academic outcomes as learners collaborate with others, thus increasing their motivational level. Researchers such as Smith and Mancy (2018) believe that collaboration and metacognition have a positive influence on learners, which suggests the importance of social factors, especially when ideas are exchanged within small groups. This not only promotes critical thinking but also enhances interest among learners engaged in a task. SRL and motivation work hand in hand, and students devote their time and energy and accomplish tasks successfully when they employ the appropriate SRL skills (Mahmoodi et al., 2014).

Through the meta-analysis, it was found out that the ePortfolio is one medium that educators can consider if they would like to encourage SRL among students. It is imperative for teachers, parents and the relevant parties in the community to be convinced about the SRL approach through the ePortfolio medium. Undeniably, this measure is necessary to allow students to regulate their learning in an online environment and simultaneously benefit from positive academic outcomes.

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