"E-portfolios and the development of Self-Regulated Learning":
A case study in a Hong Kong Higher Education Institution

by

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Statement of Originality

I, CHING, Mei Ying, hereby declare that I am the sole author of this thesis and the materials presented in this thesis are my original work, except for those indicated in the acknowledgements. I further declare that I have followed the university's policies and regulations on academic honesty, copyright, and plagiarism in writing the thesis, and no material in this thesis has been submitted for a degree at this or other universities.

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Abstract

Self-regulated learning (SRL) relates to self-generated thoughts, feelings, and behaviours that continuously amend and improve performance, aiming to accomplish self-set goals and the ability of people's willingness to concentrate, adjust, evaluate, and manage their own behaviour. Studies strongly suggest that students' academic success can be better achieved when the design of e-learning environments involves the consideration of SRL development. In recent years, e-portfolios are used widely and globally in higher education and have become one of the major active learning processes in self-learning online platforms that support students' self-reflection, learning motivation, self-efficacy, and so on. There is a significant need for more studies on the full range of factors of SRL for higher education students in e-portfolios projects, including but not limited to understanding the influences, all possible factors, technical support, and students' learning process and/or learning outcomes related to SRL.

This research study aims to collect information directly from higher education students with actual practice in and experience of e-portfolios for two consecutive semesters. The quantitative data have been collected within the Pintrich's (2004) social–cognitive perspective of the SRL framework and used the developed self-regulation of learning self-report scale (SRL-SRS), covering the six core factors of SRL: planning, self-monitoring, evaluation, reflection, effort, and self-efficacy. The same self-report paper questionnaire was distributed to 262 undergraduate year-1 students in semester 1 and semester 2. After data filtering, pretest and posttest data obtained from 134 valid questionnaires were used for analysis. The measuring result from the Rasch model has been analysed using SPSS 21, findings included a paired sample *t* test and the one-within-one-between subject analysis of variance (ANOVA).

On the other hand, the qualitative research positively helps collect further information that the self-report questionnaires have not covered. The preset interview questions were designed by walking through the entire process, and issues that may affect or touch all procedures in the development of an e-portfolio are considered but not limited to those issues within the framework. A total of 6 students (1 female and 1 male are randomly selected from each group) have been invited for a private interview.

Findings from this research study support the statements and opinions of researchers in SRL with e-portfolios and fill in some of the missing information about the impact of e-portfolios on the development of students' SRL.

We found that students' planning has been improved after the exposure to e-portfolios and that they even apply planning to other subjects during their year-2 study. However, the students' monitoring desire was decreased or without any improvement. Different students got different improvement in control due to the level of satisfaction. For reaction and reflection, we obtained different results from the quantitative and qualitative research. On the other hand, many factors may influence and discourage the outcome on students' SRL, such as students' backgrounds and personalities, universities' curriculum designs, and course implementation.

Keywords: self-regulated learning, e-portfolios, information technology, higher education

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Gratefully thank you for my GOD's specially leading since 2009. Since then, I have started an unexpected and unbelievable journey. "But as it is written, Eye hath not seen, nor ear heard, neither have entered into the heart of man, the things which God hath prepared for them that love him" (Cor. 2:9).

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List of Abbreviations

EdB   The Education Bureau

EdUHK   The Education University of Hong Kong

GEFC   General Education Foundation Course

GEO   The General Education Office

IT   Information Technology

LTTC   Centre for Learning, Teaching, and Technology

SRL   Self-regulated Learning

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CHAPTER 1

INTRODUCTION

Self-regulated learning (SRL) is a process by which students aim to reach academic success; therefore, planning, setting goals, thinking critically, managing time, and putting in their best efforts to solve all kinds of problems and complete different types of tasks intentionally (Zimmerman & Schunk, 2001) are all included in the SRL process. Zimmerman (2000) defined SRL as students setting goals and plans, selecting learning strategies that are suitable to their learning, maintaining motivation and monitoring learning and outcomes regularly, and evaluating and correcting errors during the entire academic progress. SRL relates to self-generated thoughts, feelings, and behaviours that continuously amend and improve students' performance, helping them accomplish self-set goals, as well as the ability of students' willingness to concentrate, adjust, evaluate, and manage their own behaviours (Baumeister & Vohs, 2003; Zimmerman, 1989).

Studies of SRL have strongly suggested that students' academic success can be better achieved when the design of e-learning environments involves the consideration of SRL development (Rowe & Rafferty, 2013). E-learning refers to digital and electronic learning applications via a computer and the Internet (Li, Qi, Wang, & Wang, 2014). It provides learning and practicing with information technology (IT) not limited to a students' level of knowledge, skills, abilities; thus, it fosters students' IT attitudes for living and surviving in the 21st century. With the rapid growth of the usage of IT, people are intentionally and independently using different digital applications through smart phones and computers for leisure, commercial purposes, to receive information, or to learn every day (EDB, 2002, 2017a; Lenhart et al., 2011). E-learning provides one of the possible student-centred

environments to reinforce students' self-generated thoughts, attitudes, and behaviours that will benefit their IT attitudes for today's lifelong learning and career development.

An e-portfolio is one of the e-learning instruments that students can use to save, showcase, and share their learning experiences and learning outcomes with others on online platforms. Evans (1995) defined a portfolio as "an evolving collection of carefully selected or composed professional thoughts, goals, and experiences that are threaded with reflection and self-assessment."

E-portfolios (also named an electronic portfolio, ePortfolio, efolio, digital portfolio, webfolio, etc.; Butler, 2006) were developed from traditional paper-based portfolios, which contain students' personal information, learning outcomes, and reflections. It is similar to traditional portfolios, but the contents and constituent parts become digital and electronically collected, stored, and managed in a particular online platform (Awwad, Nofal, & Salti, 2013). An e-portfolio is a collection of interrelated and connected components, including digital artefacts, resources, demonstrations, projects, 2-D and 3-D graphics, computerized text, graphics, sound, and video (Mautadin, Santally, & Boojhawon, 2011). Web applications, hardware and software, technical support, and network infrastructure should be included in an e-portfolio environment (Balaban, Divjak, & Mu, 2013).

Hughes, Herrington, McDonald, and Rhodes (2011) reported that when educators look for new applications or activities to benefit higher education students' reading and writing skills and computer literacy, they discovered that e-portfolios might offer possible practices. In recent years, e-portfolios have been used widely and globally in higher education (Peet et al., 2011). E-portfolios have become more important in the education sector and have become

one of the major active learning processes in self-learning online platforms that support students' self-reflection, learning motivation, self-efficacy, and so on (Huang, Yang, & Chang, 2011). It benefits learning and teaching inside school and outside campus grounds, as well as students' life-long learning and preparation for the competitive job market in the 21st century.

During the process of developing their e-portfolios, students learn individually and work with IT intentionally and independently without their teachers' direct support. They should think through potential solutions using external and online information, using their IT and language abilities, by setting goals, by planning and selecting possible strategies, and using their IT skills to achieve their target outcomes. They can personally manage and organize different learning tasks, solve problems, think critically, and improve the outcomes based on self-reflection or comments from others. These kinds of self-regulated attitudes and behaviours are necessary for individuals in 21st-century living with IT. Apart from facilitating teaching and learning processes and the collection of students' academic learning evidence, e-portfolios also provide a meaningful online learning environment that fosters students' SRL. It encourages students to be responsible for organizing courses and learning materials, for planning and selecting the appropriate strategies, for evaluating their learning outcomes, for reflecting on their learning process, and so on (Yastibas & Cepik, 2015).

1.1 Problem Statement

Based on the literature, the research into SRL has a long history in the education sector. Furthermore, based on most studies, researchers have proven that SRL has a positive impact on students' learning. Therefore, different instruments have been created by different researchers and educators with the goal to measure students' SRL and collect information for

improving and encouraging students' SRL. However, self-regulation is a complex process that involves different key motivational variables. Different theories state that many similar features and characteristics relating to SRL have been developed over the course of 20 years (Zeidner, Boekarts, & Pintrich, 2000). Those factors cannot be measured in a simple and easy way. Because SRL includes many factors, researchers have designed different instruments for measuring different factors of SRL. For example, Pintrich, Smith, Garcia, and McKeachie (1991) developed the motivated strategies for learning questionnaire (MSLQ) in the early 1980s and finalized it in 1991 (Pintrich, 2004); the MSLQ only focused on measuring higher education students' motivational orientations.

Research studies on students' learning via the Internet and computers and researchers' findings regarding the advantages of e-learning environments have emerged during the past 20 years (Li et al., 2014). E-portfolios stopped being paper-based and started being noticeable in higher education back in the mid-90s (Lorenzo & Ittelson, 2005). Although many researchers have attempted to fill the gap, there are still unsolved research problems within the area of E-portfolios.

Cheng and Chau (2013a) are aware of more and more researchers who are interested in the research study regarding the impact of e-portfolios in higher education students' reflection. E-portfolios offer opportunities for students to self-reflect during their learning process (Baumgartner, 2005). They allow students to reflect on their own learning experiences, opinions, understandings, weaknesses and strengths. On the other hand, findings from Lin, Yang, and Lai (2013), through a research study about supporting students' learning processes with e-portfolios, indicated that students' cognitive demand can be enriched by the practices of e-portfolios. Therefore, they emphasized the importance for educators and researchers to

consider the influences of e-portfolios for students' learning outcomes and success.

Artino and Jones II (2012) also found that the few rigorous studies focusing on the development of students' SRL through the practices of e-learning have become more important in higher education today. For e-portfolios, most studies showed the importance of their impact on some of the factors of SRL, such as reflection and cognitive demand, but not on all factors. Researchers also argued that previous studies focused on the learning processes and learning outcomes of the use of e-portfolios; however, the factors affecting the desired learning outcomes should also be explored (Lin, Yang, & Lai, 2013).

1.2 Significance of the Study

Universities have carried out different projects regarding students' construction of and the impacts of e-portfolios on students' learning. Barbera (2008) claimed that many existing studies on e-portfolios focused on the learning process and learning outcomes. Mok (2012) reported that we should also consider other factors that are important for students and that technical support is not the only necessary part.

In recent years, more and more researchers have been interested in studies about the reason students become successful and how they become self-regulated learners (Zimmerman, 2008). Many studies reported that SRL is particularly suitable to the higher education context. However, Orange (1999) argued that it is uncommon to promote the use or development of SRL in a traditional academic environment.

Since e-portfolios have become more important for higher education, researchers have

suggested paying attention to how e-portfolios influence higher education students' academic success. There is a significant need for more studies on the full range of factors of SRL for higher education students in e-portfolios projects, including but not limited to the understanding about the influences, all possible factors, technical support, and students' learning process and/or learning outcomes related to SRL.

This research study focuses on staying within the higher education sector and aims to measure and evaluate Hong Kong higher education students' SRL in relation to their experiences with and perceptions of e-portfolios. Moreover, it aims to collect systematic information of all factors of SRL, which are not limited to one or two factors. Apart from quantitative data, in-depth comments and ideas from students are also collected, which may give a clearer and better understanding of the students' perspectives. Undoubtedly, all data and information collected in this research study may provide a better picture within the aforesaid subject area, which may facilitate researchers and educators to conduct further studies and curriculum developments.

1.3 Motivation of the Study

In 2011–2012, the Education University of Hong Kong (EdUHK) started a project while all undergraduate students developed their e-portfolios using the Mahara online platform. Because I was the teacher in the relevant course and a member of the Consultative Committee of the Centre for Learning, Teaching, and Technology (LTTC) in the EdUHK, I have read the relevant information and was involved in the related projects, which inspired me to initiate this research study.

Based on the arrangement, the university prepared all information with clear explanations and requirements in both the welcome lecture and weekly tutorials during two semesters. All necessary information is stored in the online platform Moodle, the LTTC and Mahara's website. Moreover, students can contact teachers or call the LTTC's hotline for help.

From the teachers' expectations, although students get all of their information and basic training with the online platform that is organized by the university, students should manage and construct their own learning journey by setting goals, selecting strategies, problem-solving, and doing self-evaluations without the teachers' direct support during the process with the e-portfolios. Students may face different challenges and should take full responsibility to work independently outside classroom.

Some questions were raised, and we were interested to learn the answers:

- Could the information and support be arranged by the university to foster students' SRL with the e-portfolios' development? Is there any improvement for the university's future preparation for the e-portfolio project?

- How can teachers help enhance students' SRL through the e-portfolio project? What is the role of the teachers in students' direct online learning?

- How can e-portfolios provide the opportunities for SRL? Which factors of SRL are affected?

- How do e-portfolios impact the development of SRL among higher education students?

- Can the process of constructing and managing e-portfolios foster higher education students' SRL?

- Which factors of SRL can be fostered?

- Will any other factors influence students' SRL with the e-portfolios?

1.4 Contextual Background

In 2011–2012, the EdUHK installed an e-portfolios system called Mahara for undergraduate students to develop their own e-portfolios. This learner-centred personal learning environment was first established in mid-2006. It started as collaborative venture funded by New Zealand's Tertiary Education Commission E-Learning Collaborative Development Fund (eCDF), involving Massey University, Auckland University of Technology, the Open Polytechnic of New Zealand, and Victoria University of Wellington (Mahara, 2017).

According to the goals of the EdUHK, the e-portfolios aim to enrich students' self-monitoring, organizing, and management of their own learning journey, thus encouraging their critical thinking and self-reflection in learning. It provides a platform for students to store, showcase, and share their 4–5 years of study outcomes, evidences, reflective practices, and professional demonstrations with others. Aside from the learning evidences, the development of e-portfolios also provides opportunities in technology and the digital online environment, which fosters students' lifelong learning capabilities in 21st century. This is echoed by "The e-portfolios aim to include the students' record of learning process and learning outcomes in both formal and informal learning experiences, such as Overseas Learning Opportunities (IO/GCA), Language Enhancement (CLE/LML/LCS), Field Experience (SPFEO), & General Education (GEO)" (Mahara@HKIED, 2017).

Starting in the 2012–2013 academic year, all of the undergraduate year-1 students in the General Education Foundation Course (GEFC) and the English Enhancement Programme (including major and nonmajor students) were compulsorily requested to develop their

e-portfolios within two semesters. In early semester 1, the LTTC of the EdUHK arranged different workshops, aiming to give basic knowledge and techniques to students before they started to develop their e-portfolios. On the other hand, walk-in clinics and online resources, templates, and user guides were also arranged to help students with further action during the process. Teachers also give clear schedules and requirements for all tasks regarding the e-portfolios in their welcome lectures and weekly tutorials. Students were also encouraged to upload their reflections on the topics learned after every lecture to their e-portfolios on a biweekly basis. Teachers gave comments on each student's reflection and offered suggestions for student improvement. As a minimum requirement, students were requested to upload personal information, 11 e-journals, and one essay to their e-portfolios during the two semesters.
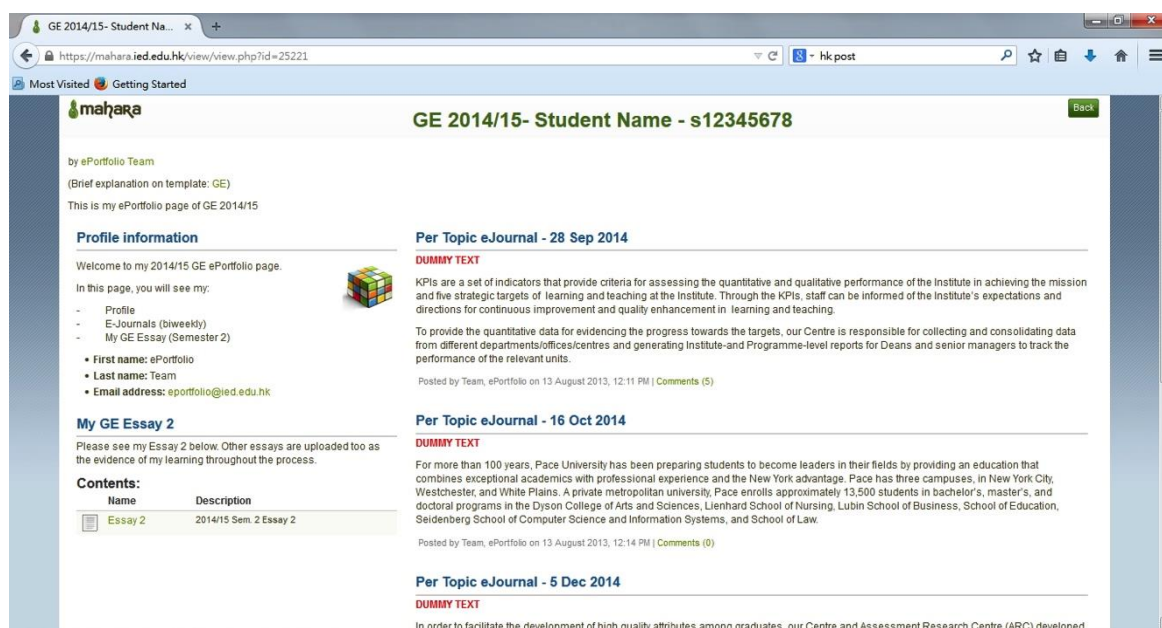
Figure 1.   Template for Year-1 Students (Mahara@HKIED, 2014)

All of the year-1 students were expected to have knowledge of English writing and computer skills. Students should have independently completed their e-portfolios after learning the

basic techniques. To complete each task of GEFC on time, students needed to set up their goals and plan and manage their learning schedule accordingly. If they aimed to have better results, they needed to self-monitor their performances, check and correct each error, frequently evaluate and reflect their learning outcomes for improvement, and manage challenges when facing different problems during the process. Students should have independently organized and engaged in their own project outside the classroom without direct support from teachers. Moreover, students needed to seek help upon facing different problems or questions during the process of developing the e-portfolios. These requirements appear to be related to the factors of SRL, such as setting goals, engaging in time management, self-monitoring, and maintaining effort and persistence when facing difficulties and problems (Zimmerman, 1998).

When students develop their e-portfolios, they may do the following:

- Set goals before they start to develop their e-portfolios and think about how to complete all tasks based on the course guidelines within time schedule.

- Plan the learning and working schedule, strategies, and techniques to better reach the goals.

- Select, search, and decide which information and digital artefacts are to be saved in the e-portfolios.

- Self-monitor their performance to decide what should appear in their own e-portfolios.

- Evaluate their learning outcomes and performance and be aware of the quality of their achievements.

- Identify reflective actions after planning, self-monitoring, and evaluating, especially when they are aware of errors or mistakes

- Reflect upon their learning experiences throughout all learning activities.

● Demonstrate their efforts to accomplish every task and to show their self-efficacy during the project while each process may directly affect their final results.

1.5 Research Questions

Based on the motivation and contextual background, three research questions have been decided to frame and guide this research study:

1) What are the impacts of e-portfolios on students' SRL as they progress through their first year of study?

2) How are the students' SRL supported as they construct their e-portfolios? (Support is available in the teaching and learning environment – role of teachers, resources, role of students, training, activities, etc.)

3) How do the barriers prevent students from developing their SRL while they are constructing their e-portfolios?

1.6 Organization of the Thesis

This thesis is organized in five chapters:

Chapter 1 presents the introduction, which includes the general background, the current problem within the area of study, the motivation and significance of the study, and the research questions.

Chapter 2 presents the literature review regarding research into SRL, the impact of higher education students' SRL with e-portfolios, the overview of current studies in different countries, the overview of different measuring instruments, the overview of different models and theories of SRL, the theoretical framework, the contextual background, and the research questions of the study.

Chapter 3, which focuses on the methodology, explains the research method and design, the information about the population and samples, the measuring instrument for quantitative research and the data filtering and reliabilities, as well as the qualitative research design, interview questions, sample strategies for the interviews, and method of interview data analysis.

Chapter 4 presents findings from both quantitative and qualitative research. The results will be discussed in detail based on the theoretical framework. Moreover, other factors that may have influenced students' SRL will be also highlighted and discussed.

Chapter 5 is the conclusion of this research study. It includes recommendations for educators regarding how they may improve higher education students' SRL using e-portfolios. The limitations of the study and the intentions and recommendations for further studies will be discussed as well.

CHAPTER 2

LITERATURE REVIEW

Zimmerman (2008) mentioned that SRL pertains to students' self-directive processes and self-beliefs for transforming their abilities in academic performance. E-portfolios provide a self-directed learning environment, which requires students' proactive participation; for instance, students must have abilities in setting goals and planning, reviewing, organizing, transforming, self-monitoring, selecting and developing strategies, as well as in accomplishing and evaluating their own learning independently (Wirth & Leutner, 2008). These behaviours depend on students' own thoughts, cognitive abilities, self-motivation, and persistence during the entire process. This chapter provides an overview and synthesis SRL and e-portfolios in the education sector.

2.1 The Development of SRL in Education Institutions

Starting in 1980, a large number of articles and journals on self-regulation in social, educational, organizational, clinical, and health psychology began to be published and appeared to draw a lot of attention (Boekaerts, Pintrich, & Zeidner, 2000).

2.1.1   Overview of SRL in Education

Educators became more aware of the importance of self-regulation skills in learning, and they have been trying hard to explore the impact of SRL on the learning process. They stated that teachers play a major role in regulating students' learning during the early grades. For instance, teachers help students set goals, manage time for every task, and guide students to

put forth effort and to complete tasks in the classroom. However, teachers gradually reduce their direct support to higher-grade students and expect them to learn to complete tasks independently. Based on these findings, SRL is fostered (Zimmerman, 2002).

Researchers identified SRL occurring in academic contexts, such as the investigation of students' learning processes, the exploration of students' development, and the transformation of these SRL processes beyond the original learning settings (Zimmerman & Schunk, 2011). SRL carries three key features: goals, actions, and assessments (Vancouver, 2000). SRL refers to self-regulation processes applied during a learning experience, where the goal is a desired level of achievement (Sitzmann & Ely, 2011).

Researchers found that students' SRL abilities can directly affect their academic success (Winne & Hadwin, 2008). Teachers who embrace their own critical reflection and accept the need for self-direction will position themselves to provide space for student empowerment in the learning process (Kranzow & Hyland, 2009). Nowadays, learning has become more student-centred; students can self-reflect or interact with peers and teachers according to their views, opinions, goals, learning needs, and difficulties (Abrami & Barret, 2005). Many studies found that students who frequently seek help from peers and teachers are learners who have better SRL abilities (Pintrich et al., 1993) because the self-regulated learners look for different ways to benefit their learning; for example, they search for useful sources from different channels to obtain useful information, attend workshops to enrich their knowledge, contact with the experts for advice, and so on.

In general, self-regulation concerns whenever students decide spontaneously to adjust and manage their performances, behaviours, or strategies and aim to reach their goals or plans.

This depends on their thoughts, cognitive abilities, self-motivation, reflection, evaluation, and persistence (Zimmerman, 1989). Self-regulation concerns three areas of psychological functioning that are essential in learning: cognitive (e.g. goal setting, learning strategies), motivational (e.g. self-efficacy, task value), and metacognitive (e.g. self-monitoring and self-reflection; Bandura, 1993).

2.1.1.1 Cognitive

The goal is the core factor of SRL because it serves as the criteria by which learners assess, monitor, and guide the cognitive process (Pintrich, 2000). Normally, the goal is placed in the first stage of the learning process. Self-regulation refers to learners' personal decisions for improving and correcting their strategies to achieve their goals (Zimmerman, 2000). Learners' success is directly affected by their plans and goal setting, their actions and behaviours, and how they manage and organize the whole learning process (Zimmerman & Tsikalas, 2005). Goal setting is one of the most effective psychological strategies for performance improvement and motivation in organization settings (Bueno, Weinberg, Fernandez-Castro, & Capdevila, 2008). However, self-set goals also rely on learners' motivation and persistence when facing problems and reactive behaviours and their performance during the learning process (Zimmerman, 1989). Researchers stated that the "outcome goals" referred to an interpersonal comparison with the result; the "performance goals" focused on the improvement and the final performance based on a self-referenced standard; and finally, the "process goals" focused on the skills and strategies. Researchers suggested combining different teaching techniques, which are applicable in the process goals and performance goals, with goal setting. It is possible to foster students' SRL, even in primary physical education (Kolovelonis, Goudas, & Dermitzaki, 2012).

2.1.1.2 Motivational

SRL research showed that the motivational outcome variables (e.g. effort) and the motivational beliefs (e.g. self-efficacy) are linked with the use of cognitive and metacognitive strategies (Pintrich & Schunk, 2002). The motivational process includes self-efficacy, task interest, school connectedness, and so on (Cleary & Kitsantas, 2017). The core motivational component of self-regulation is self-efficacy. Self-efficacy refers to people's personal beliefs in their ability to complete every task and aims to achieving the goals set before those people (Bandura, 1986). In the context of academic achievement and performance, many studies of the motivational component can be found (Ramdass & Zimmerman, 2011).

Bandura (1977) defined self-efficacy as "people's beliefs about their capabilities to produce designated levels of performance that exercises influence over events that affect their lives" (p. X). It includes students' beliefs about their efficacy for regulating learning activities and mastering academic subjects. Their thoughts and motivation affect their actions through their self-reactive influence (Caprara et al., 2008). Researchers also stated that students lacking self-efficacy can no longer believe their ability to learn and complete an academic task (Cleary & Zimmerman, 2004).

2.1.1.3 Metacognitive

The term metacognition was first introduced by Brown (1978) and Flavell (1976). Metacognition is gained through experience, which consists of the knowledge of oneself, the task at hand, and the strategies that are helpful for monitoring and controlling one's performance on the task. Students' awareness of the importance of self-monitoring their

understanding and cognition in their learning processes is the metacognitive component in SRL (Kauffman, 2004). This is the degree of judgment from students to their actual performance. The self-evaluative judgment on students' personal performance develops after they have completed a task because they received information from the experience, knowledge from the task, the ability to self-monitor, and so on (Labuhn, Zimmerman & Hasselhorn, 2010).

Blackburn and Hakel (2006) reported that SRL can help in increasing metacognition, and they explored Pintrich's (2004) four stages of SRL, which are goal setting, monitoring, regulating, and reflecting. Reflection is a common word in the education sector. Moon (1999) proposed that reflection can contain five learning stages: "noticing, making sense, making meaning, working with means, and transformative learning to represent a learning map". Pintrich (2002) suggested that metacognition was useful for students when facing different tasks, situations, and conditions. In his framework, metacognition is linking with self-regulating strategies, which can help in monitoring, improving, and adjusting cognition and learning. Metacognition and self-monitoring both assist students in adequately assessing their own abilities (Cohen, 2012). Sophisticated, self-regulated learners will use different strategic plans and self-monitoring techniques to keep track of and better gauge their learning progress successfully (Timothy & Zimmerman 2004).

2.1.2 Overview of SRL in the Higher Education Context

In primary and secondary education, most students learn with direct support from teachers. However, higher education students will start self-regulating their learning because teachers will reduce direct support across many aspect of learning, such as setting goals, managing

time, solving problems, and so on (Zimmerman, 2002). Students take the responsibility to self-regulate their learning, problem solving, time management, and so on, without teachers' direct support (Zimmerman, 1998).

SRL competences, such as setting goals, time management, self-monitoring, problem solving effort, and persistence during difficulties, are important to academic success because higher education students are under an obligation to finish every task independently in higher education (Zimmerman, 1998). Self-regulated learners take cognizance of their academic strengths, weaknesses, and strategies to organize learning materials in a much better way (Farsani, Beikmohammadi, & Mohebbi, 2014). Peverly, Brobst, Graham, and Shaw (2003) also claimed that SRL is important for success in higher education because students have to deal with a large number of unstructured contexts and face diverse learning challenges.

Peverly et al. (2003), through a research study with 82 undergraduate students in an introductory psychology classes (80.5% female and 19.5% male) with a mean age of year 23.07, found that higher education students were not good at self-regulation. Findings showed that their metacognitive sense for examination preparation was poor. Background knowledge and note taking in the class were not predictors of students' SRL.

Researchers found six aspects of SRL – environment structuring, goal setting, time managing, implementing task strategies, help seeking, and using self-evaluation – that could predict the level of initiative ability, the sense of control, and the level of self-reflection in personal learning environment management through a research study with 104 Educational Technology graduate students (58.65% female and 41.35% male) in an online course (Yen, Tu, Sujo-Montes, & Sealander, 2016).

Ambreen, Haqdad, and Saleem (2016) interviewed 12 students of M Phil secondary school teacher education and found that SRL depended on students' motivation. Normally, students might think of the task, process, and effort during the planning stage. If students do not consider the assignment valuable during the planning stage, they will spend less effort. Artino (2008) also found that students' motivational beliefs and attitudes towards the learning task were based on their satisfaction using a research study with 646 service academy undergraduate students (17% female, 80% male, and 3% no gender record) with a mean age of year 20.4.

2.2 Potential of E-Portfolios for the Development of SRL

E-portfolios are not the only storage systems for students' learning outcomes. Researchers stated that e-portfolios also benefit the enhancement of students in learning, preparing for careers, sharing learning and teaching practices, and using teaching and assessment tools for teachers. For instance, they include student e-portfolios, teaching e-portfolios, institutional e-portfolios, and so on (Lorenzo & Ittelson, 2005), especially in the electronic and technology life in 21st century.

For student e-portfolios, researchers stated that it can benefit students' critical thinking, writing, and communication skills; learning and usage of information and technology literacy; and self-reflection through their self-evaluation and feedback according to the learning experience (Dennis & Hardy, 2006; Lorenzo & Ittelson, 2005). Alexander and Golja (2007) also found that e-portfolios gave opportunities for students to enrich their independent

learning experiences. According to the e-portfolio project, students work outside classroom and are responsible for their work without teachers' direct support. Students should consider and select proper strategies, as well as make decisions in using different information and technology literacy and applications because the e-portfolios can include text and images, videos, sounds, and so on (Butler, 2006). E-portfolios have the potential to make a difference in learning environments and students' learning through different types of engagement, such as SRL (Deneen & Shroff, 2014).

2.2.1 Overview of E-Portfolios in the Higher Education Context

E-portfolios are mainly used for learning, teaching, and making assessments in education. They include student e-portfolios, teaching e-portfolios, and institutional e-portfolios (Lorenzo & Ittelson, 2005). They have been used for assessment and teaching tools in English language teaching to improve students' writing skills (Yastibas & Cepik, 2015).

The University of Denver started the University of Denver Portfolio Community system in the late 90s and launched it in September 2002 after internal development was completed. It is a home-grown e-portfolio system for supporting individual courses, community portfolios, and curriculum assessments. By 2004, 6,400 e-portfolios (including 540 from faulty) have been created by students, alumni, and staff (Lorenzo & Ittelson, 2005).

In the Netherlands, the School of Education in a large university of applied science has achieved full implementation of its e-portfolio system after being piloted for three years in the late 90s. The school is using its own developed sophisticated platform and plans for further technological development after 15 years' experience with the e-portfolios programme.

It found that assessments design is one of the difficulties in the e-portfolio project, but it is crucial for students (Deneen & Shroff, 2014).

In 2007, Taiwan's government decided to start using the European Institute for E-learning's perspective for promoting the implementation of e-portfolios in higher education. It took place due to the government's awareness of the importance of the use of e-portfolios in the higher education sector. The government recognized that it could improve the students' ability, international perspective, academic interest, and self-reflection relating to professional development for the preparation of future careers. Higher education students have been encouraged to develop their e-portfolios with their learning experience and achievements towards future careers. Based on the record from Taiwan's National Youth Commission (NYC, 2012), a total of 52 universities (36 academic and 16 teaching universities) have processes in place for e-portfolios for all students (Hsieh, Lee, & Chen, 2015).

2.2.2 Overview of the Potential of E-Portfolios for the Development of SRL

Richards (2002) suggested that the use of e-portfolios "addressed the convergent need for an applied approach to different types of learning in the digital age". A technology-rich learning platform is important to both teachers and students. In general, most researchers found that the use of e-portfolios could improve students' personal development and encourage and evaluate students' self-assessment, learning process, and learning outcomes, especially in the learner-centred education context (Singh & Ritzhaupt, 2006). Students should practice planning, monitoring, evaluating, reflecting, adjusting, amending their own work, seeking help with problems, and improving and developing their learning strategies during the entire learning progress (Cheng & Chau, 2013b).

Researchers commented that the successful integration of computer technologies can create active learning environments for students (Kagima & Hausafus 2000).

2.2.2.1 Cognitive

Cheng and Chau (2013b) examined the relationship between the SRL ability of students and the achievement of e-portfolios; he found that the use of cognitive and self-regulated strategies was positively related to learning outcomes. E-portfolios could encourage students to look for better learning outcomes and enhance their learning experience (Zubizarreta, 2004).

Lin et al. (2013), through a research study with 374 undergraduate students, reported that although e-portfolios increased students' cognitive demands, students needed the appropriate support to get better learning outcomes. Their findings indicated that students' cognitive demands could be influenced by the amount of feedback from teachers and professional support.

Based on Pintrich's (2000) work, students setting goals and selecting proper strategies were the core factors of SRL. This was the first stage of the whole process (Zimmerman, 2000). It would affect the second stage; for instance, self-monitoring and effort.

2.2.2.2 Motivational

Artino (2008) indicated that self-efficacy and satisfaction were positively correlated, and both

of them were healthily growing fast in the online training context.

Huang, Yang, and Chang (2011) collected data from 450 students who were taking a common course at a university in Taiwan. Findings showed that learning motivation was positively correlated with self-efficacy and e-portfolios. Learning motivation was the significant predictor of self-efficacy. On the other hand, self-efficacy was the significant predictor of e-portfolio satisfaction.

2.2.2.3 Metacognitive

Zellers and Mudrey's (2007) study in a community higher education setting found that e-portfolios could effectively increase students' metacognition. E-portfolios provided the opportunity for students to search, select, choose, and judge the appropriate artefacts for their own research studies. During the development of the e-portfolios, students could also self-evaluate and reflect on their own learning, as well as their interactions through discussions and sharing with peers. Students' reflection could ensure efficient artefacts in their e-portfolios and enhance their performance (Park & Lim, 2007). This is one of the reasons that e-portfolios have been widely used in higher education programmes.

2.2.3 Summary

In Hong Kong, Cheng and Chau (2013a, 2013b) carried out two studies for an e-portfolio project that was designed and managed by the English Language Centre of the Hong Kong Polytechnic University. A total of 26 Hong Kong (Chinese) undergraduate students at the Hong Kong Polytechnic University participated. One of the studies explored and discussed

the effects of different goal orientations on students' reflective abilities. They found that the appropriate coding schemes were utilized to measure goal orientation and reflection level. Their other study explored the relationship between students' SRL abilities and their e-portfolio achievements in a language-enhancement programme.

In their research study, the assessment rubrics for students' e-portfolios were designed by two experienced teachers, and the rubrics comprised six key criteria: 1. use of English, 2. quality of work, 3. quantity and variety of work, 4. reflection ability, 5. achievement of language learning goals, and 6. commitment to further language development. Every e-portfolio submitted to the programme was evaluated based on the criteria, and each received a score.

The first study showed that students' reflection in the e-portfolio environment was as important as the students' ability to develop through performance. The other research study's results indicated that elaboration, organization, critical thinking, metacognitive self-regulation, and peer learning were significantly positively correlated with the e-portfolio scores of the participants.

Britten, Mullen, and Stuve (2003) also found that the students in the teacher education programme realized that their reflection on the e-portfolios successfully helped improve their concepts, teaching practices, position in education, knowledge, teaching, and learning. The process of using e-portfolios is closely linked with the abilities of SRL, and it can enrich students' literacy skills and abilities (Wade, Abrami, & Sclater, 2005).

Many universities and researchers carry different projects and studies, aiming to explore their relationships and to investigate how SRL and e-portfolios affect students' overall academic

performance. Although higher education is more often using a web-based platform, limited studies are published about its benefits for higher education students, such as the relationship between self-regulation and learning outcomes in e-learning environments (Warburton, Chen, & Bradburn, 2002). From the literatures, most studies are focusing on the teaching enhancement, learning performance and assessment (Hsieh et al., 2015; Kuo & Hwang, 2014; Yastibas & Cepik, 2015). According to the factors of SRL, most studies are interesting in the critical benefits of e-portfolios is that students' reflection and self-evaluation (Awwad et al., 2013; Kuo & Hwang, 2014).

Researchers stated that e-portfolios were not only mainly used for enhancing learning, teaching, assessment, personal development, students' self-assessment, and outcomes. This student-directed, technology-rich, and evidence-based learning platform also provides self-regulated opportunities, especially for higher education students in this digital age (Richards, 2002; Zimmerman, 2002). These include planning, monitoring, evaluating, reflecting, adjusting, and revising their work; seeking help; solving problems; improving and developing learning strategies; using cognitive and self-regulated strategies; and so on.

2.3 Theoretical Framework

In the 1980s, different models and theories of SRL appeared, aiming to define students' abilities, efforts, and how they gained success from their learning (Zimmerman, 1989). Zimmerman and Schunk (2001) studied different models and theories of SRL and discovered that they had same idea about SRL. All of them found that SRL had cognitive, metacognitive, and motivational components. However, those theorists have different areas of focus; for example, some theories aim at improving learning outcomes. For instance, the operant

theorist focuses on external reinforcement during the SRL process. The information-processing theorist focuses on the role of memory, tactics, and knowledge. The social–cognitive perspective considers the relationship between cognitive strategy use, metacognition, and motivation, and it can reflect the entire process when students develop their e-portfolios.

2.3.1 The Cyclical Model of Self-regulation

In the social–cognitive perspective, Zimmerman's (2000) cyclical model of self-regulation gives a clear and easy framework to understand the process, promoting student learning in an academic context and the relationship of academic motivational beliefs. This model has been successfully applied to education. Assuming that students are proactive learners who have self-regulation processes with proper strategies and self-motivational beliefs, they will regulate their academic behaviours and beliefs in three cyclical phases: forethought, performance control, and self-reflection (Cleary & Zimmerman, 2004; Labuhn et al., 2010).

2.3.1.1 Forethought

Forethought should be the first stage, occurring before all action for learning. It involves students' beliefs, attitudes, and process, which exist for their school activity. These include goal setting, strategic planning, motivational beliefs, self-efficacy, goal orientation, intrinsic interest, outcome expectation, and so on.

2.3.1.2 Performance Control

Performance control affects students' learning efforts. Students' self-control will help guide learning and performance, such as self-instruction, imagery, attention, focusing, task strategies, and so on. Students' self-observation is related to their self-monitoring ability of their performance.

2.3.1.3 Self-reflection

Self-reflection is the final stage, which takes place after learning or performance. The self-evaluation or self-judgment refers to students judging their performance or outcome and then making an adjustment for future or upcoming learning.

Based on Zimmerman's idea, the forethought processes will directly influence the performance control processes, the performance control processes will directly influence the self-reflection processes, and the self-reflection processes will give feedback and help adjust and amend the forethought processes for future development and learning. Each process is very important and gives value to the next process; thus, students will have better improvement by reviewing their own learning efforts and experiences (Zimmerman, 2000).
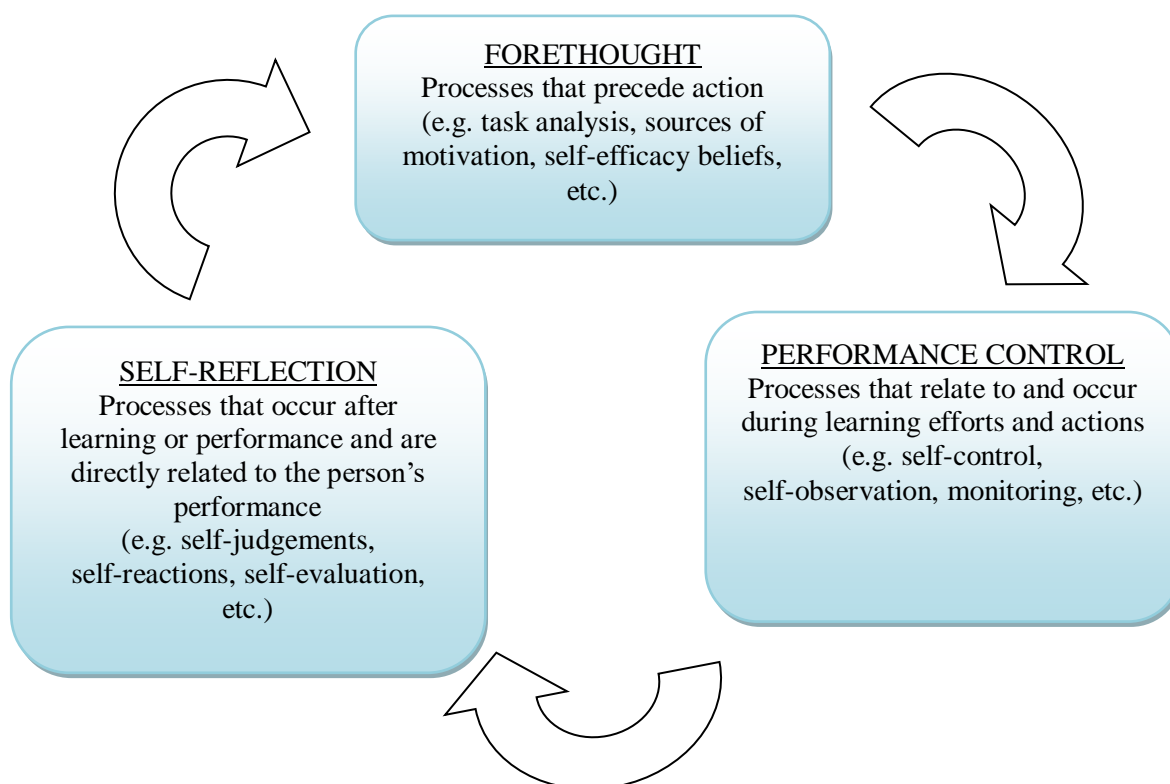
Figure 2. Zimmerman's (2000) Cyclical Model of Self-regulation

2.3.2   The Social–Cognitive Perspective of SRL

A social–cognitive perspective specifically focuses on observing SRL in the personal (e.g. beliefs about success), behavioural (e.g. engaging in a task), and environmental (e.g. feedback from a teacher) triadic interaction processes. Social cognitive theory situates human behaviour within a model of interacting influences comprising personal (cognitive; affective), behavioural, and social and environmental influences (Bandura, 1986). It pays particular attention to students' beliefs about their capabilities and perceptions of contextual factors, such as interest (Cleary & Kitsantas, 2017).

Pintrich (2000) illustrated the social–cognitive perspective of SRL. This conceptual framework is based on four general assumptions that he found from different SRL models.

The four general assumptions are 1. active and constructive assumption; 2. potential for control assumption; 3. goal, criterion, or standard assumption; and 4. mediators between personal and contextual characteristics and actual achievement or performance.

Table 1

The Four General Assumptions that Most SRL Models Share (Pintrich, 2000)

Active, constructive assumption	Assume that students will construct their own meanings, goals, and strategies from the information available in the external environment and from information in their own minds.
Potential for control assumption	Assume that students can potentially monitor, control, and regulate certain aspects of their own cognition, motivation, and behaviour, as well as some features of their environments.
Goal, criterion, or standard assumption	Assume that there are some types of goals, criterion, or standards against which comparisons are made to assess whether the learning process should be continued as is or if some types of change are required.
Mediators between personal and contextual characteristics and actual achievement or performance	It is not just individuals' cultural, demographic, or personality characteristics that influence achievement and learning directly, nor just the contextual characteristics of the classroom environment that shape achievement, but the individuals' self-regulation of their cognition, motivations, and behaviours that mediate the relationships between the person, the context, and, eventually, the achievement.

Pintrich (2000) grouped and organized the processes that mentioned many models of SRL and placed those processes in four phases: planning and goal-setting, self-monitoring,

controlling, and reflecting. Furthermore, he modified these four stages to be "A conceptual

Framework for SRL in the college classroom" (Pintrich, 2004).

Table 2
Phases and Areas for SRL (Pintrich, 2004)

Phases and relevant scales	Areas for regulation			
	Cognition	Motivation	Behaviour	Context
Phase 1 Forethought, planning and activation	Setting target goals	Accepting responsibility for goals	Planning for time, effort, and self-observation	Perceiving the context of the task
Phase 2 Monitoring	Checking for comprehension	Being aware of motivation and interest	Being aware of the effort and need to seek help	Checking for changes in the task and context conditions
Phase 3 Control	Selecting and adapting strategies for making meaning	Selecting and adapting strategies for controlling motivation and interest	Increasing and decreasing effort	Restructuring the task
Phase 4 Reaction and reflection	Making judgments about understanding	Having reactions	Analysing feedback	Assessing the task within the context

By combining Zimmerman's (2000) cyclical model of self-regulation and the four phases and

areas of Pintrich's (2004) social–cognitive perspective of SRL, we developed the cyclical

movement of SRL (Pintrich, 2004; Zimmerman, 2000), and it can explain the process of the

development of e-portfolios.
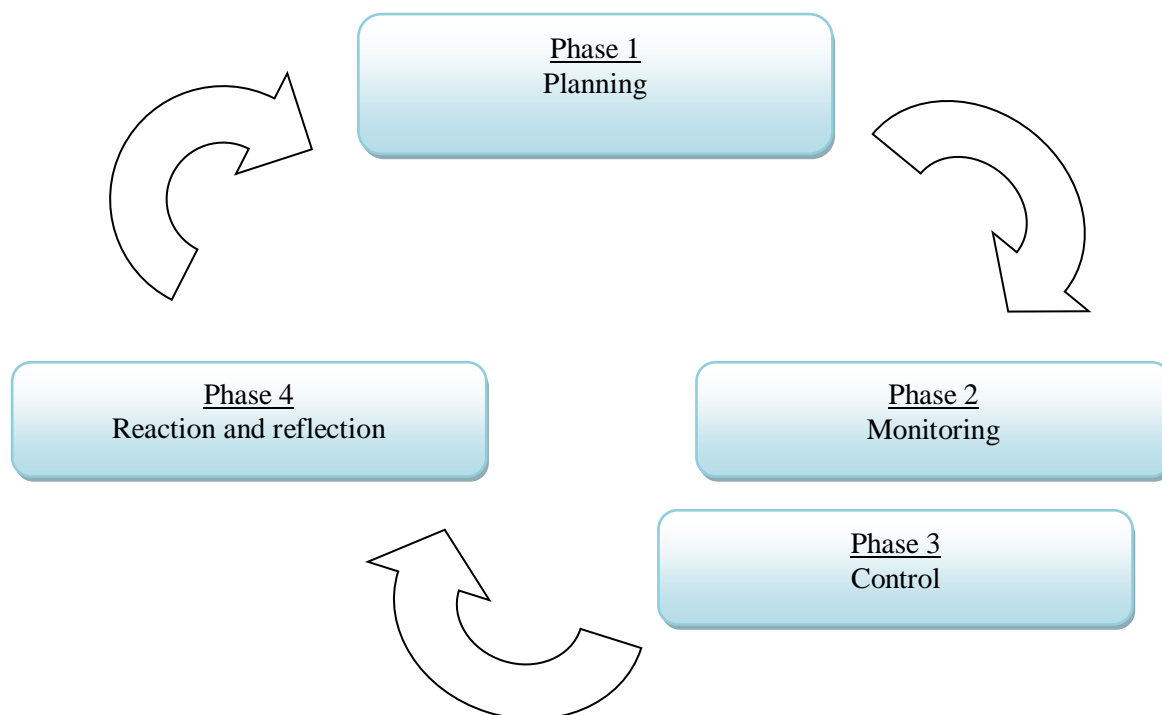
Figure 3 Cyclical Movement of SRL (Pintrich, 2004; Zimmerman, 2000)

Table 3
Applying the Phases for SRL (Pintrich, 2004) with the Development of E-Portfolios

Phase 1 Planning	Assume that students will set goals and plan after receiving external information of the e-portfolios from university and teachers. They will think, select, and decide proper strategies based on their abilities, such as the use of different IT skills and applications; therefore, they aim at achieving the target or course requirements.
Phase 2 Monitoring	Assume that students will intentionally monitor each task they have to complete in the e-portfolios. They will check if any errors or mistakes should be corrected, as well as the format and layout of e-portfolios.
Phase 3 Control	Assume that students will put forth the effort to complete each task in the e-portfolios. When facing difficulties, such as failure to upload a document to the e-portfolios system, they will seek help and find the

	proper solution to the problems.
Phase 4 Reaction and Reflection	Assume that students will rethink the outcome of e-portfolios. They will adjust their further actions based on teachers' feedback, self-evaluation, and experience. They will apply improvement in the next submission.

The cyclical movement of SRL (Pintrich, 2004; Zimmerman, 2000) helps explain a clear understanding of the actual process when developing the e-portfolios. It helps frame the research design and data collection for this research study. Moreover, it aims to study whether e-portfolios really can foster and develop students' SRL.

2.4 Chapter Summary

From the literature, most studies found that SRL – such as planning, setting goals, effort, actions, behaviours, self-monitoring, managing time, solving problems, adjustment, evaluation, and so on (Baumeister & Vohs, 2003; Zimmerman, 2002; Zimmerman 2008; Zimmerman & Tsikalas, 2005) – can positively benefit students' learning processes and academic success (Winne & Hadwin, 2008), especially in the learner-centred curriculum (Abrami & Barret, 2005).

According to the use of e-portfolios in the higher education sector, studies found that the e-portfolios is positive for enhancing students' learning. For instance, self-reflection and self-evaluation in e-portfolios positively enhanced students' performance (Cheng & Chau, 2013a; Park & Lim, 2007). Hyland and Kranzow (2012) also stated that e-portfolios potentially contributed to the cycle of students' intentions across reflection, action, and

self-directed learning.

Although the literature revealed strong linkages between e-portfolios and the factors of SRL, most studies focused on one or two factors of SRL, and not all factors of SRL have been investigated. Although studies have examined how e-portfolios supported among students, there have been few attempts to examine what factors affect students' SRL in the process of e-portfolios and how such factors facilitate or inhibit SRL.

Zimmerman's (2000) cyclical model of self-regulation and Pintrich's (2004) social–cognitive perspective of SRL successfully applies to the actual process of the development of e-portfolios and frames the investigation of students' SRL for this research study. Furthermore, it covers most of the core factors of SRL, such as goal setting and planning, monitoring, putting in effort, and students' reaction and reflection.

CHAPTER 3

METHODOLOGY

3.1 Introduction

According to the significance of the study, research questions, theoretical framework, and contextual background, we aimed to collect information and data directly from the users of e-portfolios. To investigate and measure higher education students' SRL in a period of practice with the e-portfolios, a proper measuring instrument and research method had to be considered.

Apart from the literature and theoretical framework, we also gathered information to assess different measuring tools and analyzing methods to apply the most suitable one in this research study. Our aim was to adopt a better study design that could maximize the reliability of the data collected in this research and provide for a better understanding of SRL and e-portfolios for researchers and educators.

3.2 Instruments for Measuring SRL

Not limited to personal thoughts, feelings, attitudes, and behaviors, SRL contains different factors, such as goal setting and planning, self-efficacy, motivation, etc. (Zimmerman, 1989). These factors are not easily measured with simple measuring tools, as weight and height are. Since researchers stated the importance of SRL, around the 1980s, different scholars have developed different measuring instruments for SRL, such as metacognitive, motivational, and behavioral constructs (Zimmerman, 2008). The following are some measuring instruments

for measuring different factors in SRL content:

3.2.1 AMI

The Academic Motivations Inventory (AMI) is a self-report instrument for examining the domain of motivation. This instrument was designed specifically for the theory of academic motivation with the aim of identifying and measuring students' motivation. Researchers reported that it is a useful tool for individual assessment. It includes the dimensions of the motivational characteristics of the educational environment, motivational characteristics of the individual, and hypothesized motivational effects (Moen & Doyle, 1977).

3.2.2 LASSI

The Learning and Study Strategies Inventory (LASSI) (Weinstein et al., 1987) is a published, standardized, '80-item self-report inventory of students' strategies for enhancing their study practices'. It has 10 scales for measuring skill (or metacognition, including concentration, selecting main ideas, and information processing), will (or motivation, including motivation, attitude, and anxiety) and self-regulation strategies (or behavior, including time management, study aids, self-testing, and test strategies). This is a five-point rating scale, from 'not at all typical of me' to 'very much typical of me' (Zimmerman, 2008).

3.2.3 MSLQ

Pintrich, Smith, Garcia, and McKeachie (1991) developed the Motivated Strategies for Learning Questionnaire (MSLQ), which started in the early 1980s and was finalized in 1991 (Pintrich, 2004). It is one of the widely used questionnaire measures of SRL for measuring two major sections: learning strategies and motivation (Zimmerman, 2008). This is an 81-item instrument that uses a seven-point Likert scale, and it is designed for measuring higher education students' motivational orientations and how they decide, manage, and apply learning strategies to their learning. It is used to assess intrinsic and extrinsic goal orientation (Duncan & McKeachie, 2005). In addition, it comprises several scales and measures of students' motivational beliefs as well as some factors in SRL from a socio-cognitive perspective, such as cognitive, metacognitive, motivational, and behavioral factors (Wolters, 2010).

3.2.4 GSS (GSS-H)

Jerusalem and Schwarzer (1992) developed the English version of the General Self-Efficacy (GSS) scale, which consists of 10 items rated on a four-point rating scale. Sud (2002) further translated it into a Hindi version (GSS-H). This scale ranged from 10 to 40, with high scores indicating the high self-efficacy of the person and vice versa. The reliability coefficient of this scale was found to range from 0.76 to 0.90, whereas the validity of this scale is well established.

3.2.5 SRM

The Self-regulation of Motivation (SRM) model (Sansone & Thoman, 2005) suggests that the terms 'motivated' or 'unmotivated' may not be clear for describing or separating students. They may also be goal defined or experience defined. This model focuses on motivation and performance outcomes with students' actions in the online learning environment (Sansone et al., 2011).

3.2.6 SRLIS

The Self-Regulated Learning Interview Scale (SRLIS) is used for measuring SRL as a metacognitive, motivational, and behavioral construct (Zimmerman, 2008). During the interview, six problem contexts were present for students. Students' responses were transcribed and coded into 14 self-regulatory categories. Students also rated their use of strategy from 'seldom' to 'most of the time' (four-point scale).

3.2.7 SRL-SRS

Toering et al. (2012) developed the Self-Regulation of Learning Self-Report Scale (SRL-SRS) based on Zimmerman's SRL theory. This self-report contains six factors in SRL, which are planning, self-monitoring, evaluation, reflection, effort, and self-efficacy. Their study showed that the SRL-SRS is a reliable instrument.

3.2.8 SRSI-TRS

The Self-Regulation Strategy Inventory – Teacher Rating Scale (SRSI-TRS) is a 13-item teacher rating scale. It is specially designed for measuring students' motivation and regulatory behavior in the classroom. Factors include help-seeking behaviors, self-monitoring, and self-motivation tactics (Cleary & Callan, 2014).

3.2.9 Selection of Instrument for This Study

According to the aim of this research study, we wished to understand the impacts, support, and barriers for students' SRL with the development of e-portfolios. Students should engage in detailed planning before developing e-portfolios because the e-portfolio system is an online platform for users to store, organize, and upload materials. Therefore, they may create their own references to showcase their professional capabilities and learning outcomes. Students also need to monitor their portfolios, make an effort for each task, solve problems, make adjustments, reflect on what they have done, and react appropriately after completing each task with the e-portfolio.

On the other hand, from the literature and theoretical framework came Zimmerman's (2000) cyclical model of self-regulation and Pintrich's (2004) social cognitive perspective of SRL, including planning, monitoring, effort, reaction, and reflection, which are some of the core factors of SRL. The procedure of the cyclical model and social cognitive perspective of SRL seems successfully applied to the process of developing e-portfolios. For instance, students may plan before develop their e-portfolios, they may monitor their work and pay effort for every task, they may also reflect on their work and plan again for the next development of

their e-portfolios. After considering different measuring instruments for SRL, we decided to select the SRL-SRS, which covers more factors of SRL compared with the theoretical framework. The factors are highly related to the procedures of the development of e-portfolios.

Table 4

Summary of instruments for measuring SRL

Instruments	Factor(s) of SRL
AMI	Motivation
LASSI	Metacognition, Motivation, and Behavior
MSLQ	Learning strategies and Motivation
GSS (GSS-H)	Self-efficacy
SRM	Motivation
SRLIS	Metacognitive, Motivational, and Behavioral
SRL-SRS	Planning, Self-monitoring, Evaluation, Reflection, Effort, and Self-efficacy
SRSI-TRS	Motivation and Regulatory behavior

3.3 Mixed Method

Mixed methods research focuses on collecting and analyzing data from both quantitative research (for example, by using questionnaires) and qualitative research (for example, by using interviews) within one research study. Researchers stated that combining quantitative and qualitative research yields more findings, more outcomes, and the advantages of providing better and clear answers to the research questions (Bergman, 2008), with the aim of

providing the maximum benefit of the study. It is widely used in different disciplines for better understanding their complexities and associated mixed experiences (Paull & Girardi, 2017). All methods have their own advantages and disadvantages. Therefore, results from the two methods may provide the opportunity to compensate for each method's weaknesses. For instance, researchers argued that the disadvantages of relying only on the findings from using self-report questionnaires in one research study might cause potential problems due to biased responses and inaccuracies (Cleary & Kitsantas, 2017). However, qualitative research may potentially provide an in-depth understanding of the study topic, highlighting human behavior, providing reasons for it, and detailing the why and how of the associated decision-making. Using multiple sources of data from a number of perspectives provides the opportunity for achieving a better understanding through triangulation (Saks & Allsop, 2007).

3.4 Rasch Model

Rasch Analysis is a method for obtaining objective, fundamental, additive measures from stochastic observations of ordered category responses (Linacre, 2012). It is a latent trait model for converting ordinal scales (for example, rankings) to interval scales (for example, temperatures). Therefore, these data can be measured and compared based on a meaningful distance (Rasch, 1993). For instance, the seven scales used in the MSLQ range from 'not at all true of me' to 'very true of me'. Each scale may not be clearly defined, and it may not be accurately confirmed that equal distance is applied between the scales. By using the Rasch model, a person's ability and item difficulty can be measured, although the raw data from questionnaires may not be easily measured.

'Winsteps is a Windows-based software, which assists many applications of the Rasch model; particularly in the areas of educational testing, attitude surveys and rating scale analysis' (Linacre, 2012).

3.5 Research Design

Turner (1995) found that 'self-report questionnaires are the most frequently used protocols for measuring SRL'. These measuring tools help with collecting information about students' memories and interpretations through actions. On the other hand, we can understand students' explanations of cognitive and metacognitive processes from the findings.

Zimmerman (2008) advised that researchers have been attracted to 'the topic of how students become self-regulated learners for decades'. Different kinds of studies have been conducted in an attempt to measure SRL, whether it is a significant predictor of students' academic outcomes, by using questionnaires and interviews. However, the self-report measures have been shown to be inaccurate and untrustworthy in some of the research on SRL, including applications to digital literacy. Therefore, researchers do not agree on relying on quantitative research, such as using a questionnaire in a research study (Winne & Jamieson-Noel, 2002; Cleary & Kitsantas, 2017).

Based on the above findings, this research study involved adopting a quantitatively driven mixed methods design: the pilot study and the main study included phase I and phase II. Although phase I was composed of a pre- and post-quantitative study using questionnaires, phase II was a qualitative study that involved conducting interviews with students. Both qualitative and quantitative data were collected so as to compensate for each method's

weaknesses.

Based on the research questions, we decided to use a recently developed reliable measuring instrument covering six core factors of SRL. The SRL-SRS was used for the pre- and post-quantitative study. Fifty items of the SRL-SRS were transformed to a self-reported questionnaire after reasonable amendments with the actual practice with e-portfolios. The comments and findings from the pilot study, discussion with experts in the area, and the results and suggestions from Toering and colleagues (2012) provided supporting information for the further amendment of the questionnaire. The same final questionnaire was given to all participants in semester 1 and semester 2.

Pre-set interview questions were prepared based on the SRL-SRS, Pintrich's (2004) social cognitive perspective of the SRL framework, and also characteristics of the actual practice in developing the e-portfolios. For instance, the SRL-SRS only asks whether students keep working when facing difficulties, but it does not ask for the reasons. This gap could be fulfilled during the study, with the reasons investigated from students' responses during the private interviews. On the other hand, the pre-set interview questions may also highlight some more factors existing beyond the six core factors of SRL in the SRL-SRS. During the private interviews, additional questions in response to participants' individual comments and behaviors were designed, which enabled students to further elaborate and give more detailed information. All of these invaluable qualitative data could help to close the gap of the quantitative data findings.

3.5.1   Phase I of the Study – A Pre- and Post-Quantitative Study – Questionnaire)

In phase I of this research study, all participants were invited to complete a self-report questionnaire individually at two different times within two consecutive semesters. The Rasch model helps with transforming all ordinal data into interval data. Moreover, it helps with measuring the item difficulties. Therefore, results for all items are reliable and can be ascertained for further analysis. The measuring result from the Rasch model was analyzed by using SPSS 21. This study's aim was to investigate each factor of SRL without interaction with other factors. Both findings included the paired sample t-test and the one-within-one-between subject analysis of variance (ANOVA) covering the six factors of SRL: planning, self-monitoring, evaluation, reflection, effort, and self-efficacy. It may reflect the changes of each element of SRL independently when students are developing their e-portfolios at different periods.

All data related to this research study will be kept strictly confidential and stored in a computer that is password protected. Three years after the completion of the research, the raw data will be destroyed and deleted.

3.5.2   Phase II of the Study – (A Qualitative Study – Interview)

The measuring results from the Rasch model help with obtaining the improvement figures from the pre- and post-questionnaire. These figures represented students' own thoughts or evaluations about their SRL during the process with the e-portfolios. All participants were divided into three levels – positive improvement, no or less improvement, and negative improvement. From each level, one female and one male student were invited for private

interviews for the qualitative study in phase II.

In phase II – the qualitative study, two participants (one female and one male) from each level of scores, a total of six participants (three female and three male) were invited for private interviews. Qualitative data could be received that provided a deeper understanding of the topic from students' perspectives.

All interview questions were pre-designed based on the SRL-SRS and Pintrich's (2000) social cognitive perspective of the SRL framework, relating to the process and experience of e-portfolios. The qualitative data were recorded in dialogue style, which presents clearly the thoughts, feelings, and comments of the respondents.

3.5.3   Population

According to the record from GEO, there was a total of 1,123 undergraduate year-one students in the 2014–15 academic year, 738 (65.7%) females and 385 (34.3%) males. Students came from Hong Kong, Mainland China, and overseas, covering 20 programmes at EdUHK.

Table 5
Summary of Population: 2014-15 undergraduate year-one students from 20 programmes at EdUHK

	Code	Programme Title	Number of student	Percent
1	A4B066	Bachelor of Social Science Education (Honours) (Greater China Studies) (Four-year Full-time)	82	7.3
2	A4B067	Bachelor of Arts (Honours) in Language Studies (Four-year Full-time)	46	4.1
3	A4B068	Bachelor of Arts (Honours) in Creative Arts and Culture (Four-year Full-time)	37	3.3
4	A4B069	Bachelor of Social Sciences (Honours) in Global and Environmental Studies (Four-year Full-time)	40	3.6
5	A4B070	Bachelor of Music in Education (Honours)	39	3.5

		(Contemporary Music and Performance Pedagogy) (Four-year Full-time)		
6	A4B071	Bachelor of Arts (Honours) in Liberal Studies Education (Four-year Full-time)	73	6.5
7	A4B072	Bachelor of Arts (Honours) in Education for Sustainability (Four-year Full-time)	42	3.7
8	A4B073	Bachelor of Science Education (Honours) (Sports Science) (Four-year Full-time)	46	4.1
9	A4B074	Bachelor of Science Education (Honours) (Science and Web Technology) (Four-year Full-time)	42	3.7
10	A4B075	Bachelor of Social Sciences (Honours) in Psychology (Four-year Full-time)	37	3.3
11	A4B076	Bachelor of Arts (Honours) in Human and Organizational Development (Four-year Full-time)	44	3.9
12	A5B057	Bachelor of Education (Honours) (Secondary) (Five-year Full-time)	23	2.0
13	A5B058	Bachelor of Education (Honours) (Primary) (Five-year Full-time)	144	12.8
14	A5B059	Bachelor of Education (Honours) (English Language) (Five-year Full-time)	111	9.9
15	A5B060	Bachelor of Education (Honours) (Chinese Language) (Five-year Full-time)	162	14.4
16	A5B061	Bachelor of Education (Honours) (Early Childhood Education) (Five-year Full-time)	27	2.4
17	A5B062	Bachelor of Education (Honours) (Physical Education) (Five-year Full-time)	32	2.8
18	A5B063	Bachelor of Education (Honours) (Visual Arts) (Five-year Full-time)	42	3.7
19	A5B064	Bachelor of Education (Honours) (Music) (Five-year Full-time)	41	3.7
20	A5B065	Bachelor of Education (Honours) (Liberal Studies) (Five-year Full-time)	13	1.2
Total			1123	100.0

To enhance students' motivation, understanding, and participation in discussions with classmates, GEO divided all students into different tutorial groups. Each tutorial group contained student from different programmes, different focus areas, and different subjects.

3.5.4   Sample and Sampling Techniques

The initial idea was to use the full population to be the full sample size. Unfortunately, we were told by the officer of GEO that this could place an additional burden on the GE lectures because participants in different projects may also request to arrange paper surveys during the GE lectures or online questionnaires to all students throughout the GE course. Following

discussion with the officer of GEO and other researchers, 10 tutorial groups were selected

and offered for this research study, which contained 262 students from 20 programmes at

EdUHK; 173 (66%) females and 89 (34%) males participated in this research study.

Table 6
Summary of 262 participants in this study from 20 programmes at EdUHK

	Code	Programme Title	Number of student	Percent
1	A4B066	Bachelor of Social Science Education (Honours) (Greater China Studies) (Four-year Full-time)	20	7.6
2	A4B067	Bachelor of Arts (Honours) in Language Studies (Four-year Full-time)	13	5.0
3	A4B068	Bachelor of Arts (Honours) in Creative Arts and Culture (Four-year Full-time)	10	3.8
4	A4B069	Bachelor of Social Sciences (Honours) in Global and Environmental Studies (Four-year Full-time)	12	4.6
5	A4B070	Bachelor of Music in Education (Honours) (Contemporary Music and Performance Pedagogy) (Four-year Full-time)	4	1.5
6	A4B071	Bachelor of Arts (Honours) in Liberal Studies Education (Four-year Full-time)	9	3.4
7	A4B072	Bachelor of Arts (Honours) in Education for Sustainability (Four-year Full-time)	8	3.1
8	A4B073	Bachelor of Science Education (Honours) (Sports Science) (Four-year Full-time)	9	3.4
9	A4B074	Bachelor of Science Education (Honours) (Science and Web Technology) (Four-year Full-time)	11	4.2
10	A4B075	Bachelor of Social Sciences (Honours) in Psychology (Four-year Full-time)	15	5.7
11	A4B076	Bachelor of Arts (Honours) in Human and Organizational Development (Four-year Full-time)	11	4.2
12	A5B057	Bachelor of Education (Honours) (Secondary) (Five-year Full-time)	6	2.3
13	A5B058	Bachelor of Education (Honours) (Primary) (Five-year Full-time)	42	16.0
14	A5B059	Bachelor of Education (Honours) (English Language) (Five-year Full-time)	18	6.9
15	A5B060	Bachelor of Education (Honours) (Chinese Language) (Five-year Full-time)	29	11.1
16	A5B061	Bachelor of Education (Honours) (Early Childhood Education) (Five-year Full-time)	9	3.4
17	A5B062	Bachelor of Education (Honours) (Physical Education) (Five-year Full-time)	9	3.4
18	A5B063	Bachelor of Education (Honours) (Visual Arts) (Five-year Full-time)	11	4.2
19	A5B064	Bachelor of Education (Honours) (Music) (Five-year Full-time)	13	5.0
20	A5B065	Bachelor of Education (Honours) (Liberal Studies) (Five-year Full-time)	3	1.1
Total			262	100.0

To check whether this sample number was appropriate before data collection, the statistical consultant suggested using the G*power 3.1 for the initial checking. The result indicated that the minimum sample size that can satisfy the ANOVA within-factor repeated measurement is 54 samples. We also considered the unexpected situation during actual data collection, actual attendance on the day of the data collection, the missing data in the completed questionnaires, etc. Finally, the 262 participants were confirmed as an acceptable sample size after further discussion with experts in the area. When the pre- and post-questionnaires were completed, the data could help with calculating the actual power.
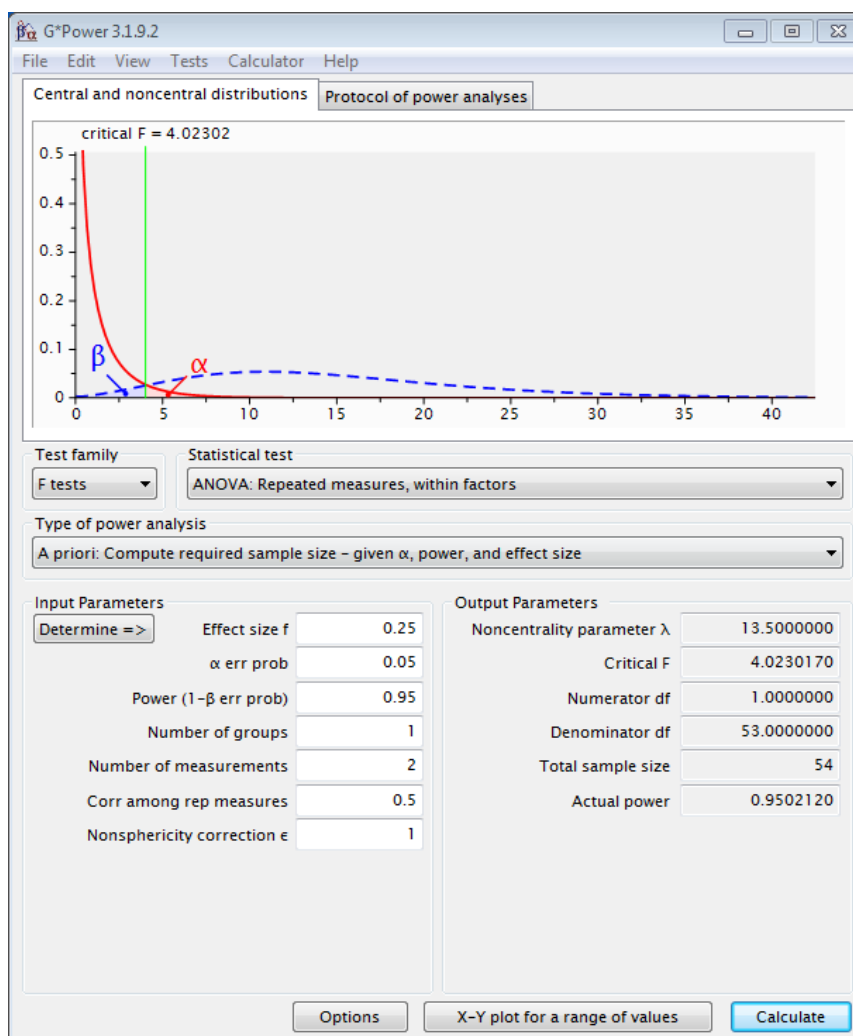
Figure 4   Result of G*power 3.1

3.6 The Quantitative Research

Among different measuring instruments for SRL, this research study's aim was to apply the updated version of the measuring instrument that had already been examined for reliability and validity, covering six core factors of SRL.

3.6.1 Self-Report Questionnaire

This research study's aim was to evaluate Hong Kong higher education students' SRL during their developing their e-portfolios by using a reliable instrument. Toering and colleagues (2012) reported that 'the Self-Regulation of Learning Self-Report Scale (SRL-SRS) is a reliable instrument, supporting its content and constructing validity'. It is a reliable instrument for measuring the self-regulation of learning. Their study contained 1,201 participants, aged 11 to 17 years. The validation confirmatory factor analysis (CFA) produced a good fit, and factor loadings were all statistically significant, therefore supporting the validity of the SRS. All Cronbach's coefficients were higher than the criterion of .70, indicating sufficient internal consistency. CFI and NNFI were higher than .90, and RMSEA was below .08, so these revealed that the SRL-SRS factor structure could be considered equal over time.

The SRL-SRS (Toering et al., 2012) contains 50 items under six factors of SRL, which are planning (nine items), self-monitoring (eight items), evaluation (eight items), reflection (five items), effort (10 items), and self-efficacy (10 items). The original SRL-SRS is presented in Appendix C with the findings from Toering and colleagues' (2012) reported.

Based on Pintrich's (2004) social cognitive perspective of the SRL framework, there are four phases of SRL: 1) planning, 2) monitoring, 3) control, and 4) reaction and reflection.

To avoid any influence of the reliability and validity resulting from Toering's (2012) report, some subscales of the SRL-SRS were combined and arranged under one phase of the framework. Effort and self-efficacy (two subscales) of the SRL-SRS were combined and placed under phase III – control. Evaluation and reflection (two subscales) of the SRL-SRS were combined and placed under phase IV – reaction and reflection.

Table 7
Pintrich's (2004) social cognitive perspective of SRL framework matches with the SRL-SRS

- Effort and self-efficacy (two subscales) of SRL-SRS were combined and placed under phase III – control.
- Evaluation and Reflection (two subscales) of SRL-SRS were combined and placed under phase IV – reaction and reflection.

Theoretical Framework
Planning
Monitoring
Control
Reaction and Reflection

SRL-SRS	Item Quantity
Planning	9
Self-monitoring	8
Evaluation	8
Reflection	5
Effort	10
Self-efficacy	10
Total	50

Toering (2012) mentioned that those 50 items in the original SRL-SRS were designed for general use. For different studies in different areas, Toering (2012) suggested that researchers should consider the wordings critically based on the actual situation within the study.

Therefore, some descriptions and wordings in each item required reasonable amendments to make sense with the actual practice and perception of e-portfolios. Throughout the framework design stage, experts in relevant areas gave professional advice for the amendment of the wordings.

3.6.2 Pilot Study

Although the reliability and validity of the SRL-SRS was already examined by Toering and colleagues (2012), some wordings in each item were revised based on the actual practice with the e-portfolios. Furthermore, the self-report questionnaire was designed in English, but all of the participants were local and mainland students with Chinese as the mother language. Therefore, comments from students who had experience with e-portfolios and no misunderstanding of the English content of the questionnaire were extremely important. The aim of the pilot study was to ascertain that these wordings, sentences, and meanings were clear to students, including the use of time and the understanding of the study as shown on the front page of the self-report questionnaire.

The pilot study was arranged after the discussion with experts based on the amended version of the SRL-SRS and before data collection from the samples. Finally, seven undergraduate year-two students' voluntary attended. They took around 12 minutes to complete the SRL-SRS individually without interaction with others in a private room. After the completion, they gave valuable comments and also discussed together the amendment of the wordings, the descriptions, and the whole questionnaire.

Table 8
Finding of pilot study

SRL-SRS Item No.	Comments from students
31	Verb – 'bind'; may easily lead reader to a wrong thinking direction
32	Terms – 'remain calm'; may not really happen in the practice of e-portfolios
8 & 9	Repeating question
11 & 13	These two questions create confusion with each other.
15, 28, 29	Confused question
38 to 45, 12 to 16	Similar meaning but using different descriptions

Based on the findings from the pilot study, Toering's (2012) report, and discussions with experts, further amendment was arranged accordingly. Some wordings and sequences were changed, whereas the original item numbers of 3, 10, 14, and 42 were deleted due to the low rating of factor loadings and explained variance (R^2). The final version of the self-report paper questionnaire was developed by transforming from the SRL-SRS (Toering el at., 2012), which included six factors of SRL: planning, self-monitoring, effort, self-efficacy, evaluation, and reflection. These six factors of SRL directly pointed to Pintrich's (2004) social cognitive perspective of SRL framework. This newly developed SRL-SRS was specially designed for measuring students' SRL in relation to their experiences and perceptions of e-portfolios only. The final version of the questionnaire is presented in Appendix D.

Table 9

Final version of questionnaire matches with Pintrich's (2004) social cognitive perspective of SRL framework

Theoretical Framework	SRL-SRS	Item Qty.	Item No.
Planning	Planning	8	1 to 8
Monitoring	Self-monitoring	6	9 to 14
	Evaluation	8	34 to 41
Control	Reflection	5	42 to 46
	Effort	10	15 to 24
Reaction and Reflection	Self-efficacy	9	25 to 33
	Total	46	

The developed SRL-SRS is a five-point Likert scale self-report paper questionnaire (see Appendix C). '1=Never to 5=Always' for planning, self-monitoring, effort, self-efficacy, evaluation; and '1=Strongly disagree to 5=Strongly agree' for reflection.

The same self-report paper questionnaire was distributed to the same group of 262 undergraduate year-one students in semester 1 and semester 2, yielding a response rate of 61.5% and 65.6% for the pretest and posttest respectively. In the data filtering, we kept those questionnaires from only students who had completed both the pretest and posttest questionnaires with no more than one missing data entry. Data from 134 valid pretest and posttest questionnaires, including 46 items of SRL, were finally used for data analysis.

3.6.3   Data Collection and Filtering

In the beginning of semester 1, the final versions of the questionnaires were distributed to 10 tutorial groups in class, and a total of 161 valid questionnaires were received. Again, the same

questionnaire was distributed to these 10 tutorial groups by the end of semester 2, and a total of 172 valid questionnaires were received. After filtering, 134 students completed both questionnaires, which were distributed and collected in the two semesters respectively. These data helped with investigating the difference of student's SRL during the process of working with the e-portfolios in the two consecutive semesters.

Table 10
Summary of 134 students from 19 programmes at EdUHK

	Code	Programme Title	Number of student	Percent
1	A4B066	Bachelor of Social Science Education (Honours) (Greater China Studies) (Four-year Full-time)	15	11.2
2	A4B067	Bachelor of Arts (Honours) in Language Studies (Four-year Full-time)	9	6.7
3	A4B068	Bachelor of Arts (Honours) in Creative Arts and Culture (Four-year Full-time)	4	3.0
4	A4B069	Bachelor of Social Sciences (Honours) in Global and Environmental Studies (Four-year Full-time)	1	0.7
5	A4B071	Bachelor of Arts (Honours) in Liberal Studies Education (Four-year Full-time)	3	2.2
6	A4B072	Bachelor of Arts (Honours) in Education for Sustainability (Four-year Full-time)	2	1.5
7	A4B073	Bachelor of Science Education (Honours) (Sports Science) (Four-year Full-time)	6	4.5
8	A4B074	Bachelor of Science Education (Honours) (Science and Web Technology) (Four-year Full-time)	3	2.2
9	A4B075	Bachelor of Social Sciences (Honours) in Psychology (Four-year Full-time)	12	9.0
10	A4B076	Bachelor of Arts (Honours) in Human and Organizational Development (Four-year Full-time)	1	0.7
11	A5B057	Bachelor of Education (Honours) (Secondary) (Five-year Full-time)	5	3.7
12	A5B058	Bachelor of Education (Honours) (Primary) (Five-year Full-time)	33	24.6
13	A5B059	Bachelor of Education (Honours) (English Language) (Five-year Full-time)	3	2.2
14	A5B060	Bachelor of Education (Honours) (Chinese Language) (Five-year Full-time)	7	5.2
15	A5B061	Bachelor of Education (Honours) (Early Childhood Education) (Five-year Full-time)	4	3.0
16	A5B062	Bachelor of Education (Honours) (Physical Education) (Five-year Full-time)	6	4.5
17	A5B063	Bachelor of Education (Honours) (Visual Arts) (Five-year Full-time)	9	6.7
18	A5B064	Bachelor of Education (Honours) (Music) (Five-year Full-time)	10	7.5
19	A5B065	Bachelor of Education (Honours) (Liberal Studies) (Five-year Full-time)	1	0.7
Total			134	100.0

Valid data were collected from 134 participants from 19 programmes at EdUHK, representing 84 (62.7%) females and 50 (37.3%) males, and 113 (84.3%) local students and 21 (15.7%) mainland students, ages 16 to 23 (mean age: 18.83) during the pretest period. Originally, we were also interested in investigating if there were any differences in groups, such as gender, subject major, local, and mainland students. However, the sample size was limited in this research study. According to the details of the participants, the number of students in each programme and for each age may not have been enough for an appropriate analysis. On the other hand, the proportion of local students and mainland students (84.3% and 15.7%) in this research study may not have been suitable for comparison, either.

Gender
F
M

	Percent
Female	62.7
Male	37.3

Age
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0

Age	Percent
16	0.7
17	6.0
18	39.6
19	28.4
20	17.9
21	4.5
22	2.2
23	0.7

Nationality
Local
Mainland

	Percent
Local students	84.3
Mainland students	15.7
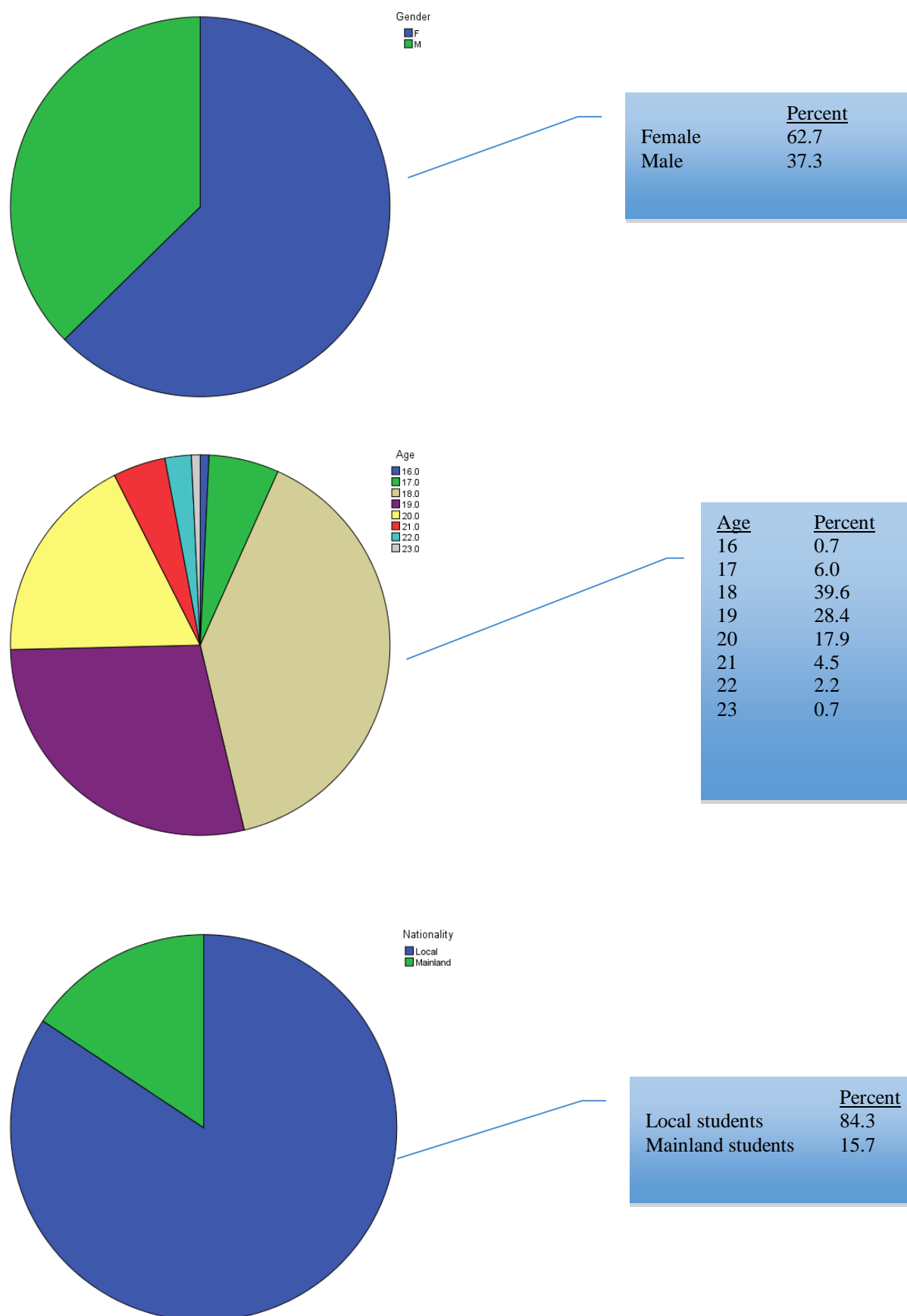
Figure 5   Percentage of Gender, Age, and Nationality

According to Liaw and Huang's (2015) study, the statistical result was that both female and male higher education students have highly positive perceptions according to online learning. In addition, the perceived self-regulation has a gender difference, where the personal attitudes and learning environments affect gender difference. Researchers believed that gender is one of the important variables in SRL (Bozpolat, 2016). Regarding the proportion of gender in this research study (*N*=134, 62.7% female and 37.3% male), it was close to the proportion of the population (*N*=1,123, 65.7% female and 34.3% male). Therefore, we decided to include the investigation of the gender differences in this research study, and we are looking forward to other investigations of other groups with larger samples in future studies.

3.6.4 Items Measured Using the Rasch Model

This research study used the Rasch model to convert ordinal-scale data to interval-scale data. It helped with examining and comparing the difficulty of each item in the questionnaire. By using the data from 134 valid questionnaires, Winsteps 3 helped to calculate the 'Item Statistics – Misfit'. Whole questionnaires with a total of 46 items were measured. The 'MEASURE' figure from the pre-questionnaires with the Andrich Threshold result (1 0, 2 -3.04, 3 -1.45, 4 .76, 5 3.72) became an anchor for measuring the data from the post-questionnaires. All items were within 0.5 and 1.5 acceptable ranges; therefore, all 46 items were kept for further data analyzing.

Table 11
Finding of 'Item Statistics – Misfit' (46 items)

	Item	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
1	I determine how to complete each task of my e-portfolio before I begin.	-.01	.14	1.10	.8	1.18	1.4
2	I think through in my mind	-.01	.14	.90	-.8	.94	-.5

	the steps of developing my e-portfolio that I have to follow.						
3	I ask myself questions about what difficult task requires me to complete when developing my e-portfolio, before I start.	.22	.13	1.01	.1	1.11	.9
4	I imagine what difficulties I may encounter during developing my e-portfolio.	.41	.13	1.16	1.3	1.14	1.1
5	I carefully plan my course of action to develop my e-portfolio.	.25	.13	.80	-1.7	.81	-1.6
6	I figure out the goals of my e-portfolio and what I need to accomplish.	.25	.13	.71	-.2.6	.70	-2.6
7	I clearly plan my course of action to develop my e-portfolio.	.58	.13	.70	-2.7	.71	-2.6
8	I work out a plan for developing my e-portfolio.	1.09	.13	1.07	.6	1.08	.7
9	I check my work while developing my e-portfolio.	-.48	.14	.87	-1.1	.87	-1.1
10	I check how well I am doing upon completion of all tasks of my e-portfolio.	-.12	.14	.58	-4.0	.59	-3.8
11	While developing my e-portfolio, I ask myself how well I am doing on each task.	.08	.13	.62	-3.5	.61	-3.6
12	I correct errors of my e-portfolio.	-.33	.14	.94	-.5	.94	-.5
13	I check my accuracy as I progress through my e-portfolio.	-.12	.14	.56	-4.2	.56	-4.3
14	I judge the correctness of my e-portfolio.	-.20	.14	.72	-2.5	.72	-2.5
15	I keep working even on difficult tasks of my e-portfolio.	-.35	.14	.93	-.5	.94	-.4
16	I put forth my best effort when developing my e-portfolio.	-.55	.14	8.6	-1.1	.84	-1.4
17	I concentrate fully when I do each task of my e-portfolio.	-.21	.14	.82	-1.5	.80	-1.7
18	I don't give up even if the task of my e-portfolio is hard.	-.62	.14	1.08	.7	1.07	.6
19	I work hard on a task of my e-portfolio even if it is not important.	.12	.13	.88	-.9	.90	-.8
20	I work as hard as possible on all tasks of my e-portfolio.	-.60	.14	.79	-1.8	.79	-1.8
21	I work hard to do well even if I don't like a task of my e-portfolio.	-.01	.14	.94	-.5	.92	-.7
22	If I'm not really good at a	-.20	.14	.74	-2.3	.73	-2.4

	task of my e-portfolio, I can compensate for this by working hard.						
23	I am willing to do extra work on tasks of my e-portfolio in order to learn more.	1.07	.13	1.26	2.1	1.25	1.9
24	If I persist on each task of my e-portfolio, I'll eventually succeed.	.30	.13	.71	-2.5	.71	-2.5
25	I know how to handle unforeseen situations when developing my e-portfolio, because I can think of strategies to cope with things that are new to me.	.53	.13	.90	-.8	.89	-.9
26	I am confident that I can deal efficiently with unexpected events when developing my e-portfolio.	.35	.13	.70	-2.7	.69	-2.8
27	If I tied up when developing my e-portfolio, I can think of something to do.	.21	.13	.67	-3.0	.69	-2.8
28	I remain calm when facing difficulties during developing my e-portfolio, because I know many ways to cope with difficulties.	.07	.13	.74	-2.3	.75	-2.2
29	I manage to complete difficult tasks in my e-portfolio if I try hard enough.	-.01	.14	.58	-3.9	.58	-4.0
30	It is easy for me to concentrate on the goals of my e-portfolio and to accomplish them.	.34	.13	.72	-2.5	.71	-2.5
31	I can complete most difficult tasks of my e-portfolio if I invest sufficient effort.	.36	.13	.84	-1.3	.85	-1.2
32	When I am confronted with a difficult task of my e-portfolio, I find several solutions.	.42	.13	.56	-4.2	.56	-4.2
33	No matter what comes my way during developing my e-portfolio, I'm able to handle it.	.25	.13	.81	-1.6	.84	-1.3
34	I look back what I did to my e-portfolio and check if everything was right.	-.31	.14	1.21	1.6	1.24	1.9
35	I double-check to make sure I did my e-portfolio right.	-.56	.14	1.34	2.5	1.34	2.5
36	I check to see if my expectations for my e-portfolio are correct.	-.31	.14	.86	-1.1	.84	-1.3
37	I look back to see if I did	-.35	.14	.95	-.3	.92	-.6

	the correct procedures of my e-portfolio.						
38	I check my work all the way through each task when developing my e-portfolio.	-.23	.14	.84	-1.3	.82	-1.5
39	I look back at each task of my e-portfolio to see if my action makes sense.	-.27	.14	.75	-2.1	.76	-2.1
40	I stop and re-think each step I have already done for my e-portfolio.	.12	.13	1.03	.3	1.06	.6
41	I make sure that I have completed all procedures for my e-portfolio.	-.44	.14	.79	-1.8	.77	-2.0
42	I evaluate the experiences of my e-portfolio so I can learn from each task.	-.10	.14	.58	-4.0	.57	-4.1
43	I assess my strengths and weaknesses when developing my e-portfolio.	.10	.13	.84	-1.3	.79	-1.8
44	I think about how the actions of developing my e-portfolio can be improved.	-.05	.14	.86	-1.2	.84	-1.3
45	I use my past experiences to generate new ideas in completing my e-portfolio to achieve better results.	-.33	.14	.74	-2.2	.75	-2.2
46	I explore how I can develop my e-portfolio in better ways next time.	-.35	.14	.97	-.2	.95	-.4

In fact, this questionnaire contained six factors of SRL: planning, self-monitoring, effort, self-efficacy, evaluation, and reflection. We assumed each factor to be without interaction and correlation with one another in this research study. A total of 46 items were divided into six parts, and we calculated the 'Item Statistics – Misfit' respectively without any influence from other items' difficulties.

The final results showed good model-data fit (item infit and outfit MNSQ ranged from .5 to 1.5) for five factors of SRL: planning, self-monitoring, self-efficacy, evaluation, and reflection. Only item 13, effort, showed .45 (infit) and .47 (outfit), which are still close to the range of good model-data fit. After discussing this with the expert, we also kept this item for further analysis.

Table 12
Finding of 'Item Statistics – Misfit' (divided into six parts)

Item		MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
	A. Planning						
1	I determine how to complete each task of my e-portfolio before I begin.	-.47	.15	.89	-.9	.94	-.5
2	I think through in my mind the steps of developing my e-portfolio that I have to follow.	-.47	.15	.68	-2.9	.68	-2.8
3	I ask myself questions about what difficult task requires me to complete when developing my e-portfolio, before I start.	-.16	.15	.77	-2.0	.80	-1.7
4	I imagine what difficulties I may encounter during developing my e-portfolio.	.08	.15	.90	-.8	.91	-.7
5	I carefully plan my course of action to develop my e-portfolio.	-.13	.15	.70	-2.7	.70	-2.6
6	I figure out the goals of my e-portfolio and what I need to accomplish.	-.13	.15	.86	-1.1	.90	-.8
7	I clearly plan my course of action to develop my e-portfolio.	.30	.15	.64	-3.4	.64	-3.2
8	I work out a plan for developing my e-portfolio.	.96	.15	1.09	.8	1.12	1.0
	B. Self-monitoring						
9	I check my work while developing my e-portfolio.	-.37	.16	.74	-2.2	.73	-2.2
10	I check how well I am doing upon completion of all tasks of my e-portfolio.	-.10	.15	.55	-4.2	.60	-3.6
11	While developing my e-portfolio, I ask myself how well I am doing on each task.	.35	.15	.76	-2.0	.77	-1.9
12	I correct errors of my e-portfolio.	-.17	.15	.79	-1.8	.82	-1.5
13	I check my accuracy as I progress through my e-portfolio.	.10	.15	.45	-5.4	.47	-5.1
14	I judge the correctness of my e-portfolio.	.00	.15	.66	-3.0	.64	-3.1
	C. Effort						
15	I keep working even on difficult tasks of my e-portfolio.	-.31	.15	1.02	.2	1.05	.4
16	I put forth my best effort when developing my	-.56	.16	.92	-.6	.92	-.6

	e-portfolio.						
17	I concentrate fully when I do each task of my e-portfolio.	-.14	.15	.76	-2.0	.75	-2.1
18	I don't give up even if the task of my e-portfolio is hard.	-.65	.16	1.09	.8	1.09	.8
19	I work hard on a task of my e-portfolio even if it is not important.	.28	.15	.87	-1.0	.87	-1.0
20	I work as hard as possible on all tasks of my e-portfolio.	-.62	.16	.72	-2.5	.70	-2.7
21	I work hard to do well even if I don't like a task of my e-portfolio.	.12	.15	.94	-.5	.94	-.4
22	If I'm not really good at a task of my e-portfolio, I can compensate for this by working hard.	-.12	.15	.84	-1.3	.82	-1.5
23	I am willing to do extra work on tasks of my e-portfolio in order to learn more.	1.48	.15	1.48	3.5	1.50	3.3
24	If I persist on each task of my e-portfolio, I'll eventually succeed.	.51	.15	.79	-1.8	.77	-1.9
	D. Self-efficacy						
25	I know how to handle unforeseen situations when developing my e-portfolio, because I can think of strategies to cope with things that are new to me.	.44	.18	1.30	2.1	1.25	1.7
26	I am confident that I can deal efficiently with unexpected events when developing my e-portfolio.	.13	.18	1.00	.1	.97	-.2
27	If I tied up when developing my e-portfolio, I can think of something to do.	-.12	.18	.85	-1.1	.81	-1.3
28	I remain calm when facing difficulties during developing my e-portfolio, because I know many ways to cope with difficulties.	-.36	.18	.99	.0	.96	-.3
29	I manage to complete difficult tasks in my e-portfolio if I try hard enough.	-.49	.18	.83	-1.3	.81	-1.4
30	It is easy for me to concentrate on the goals of my e-portfolio and to accomplish them.	.10	.18	.87	-.9	.86	-1.0
31	I can complete most difficult tasks of my	.11	.18	1.18	1.3	1.18	1.2

#	Item						
	e-portfolio if I invest sufficient effort.						
32	When I am confronted with a difficult task of my e-portfolio, I find several solutions.	.25	.18	.59	-3.4	.57	-3.5
33	No matter what comes my way during developing my e-portfolio, I'm able to handle it.	-.06	.18	.98	-.1	1.01	.2
	E. Evaluation						
34	I look back what I did to my e-portfolio and check if everything was right.	-.02	.16	.82	-1.5	.82	-1.5
35	I double-check to make sure I did my e-portfolio right.	-.34	.16	.93	-.5	.90	-.7
36	I check to see if my expectations for my e-portfolio are correct.	-.02	.16	.63	-3.4	.61	-3.5
37	I look back to see if I did the correct procedures of my e-portfolio.	-.07	.16	.68	-2.8	.67	-2.9
38	I check my work all the way through each task when developing my e-portfolio.	.08	.16	.68	-2.8	.68	-2.8
39	I look back at each task of my e-portfolio, to see if my action makes sense.	.03	.16	.58	-4.0	.59	-3.7
40	I stop and re-think each step I have already done to my e-portfolio.	.55	.16	1.01	.1	1.03	.2
41	I make sure I have completed all procedures of my e-portfolio.	-.20	.16	.73	-2.3	.73	-2.3
	F. Reflection						
42	I evaluate the experiences of my e-portfolio so that I can learn from each task.	.08	.19	.69	-2.4	.58	-3.0
43	I assess my strengths and weaknesses when developing my e-portfolio.	.45	.19	.75	-1.9	.68	-2.3
44	I think about how the actions of developing my e-portfolio can be improved.	.18	.19	.85	-1.0	.76	-1.6
45	I utilize my past experiences to generate new ideas in completing my e-portfolio to achieve better results.	-.34	.19	.89	-.8	.81	-1.2
46	I explore how I can develop my e-portfolio in better ways next time.	-.37	.19	.83	-1.2	.77	-1.6

3.7   The Qualitative Research

Researchers recommended the qualitative data could support the quantitative result; therefore, provide more in-depth implications and benefit to the study (Yukselturk & Bulut, 2009).

The developed measuring tool of the SRL-SRS is a five-point Likert scale self-report paper questionnaire. The self-evaluation from '1 to 5' reflects students' own thoughts about their SRL regarding the development of e-portfolios. It may not cover all of the feelings, reasons, comments, and experiences of the participants. Because self-report questionnaires can collect findings and data only with a quantitative design base, individual interviews are arranged to obtain quantitative data. The qualitative research positively helped with collecting further information that the 46 questions on the self-report questionnaires did not cover; for example, students' detailed comments, their suggestions, and their own thoughts may not have been able to be recorded with the self-report questionnaires. On the other hand, students' personal backgrounds, interests, and IT ability may also be relevant to this study. Simultaneously, its aim was to answer the research questions of this research study, which were mentioned in Chapter 1.

The interviews were arranged after students had completed the development of e-portfolios after two semesters. They may not have remembered the actual feeling and reason for completing their e-portfolios, especially in semester one. During the private interview, the interviewee's e-portfolio was displayed on a screen to jog the student's memory and also to support the understanding about the actual experience, difficulties, and output. It provides the clear experience of the student while he/ she was developing and handling the e-portfolio throughout the two semesters.

3.7.1   Interview Questions

To supplement the data obtained from the self-report questionnaires, individual interviews were used to improve the reliability and validity of the original measure from the SRL-SRS self-report questionnaires. For the quantitative findings may not include the users' thoughts and feelings according to the experiences and perceptions of the e-portfolios, researchers suggested that the use of qualitative or mixed-method approaches may gather greater and deeper understanding (Hsieh et al., 2015). A semi-structured interview was applied in this study. Some pre-set questions were designed based on the consideration with and within the theoretical framework. On the other hand, additional questions were asked in response to the participants' personalities, behaviors, and comments. Some questions or contents may have been changed based on different participants' results from their self-report questionnaires and responses during interviews. The pre-set interview questions are presented in Appendix E.

The interview questions were aimed at collecting detailed information that the SRL-SRS self-report questionnaires do not cover but that is possibly covered within Pintrich's (2004) social cognitive perspective of the SRL framework. The practices and the development of e-portfolios may also include the consideration of IT, language, and any other unexpected issues because it may work with different online systems, applications, IT technologies, skills, abilities, etc. Therefore, the pre-set interview questions were designed by walking through the whole process, and it was also considered that these issues may affect or touch all procedures in the development of an e-portfolio and not be limited to within the framework. We also wished to collect information that could benefit this research study, future research within the concerned area, and improve the university's e-portfolio projects in the future.

3.7.1.1 Interview Questions Not Limited within the Framework

The first part of pre-set interview questions was aimed at understanding students' IT abilities, interest, and behavior with computers, smartphones, online platforms, or any kinds of technology. We also wanted to gather information on students' knowledge, experience, and understanding of e-portfolios before they started higher education.

The end of the first part allowed interviewees to describe all of the procedures of the development by showing their completed e-portfolios and encouraged them to express their comments and suggestions to the university about this e-portfolio project.

3.7.1.2 Interview Questions within the Framework

The second part of the pre-set interview questions was created for understanding students' planning with the e-portfolios—for instance, what they do, what they think, and how and why they select and decide on receiving the information and requirements of e-portfolios. Moreover, their worries and expectations before kick-off, and why and how they overcome their worries and achieve their goals were addressed.

The third part of the pre-set interview questions was created for understanding students' self-monitoring with the e-portfolios—for understanding when, what, how they check the task, and why they have or have not taken action.

The fourth part of the pre-set interview questions was created for understanding students' effort and self-efficacy with the e-portfolios. Interviewees were encouraged to list their

difficulties during the whole process of development. Furthermore, the hope was to understand how they solve problems, what skills help, whether they are able to seek external support, and whether they will increase or decrease such efforts thereafter.

The last part of the pre-set interview questions was created for understanding students' evaluation and reflection with the e-portfolios. We aimed to understand students' thoughts on their outcomes and experiences with the e-portfolios, and what and how they will change as a result.

Based on the actual practice of the development of e-portfolios, some factors could be covered and extended from the core factors of SRL. For instance, when students are developing the e-portfolios, the control phase may also include students' ability with the e-portfolio system and online platform. It is because all e-portfolios should be developed through the e-portfolio system and completed with digital literacy. Moreover, the resources and information are stored online. Therefore, students' abilities, interests, problem-solving power using computers, perceived difficulties using online platforms, e-portfolio system, etc., needed to also be considered.

Each question allowed participants to express their own comments and feelings regarding their experiences during the whole process of constructing their e-portfolios. They were welcome to add any explanations wherever appropriate. Moreover, their SRL attitudes were applied to other courses, and year-two research will also be valuable to educators and researchers for further study. It is straightforward to understand how students' SRL support them in constructing their e-portfolios and also that there are barriers preventing them from accomplishing the task during the process.

3.7.2   Coding Method for Qualitative Data

All of the pre-set interview questions were shown on paper during the private interview. Because all participants were local students, interviews were conducted in Cantonese; therefore, they could express their feelings and comments clearly, with the aim being to develop better communication and understanding. Questions and responses in Cantonese were recorded in audio format. The link to interviewees' e-portfolios was recorded with students' personal data and saved on a computer for this study only and kept strictly confidential.

The coding method used in this study was a bottom-up generalized method for descriptive purposes. All raw data were refined to arrive at different categories, themes, and theories by using a computer (Hahn, 2008).
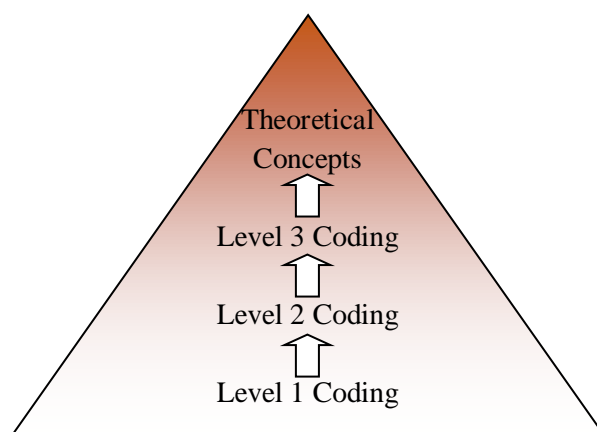
Figure 6 Bottom-up generalized method for descriptive purposes (Hahn, 2008)

Hahn (2008) introduced a bottom-up generalized method which based on the concept of gold miner. The first stage is the initial coding or open coding for the large quantities of raw qualitative data that received from participants. The second stage is to refine the data, which called focused coding or category development. The third stage is focusing the

progressive convergence of ideas in which to refine data to be used for reporting, called Axial or Thematic coding. The final stage is to organize the data from third stage by categories and themes based on literatures for not only relay on author's personal expectation.

In this study, we were using the bottom-up generalized method (Hahn, 2008). First of all, both questions and responses from audio files were translated to English transcript texts and recorded in a Microsoft Word file. An English expert helped to proofread the transcript text with all of the supported records from audio, paper, and online (students' e-portfolios) documents. Some responses needed further reconfirm or clarification from the interviewees.

The second step was refined all raw data to be focused coding or category development by using Microsoft Excel file which allow sort, manipulate, and filter. All data have been placed in different columns using keywords representing the key components of the theoretical framework, which are Phase 1 (planning), Phase 2 (monitoring), Phase 3 (control), and Phase 4 (reaction and reflection), and also one more column for data that could not classified by using the framework.

The third step was extended and divided the data based on keywords or related to each factor within the framework. For instance, the column for Phase 3 (control) has been extended to some more columns, such as increase effort, decrease effort, problem solving, help seeking, and so on. When students during in the control stage – developing the e-portfolios independently, they may face to different kinds of difficulties, some students may be willing to try again, some students may ask for help and some students may decide to give up.

The final stage aimed to consolidate the categories into main themes. All main themes

connected with literatures in order to provide further interpretation of the findings. On the other hand, discussion with supervisors and peers with considering and thinking through the actual practice of e-portfolios, students' thought or course implementation were most appropriated for ensure all data have been categorized and analyzed correctly.

3.7.3 Sampling Method for Interviewees

The Rasch method was used to convert ordinal-scale data from 134 valid pre- and post-questionnaires to interval scales. Winsteps 3 helped with calculating a pair of pre– and post– 'MEASURE' SRL total values for each sample. By comparing the post-value with the pre-value, all samples were divided into six groups; there was positive improvement, no or less improvement, and negative improvement for female students and male students, respectively, for the period of experience and the perception of e-portfolios.

Table 13
Finding of 134 students' SRL improvement figure

No	Gender	Pre-total	Post-total	Improvement figure
112	F	3.35	8.83	5.48
105	F	-0.8	3.36	4.16
98	F	-2.94	-0.15	2.79
93	F	-0.05	2.14	2.19
37	F	-1.32	0.61	1.93
49	F	-0.39	1.45	1.84
111	F	1.82	3.43	1.61
78	F	1.76	3.22	1.46
54	F	-0.29	1.16	1.45
59	F	0.72	1.95	1.23
103	F	-0.05	0.88	0.93
128	F	-1.62	-0.76	0.86
19	F	0.25	1.04	0.79
84	F	1.33	2.07	0.74
2	F	-1.2	-0.48	0.72

47	F	-0.19	0.5	0.69
110	F	2.01	2.67	0.66
72	F	1.95	2.6	0.65
11	F	1.1	1.69	0.59
13	F	1.63	2.14	0.51
50	F	1.45	1.95	0.5
71	F	1.1	1.51	0.41
43	F	1.88	2.27	0.39
40	F	0.05	0.4	0.35
119	F	-0.19	0.15	0.34
17	F	-0.62	-0.34	0.28
102	F	2.74	3.01	0.27
30	F	2.01	2.27	0.26
9	F	-0.65	-0.39	0.26
45	F	-1.45	-1.24	0.21
75	F	0.93	0.99	0.06
95	F	2.27	2.27	0
124	F	2.6	2.6	0
104	F	0.77	0.71	-0.06
96	F	1.07	0.99	-0.08
29	F	0.3	0.2	-0.1
116	F	0.15	0.05	-0.1
64	F	1.82	1.68	-0.14
91	F	1.63	1.45	-0.18
52	F	0.72	0.5	-0.22
4	F	1.05	0.82	-0.23
7	F	-1.96	-2.22	-0.26
5	F	0.66	0.35	-0.31
121	F	-0.75	-1.07	-0.32
55	F	3.08	2.74	-0.34
41	F	0.07	-0.29	-0.36
115	F	1.05	0.66	-0.39
36	F	2.67	2.27	-0.4
22	F	-1.37	-1.78	-0.41
8	F	2.27	1.82	-0.45
129	F	0.93	0.45	-0.48
27	F	2.47	1.95	-0.52
14	F	1.1	0.56	-0.54
46	F	2.14	1.57	-0.57
26	F	1.63	1.04	-0.59
100	F	1.51	0.88	-0.63
44	F	0.51	-0.15	-0.66
117	F	0.35	-0.34	-0.69

56	F	2.07	1.33	-0.74
38	F	1.1	0.35	-0.75
85	F	1.76	0.99	-0.77
82	F	0.61	-0.2	-0.81
24	F	1.1	0.25	-0.85
51	F	0.56	-0.29	-0.85
12	F	0.25	-0.67	-0.92
63	F	1.82	0.77	-1.05
32	F	0.93	-0.2	-1.13
6	F	1.82	0.66	-1.16
53	F	0.1	-1.07	-1.17
76	F	-0.05	-1.24	-1.19
134	F	-0.29	-1.5	-1.21
10	F	2.2	0.93	-1.27
1	F	1.05	-0.25	-1.3
83	F	1.57	0.25	-1.32
20	F	1.39	0.05	-1.34
77	F	1.51	-0.2	-1.71
79	F	1.82	0.1	-1.72
73	F	1.39	-0.34	-1.73
133	F	2.07	0.3	-1.77
90	F	2.27	0.45	-1.82
3	F	4.35	2.4	-1.95
28	F	0.2	-1.96	-2.16
15	F	2.47	-0.15	-2.62
125	F	0.88	-2.48	-3.36
34	M	0.51	3.01	2.5
97	M	2.27	4.63	2.36
94	M	-0.48	1.82	2.3
127	M	-1.41	0.71	2.12
48	M	-0.84	1.1	1.94
80	M	0.51	2.27	1.76
126	M	-0.24	1.22	1.46
130	M	-2	-0.57	1.43
99	M	1.22	2.6	1.38
101	M	1.51	2.67	1.16
58	M	0.3	1.1	0.8
123	M	-0.8	-0.15	0.65
16	M	-0.19	0.45	0.64
109	M	1.18	1.75	0.57
107	M	2.07	2.6	0.53
42	M	1.76	2.27	0.51
106	M	-0.21	0.25	0.46

132	M	-0.34	0.1	0.44
122	M	-0.19	0.25	0.44
66	M	0.93	1.16	0.23
39	M	0.1	0.25	0.15
68	M	-0.1	-0.1	0
88	M	-0.29	-0.29	0
60	M	0.1	0	-0.1
21	M	-0.1	-0.25	-0.15
108	M	-1.02	-1.24	-0.22
61	M	-1.02	-1.41	-0.39
92	M	-0.66	-1.24	-0.58
89	M	0.35	-0.29	-0.64
57	M	-0.67	-1.33	-0.66
23	M	2.94	2.27	-0.67
74	M	0.4	-0.4	-0.8
86	M	0.05	-0.76	-0.81
35	M	1.05	0.15	-0.9
81	M	0.66	-0.25	-0.91
113	M	1.27	0.3	-0.97
87	M	-0.8	-1.83	-1.03
118	M	1.33	0.2	-1.13
18	M	0.05	-1.11	-1.16
31	M	0.51	-0.71	-1.22
120	M	0.99	-0.34	-1.33
114	M	1.1	-0.25	-1.35
67	M	1.63	0.22	-1.41
65	M	1.45	-0.1	-1.55
25	M	1.27	-0.62	-1.89
70	M	0.66	-1.67	-2.33
33	M	1.57	-0.94	-2.51
62	M	2.27	-0.29	-2.56
131	M	-1.58	-4.37	-2.79
69	M	1.27	-1.79	-3.06

There was a total of 84 female students with a mean score of -0.1320 and 50 male students with a mean score -0.1858. All female and male students were equally divided into three groups (positive improvement, no or less improvement, and negative improvement) respectively. As a result, each group included 28 female students and 16~17 male students.

Table 14
Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Improvement	F	84	-.1320	1.32556	.14463
	M	50	-.1858	1.39293	.19699

Students who had a mean score close to 0 and were included in the middle group did not have significant improvement following their experiences with and the development of their perceptions of e-portfolios. On the other hand, students in the group with a higher value had positive improvement, whereas students in the group with a lower value had an adverse impact.

In this research study, two students (one female and one male) from each group were randomly selected for individual interviews within the academic year of 2015/16. To avoid selecting an extreme case, students with the highest and lowest scores were not invited for interviews.
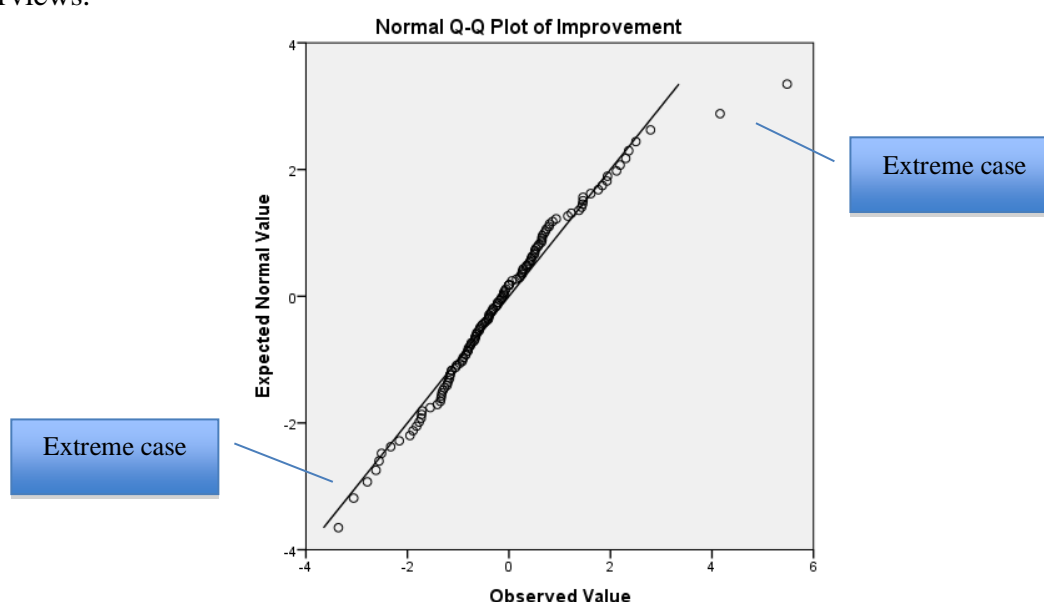
Figure 7 Normal Q-Q plot of improvement

A total of six students (three females and three males) were invited and agreed to participate in the study. Each student was given a code and report with an alias in the findings for the purpose of anonymity.

3.8 Ethics and Confidentiality

Before the whole study, the initial proposal with the full documents of the questionnaire, pre-set interview questions, and consent forms were submitted to the human research ethics committee (HREC), and proper approval for the ethical review of this research study was obtained.

The first page of the self-reported questionnaires was a consent form with a description of the study. Although some students were in the age group of 16–17 during the pre-test stage, all of them were higher education students with appropriate English reading skills, and the researcher also explained this research study clearly in Chinese. Therefore, all students were ensured to have a clear understanding of and have no doubt about the study before signing the consent form and getting involved in this research study.

Because students were required to submit their student numbers, some feared that their academic performance may be impacted by the research results. To minimize students' uncertainty, students were clearly told the use of the research results and the objective of this project. Their student number would be used only in data matching and a follow-up research arrangement. All data related to this research study would be kept strictly confidential and would be known only by the research team at EdUHK. Moreover, all data will be stored in a computer that is password protected. Three years after the completion of the research, all data

will be destroyed and deleted.

3.9   Chapter Summary

After the consideration of different measuring instruments for SRL, the SRL-SRS was used for the pre- and post-quantitative study, which covered six core factors of SRL: planning, self-monitoring, effort, self-efficacy, evaluation, and reflection. A 46-item, five-point Likert scale self-report paper questionnaire was finalized after reasonable amendment, a pilot study, discussion with experts, and a report and suggestions from Toering and colleagues (2012).

After data filtering, pre- and post-data from 134 sets of valid questionnaires were obtained for analysis by using the Rasch model, and SPSS provided quantitative findings. Six private individual interviews were conducted, where one female and one male student were randomly selected in each of three different level groups, providing qualitative findings from students' perspectives.
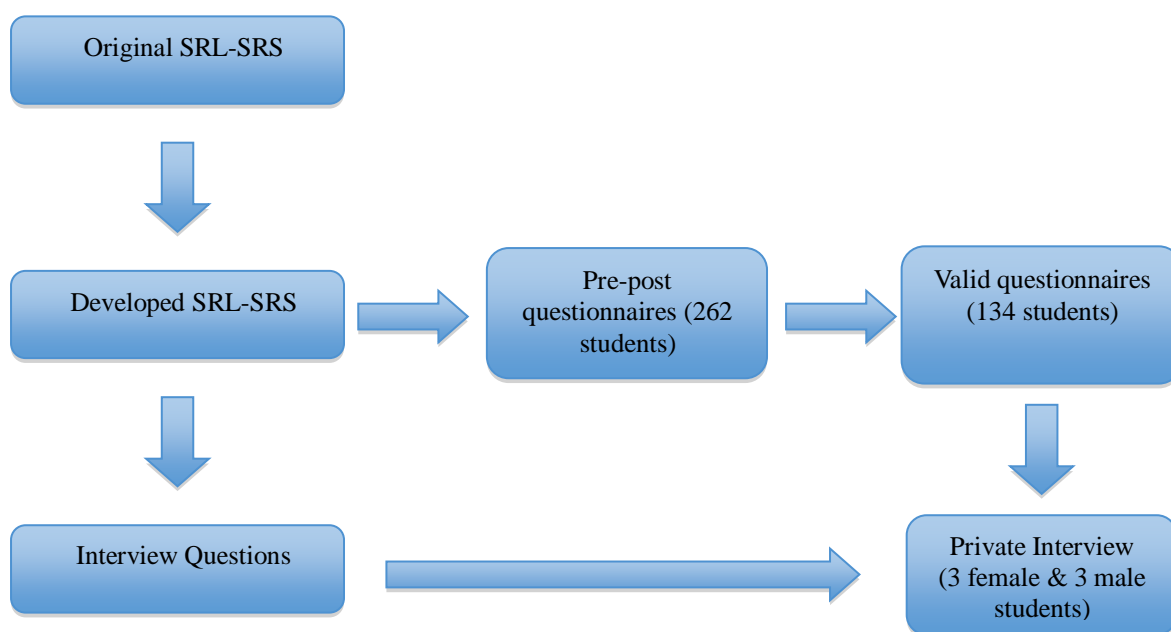
Figure 8 The process of data collection

CHAPTER 4

FINDINGS AND DISCUSSION

The first part of this chapter is an overview of the data collected for this research study, including both quantitative and qualitative data. The second part discusses the findings, which echo the four phases of Pintrich's (2004) social cognitive perspective on the SRL framework: Phase 1 (planning), Phase 2 (monitoring), Phase 3 (control), and Phase 4 (reaction and reflection). The effort and self-efficacy subscales of SRL-SRS have been combined and placed under Phase 3, and the evaluation and reflection subscales of SRL-SRS have been combined and placed under Phase 4. According to the design of SRL-SRS (Toering el at., 2012), the findings from SPSS 21 are separated into six factors of SRL and reported individually with the assumption that there is no interaction between them.

The preset interview questions for the private interviews were based on the gaps between SRL-SRS and actual practices with the e-portfolios. Qualitative findings from the six interviewees (three females and three males) will be discussed in relation to the four phases of Pintrich's (2004) social cognitive perspective of SRL framework.
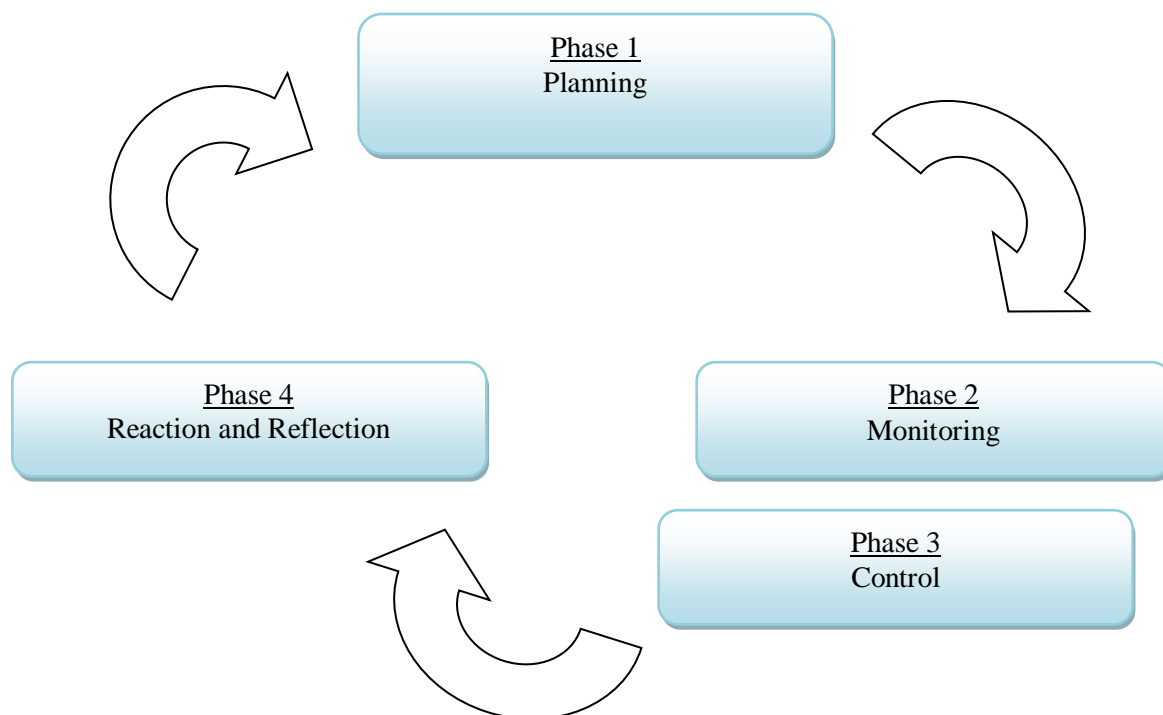
Figure 9 Cyclical movement of SRL (Pintrich, 2004; Zimmerman, 2000)

The aim of the third part is to highlight the pre-existing factors of both students and the university that may influence students' SRL with e-portfolios. Moreover, the other factors that influence students' SRL during the use of e-portfolios are also discussed.

In the second and third parts mentioned above, the quantitative and qualitative research methods helped make up for each other's weaknesses and filled the missing parts within the study. We targeted a wider, deeper, and better understanding by utilizing both types of findings and not limiting our study to rely on either particular one.

The final part is the summary of this chapter.

4.1 Summarization of the Data Collection and Analysis

After the literature review, the Self-Regulation of Learning Self-Report Scale (SRL-SRS) (Toering el at., 2012) was chosen as the measuring instrument for this research study. The pilot study, discussion with experts in the area, and findings and suggestions from Toering and colleagues helped in developing a self-report paper questionnaire with 46 items based on a 5-point Likert scale. This questionnaire, the SRL-SRS, was used for collecting the pre- and post- quantitative data. On the other hand, the interview questions that were used for collecting the qualitative data were designed based on the theoretical framework, students' actual practice with the e-portfolios, and the aim of supplementing the SRL-SRS's findings. Moreover, it is necessary and important to have a better understanding of students' direct comments, opinions, thoughts, and suggestions based on their two semesters of practice and experience with and perception of the e-portfolios. For instance, the data from SRL-SRS cannot explain students' reasons for giving up on improving their e-portfolios. However, through the interviews, we came to clearly understand the actual difficulties that students were facing and what drove them to make this decision.

Table 15
The final version of the questionnaire matched with Pintrich's (2004) social cognitive perspective of SRL framework

Theoretical Framework	SRL-SRS	Item Qty.	Item No.
Planning	Planning	8	1 to 8
	Self-monitoring	6	9 to 14
Monitoring	Evaluation	8	34 to 41
	Reflection	5	42 to 46
Control	Effort	10	15 to 24
	Self-efficacy	9	25 to 33
Reaction and Reflection	Total	46	

The same questionnaire was distributed to a total of 262 EdUHK undergraduate year 1 students in the first month of Semester 1 and at the end of Semester 2. After filtering, 134 sets of pre- and post- questionnaires were valid for the data analysis. The participants ($N = 134$, 62.7% female and 37.3% male) came from 19 programs and included both local and mainland students with a mean age of year 18.83.

All data collected from the SRL-SRS were ordinal. The Rasch model was used to convert all ordinal-scale data from the questionnaires to interval scales, as well as to examine and compare the difficulty of each item in the questionnaire. The final result showed good model–data fit (item infit and outfit MNSQ ranged from .5 to 1.5) for five factors of the SRL: planning, self-monitoring, self-efficacy, evaluation, and reflection. Only item 13 on the effort subscale showed .45 (infit) and .47 (outfit), which are still close to the range of good model–data fit. We decided to keep the item for further analysis (details shown in Chapter 3) after a discussion and recommendation from experts in the area. The measurement figures from the Rasch model were used for data analysis with SPSS 21. A paired sample t test was used to view the total of 134 participants, and a one-within-one-between-subject analysis of variance (ANOVA) was used to view the differences in gender.

The measurement figures generated from Rasch model were also used to determine the differences in values for each participant. The 134 participants were separated into three groups, positive improvement, no or less improvement, and negative improvement. Then, a total of six students (one female and one male were randomly selected from each group) were invited for a private interview. The in-depth responses from students helped us to develop a better understanding and to explain some of the findings from the quantitative data that are

not clearly covered by the SRL-SRS.

All of the responses from interviewees have been grouped under different categories, themes, and theories using a computer with a bottom-up coding method. Therefore, the qualitative findings provide a better understanding of the quantitative findings. For instance, the quantitative findings tell us students' planning improved after the perception of e-portfolios, and the qualitative findings tell us the reasons, including better understanding of and actual practice with the e-portfolios. However, we got different findings from the quantitative and qualitative data on reaction and reflection. In this case, we decided to directly report the findings even though they contradict each other, using the literature to provide a better understanding without relying on one side or the other. We trust that the findings may provide researchers and educators with insight for further studies.

4.2 The Impacts of E-Portfolios on Higher Education Students' SRL

Researchers have stated that learning motivation, Internet self-efficacy, and satisfaction with e-portfolios are positively correlated (Huang, Yang & Chang, 2011). The applications of e-portfolios can provide opportunity for giving effective feedback and reflection (Kecik et al., 2012). In this research study, we found that students' planning was improved after the perception of e-portfolios, and they even applied planning for other subjects in their year 2 studies. Students' value beliefs, the information about the course, and actual practices and reflection may successfully improve their motivation for planning. However, students' monitoring desire was decreased or unimproved because of their personal behavior, the design of the interface, the curriculum, and assessments. During the process of using e-portfolios, different students showed different levels of improvement in control because of

their levels of satisfaction. Moreover, peers' influences, students' personal behavior, IT capability, and interest are also relevant factors. For reaction and reflection, we obtained different results from the quantitative and qualitative data. The quantitative findings showed negative improvement, but the qualitative findings showed improvement in reaction and self-awareness. The overall SRL showed a decrease in the quantitative data. The one-within-one-between-subject ANOVA showed that female students have a higher SRL than male students on all subscales of SRL. This finding is in line with Bozpolat's (2016) research study, which reported that female students used more self-regulated learning strategies than male students.

On the other hand, some findings showed that the subscales of SRL may not move the same as Zimmerman's (2000) cyclical model of self-regulation. For example, after students sought help from teachers or peers, they may have planned again because of the information they received. Therefore, Phase 1 (planning) may also have been influenced and improved, and the impact may not necessarily have been limited to Phase 4 (reaction and reflection). Moreover, the e-portfolios and the online platform Mahara allowed students to amend their work and input many times before the submission deadline. This enabled student to practice continuous cyclical self-regulated behavior during the whole process of the e-portfolio assignment. Students could go back to the second and third phases (monitoring and control) after Phase 4 (reaction and reflection) as many times as they wanted to until the system was closed upon the submission deadline.

Based on the findings of the quantitative and qualitative research, we can provide some insight on Pintrich's (2004) social cognitive perspective of SRL framework. Details will be presented and discussed in the following sections. By consolidating all of the findings, we

undoubtedly provide a better understanding and collective picture, which may help researchers and educators with further studies in this area.
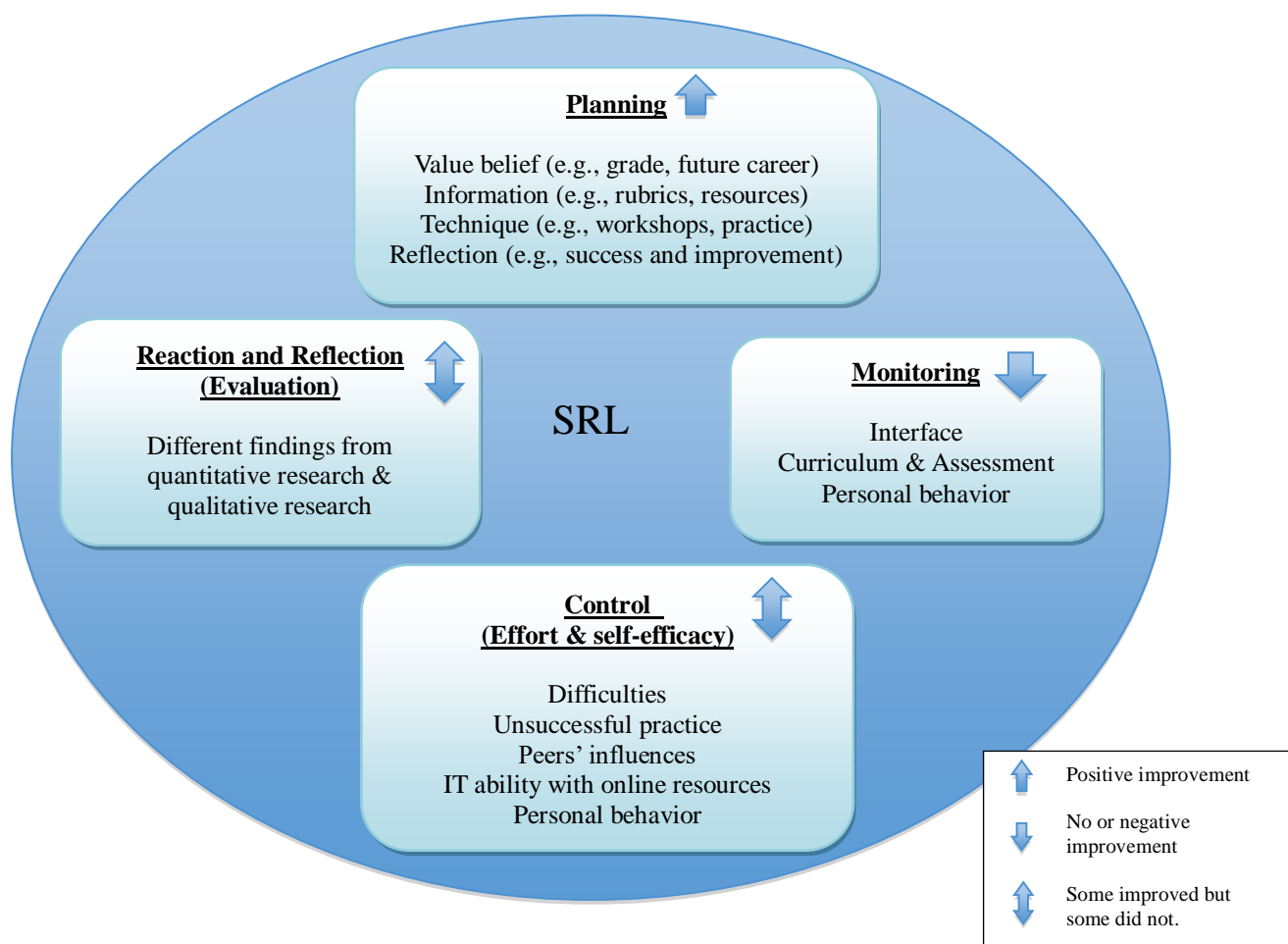
Figure 10 Findings of the impacts of e-portfolios on higher education students' SRL.

4.2.1   Overview of the Results from the SRL-SRS

The SRL-SRS included six factors of SRL: planning, self-monitoring, effort, self-efficacy, evaluation, and reflection. The pre- and post- data have been analyzed by SPSS 21 with the measurement figures from the Rasch model. The paired sample t test for viewing the whole sample ($N = 134$) of students who developed their e-portfolios for two semesters during their first year of higher education studies. The results show that only evaluation ($t = 3.703$, $p <$

0.001) with a small effect size (Cohen's $d = 0.320$) and reflection ($t = 2.208$, $p < 0.05$) with a small effect size (Cohen's $d = 0.191$) showed significance. Only the mean scores of planning and self-efficacy showed positive improvement. All other factors, such as self-monitoring, effort, evaluation, and reflection, showed negative improvement. Overall SRL also showed negative improvement.

On the other hand, the one-within-one-between-subject ANOVA was used to analyze data from 84 female and 50 male participants The results indicated significant differences in planning ($F = 5.878$, $p < 0.05$) with a weak effect size ($n2 = 0.043$), self-monitoring ($F = 8.321$, $p < 0.01$) with an effect size close to moderate ($n2 = 0.059$), and evaluation ($F = 8.434$, $p < 0.01$) with a moderate effect size ($n2 = 0.060$). The mean score of female students showed the same result as the t test. Planning and self-efficacy showed positive improvement, whereas others factors and overall SRL showed negative improvement. However, most factors and the overall mean SRL of male students showed negative improvement, except for the planning subscale. Female students had higher mean scores than male students for all six factors of SRL as well as the overall SRL.

Table 16

The Paired Sample *T*- Test Results of the Pretest and Posttest for Six Factors of SRL (*N* = 134)

	Pretest		Posttest		*t*	Effect size
	Mean	Std. Deviation	Mean	Std. Deviation		(Cohen's *d*)
Planning	0.41	1.98	0.47	2.06	-0.317	
Self-Monitoring	1.10	2.04	0.77	2.11	1.657	
Effort	1.16	1.82	0.99	2.02	1.038	
Self-Efficacy	1.19	2.47	1.25	2.87	-0.258	
Evaluation	1.63	2.13	0.88	2.49	3.703***	0.320
Reflection	1.69	2.74	1.08	3.12	2.208*	0.191
Overall (SRL)	1.20	1.80	0.91	2.17		

Note: * $p < 0.05$; *** $p < 0.001$

Figure 11 Mean score of the paired sample *T*- test results of the pretest and posttest for six factors of SRL (*N* = 134).

Table 17

The ANOVA Results of the Pretest and Posttest for Six Factors of SRL (N = 84 [F], 50 [M])

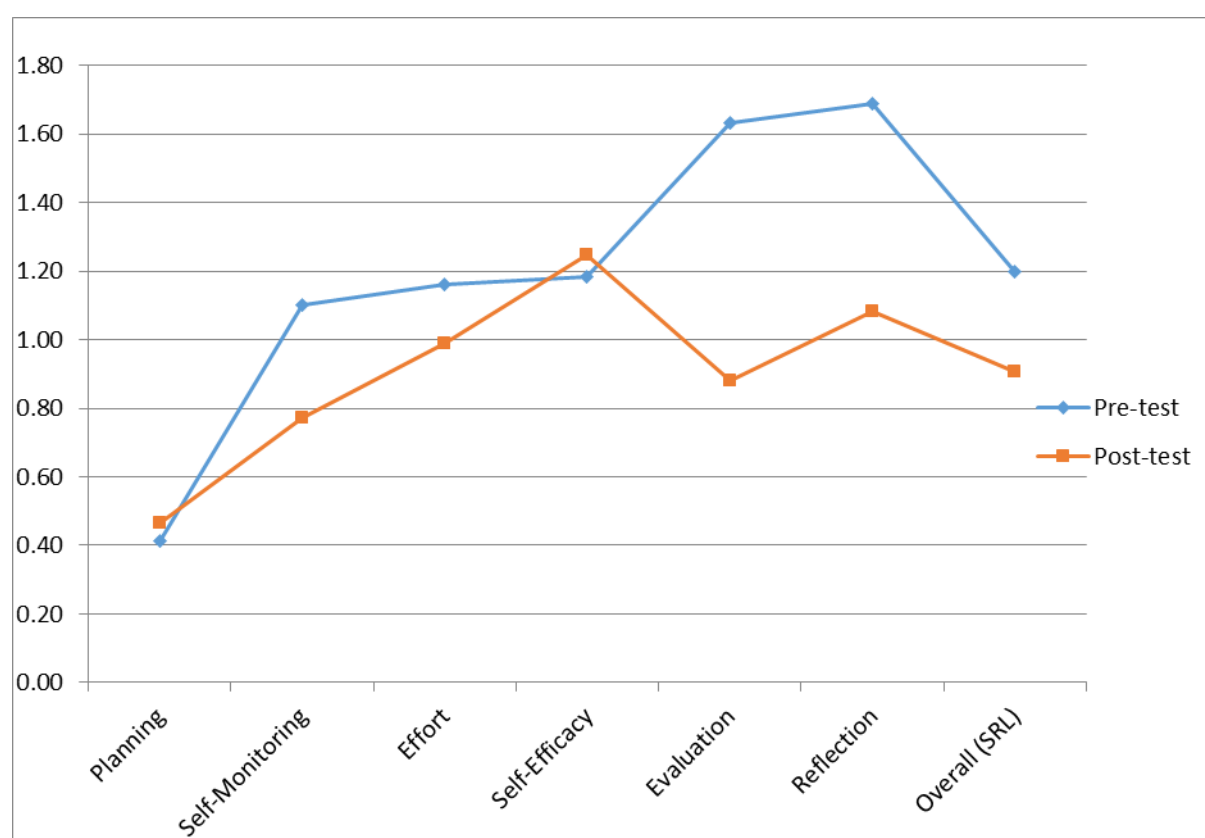|		Pretest		Posttest		F	Effect size
		Mean	Std. Deviation	Mean	Std. Deviation		(n^2)
Planning	Female	0.68	2.03	0.75	2.00	5.878*	0.043
	Male	-0.05	1.83	-0.02	2.10		
Self-Monitoring	Female	1.46	2.02	1.06	1.98	8.321**	0.059
	Male	0.50	1.95	0.29	2.25		
Effort	Female	1.37	1.88	1.18	1.92	3.223	
	Male	0.80	1.66	0.68	2.18		
Self-Efficacy	Female	1.38	2.40	1.51	2.80	2.235	
	Male	0.86	2.57	0.80	2.95		
Evaluation	Female	2.00	2.20	1.27	2.38	8.434**	0.060
	Male	1.02	1.88	0.23	2.55		
Reflection	Female	1.96	2.78	1.44	3.00	3.812	
	Male	1.23	2.63	0.47	3.25		
Overall (SRL)	Female	1.48	1.86	1.20	2.08		
	Male	0.73	1.62	0.41	2.25		

Note: * $p < 0.05$; ** $p < 0.01$
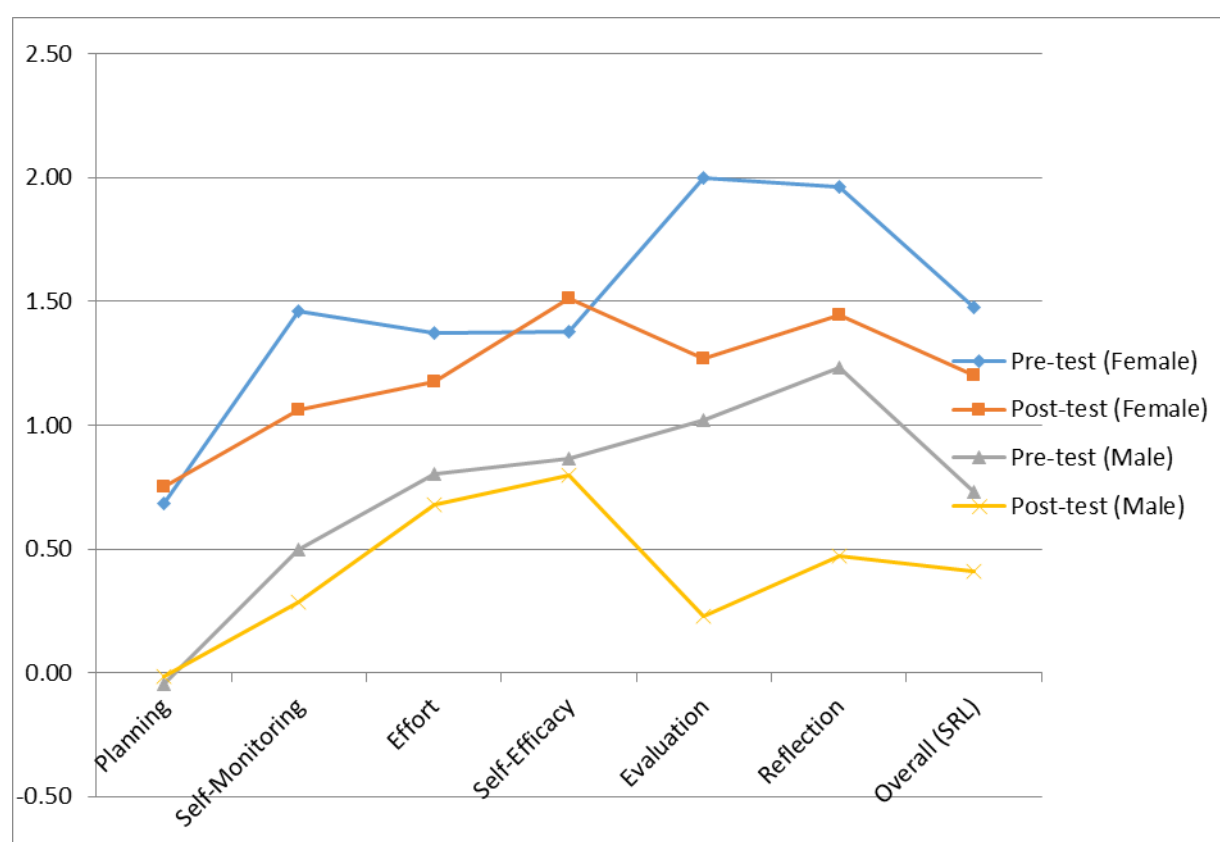
Figure 12 Mean score of the ANOVA results of pretest and posttest for six factors of SRL (N = 84 [F], 50 [M])

The above tables and graphs demonstrate the findings from both qualitative and quantitative research; and separated into four phases of Pintrich's (2004) social cognitive perspective of SRL framework, which are: 1) planning, 2) *Monitoring*, 3) *Control* and 4) *Reaction* and reflection.

4.2.2   E-portfolios significantly improved higher education students' motivation for planning

We rejected the hypothesis about planning after the *t* test, because the results showed that it was insignificant. The report showed that there was no difference in the 134 participants' planning after their experiences using e-portfolios for two semesters. However, the mean score of the *t* test result showed a difference from the pretest ($M = 0.41$) to the posttest ($M = 0.47$). Moreover, the one-within-one-between-subject ANOVA indicated a significant difference in planning ($F = 5.878$, $p < 0.05$) with a weak effect size ($n2 = 0.043$). Both female students ($M = 0.68$ & 0.75) and male students ($M = −0.05$ & $−0.02$) showed an increase from the pretest to the posttest.

In a private interview, John (a male student) said, "Before this course, I seldom to plan before work for any courses or assessments. Since then I have spent more time in planning before every submission; for example, the content, layout, and design of the e-portfolios." He was aware that this might be a basic essential skill for work in the future; not only in terms of layout or design, but also development of thinking skills and the ability to search for useful and related references before starting to work. Therefore, he applied this concept in other subjects during years 1 and 2, not only for e-portfolios, but also for other kinds of homework. Although he was not expecting it to influence his grades or marks, he felt this approach was

helpful for organizing materials to get the full picture and foresee the output. Believing the output should be good for audience members, readers, or markers, he felt that this change was positive and added value to him.

Students' value beliefs, clear information, actual practices, and reflection may encourage their motivation for planning. Details are discussed as follows.
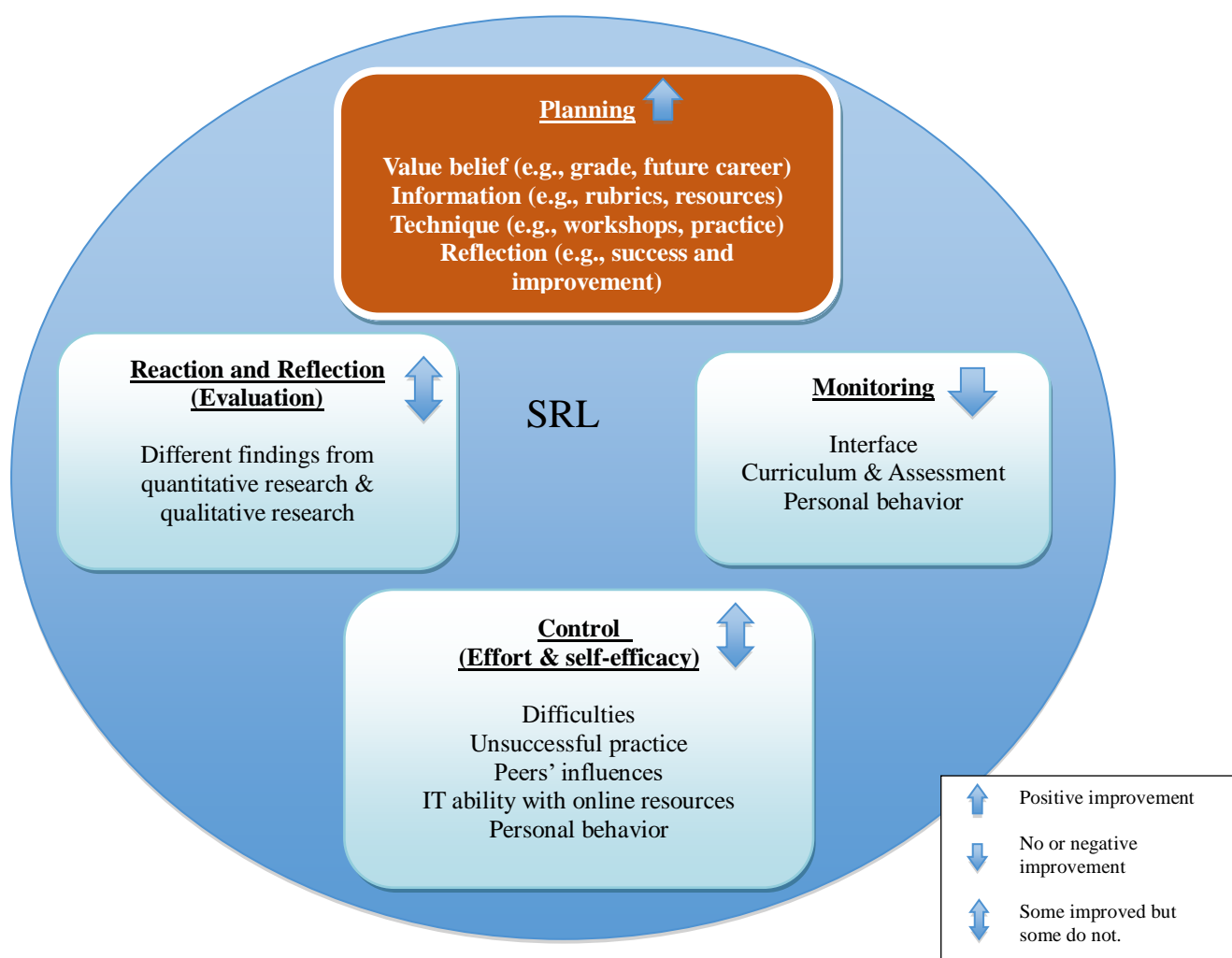
Figure 13 Findings of the impacts of e-portfolios on higher education students' SRL – planning.

4.2.2.1 Students' value beliefs motivate their planning

Pintrich and De Groot (1990) reported that students' attitudes are directly linked with their value beliefs. Planning and activation can form the goal commitment from students' wishes and desires (Gollwitzer, 1996). Researchers have explained that expectancy-by-value models include two conditions, students' belief that learning activities will improve a result and that a good result is important for them (Rheinberg et al., 2000).

John (male) believed that planning is necessary for his future work, and Susan (female) believed that planning could help her academic results. Therefore, both of them spent a lot of time reading through the course rubric to understand the requirements before developing their e-portfolios. Moreover, they not only planned the contents, layout, and digital resources but also considered the impact from the readers' viewpoint.

However, Ann (a female student) mentioned:

> In the beginning, I planned for all tasks of the e-portfolios because it was new to me. It appears to be very crucial in GEFC because of hearing this many times in the GEFC lecture and tutorial. Before I started to create my e-portfolios, I planned to follow the e-portfolio template and aimed to get full marks. However, when all other courses had started, I discovered that the frequency of using the Mahara platform was too low. Only the GE course requires a bi-weekly e-journal submission. All of the other courses did not require access to this platform. On the other hand, it is just a reflection for each topic and this assignment contents only represents 5% of the mark in the GE course. Without doing any planning, I simply follow all requirements and complete the task.

Seeing low significance in marks, Ann did not have motivation to plan again and simply followed all requirements, instructions, and steps mentioned by the university to complete every task before the due date.

4.2.2.2 Implementation intentions (plan) toward goals

Gollwitzer's (1993, 1999) suggested distinction between goal intention (goals) and implementation intentions (plans) was applied to the e-portfolio project. An example is the distinction between "I intend to get a higher grade on this assignment" (goal) and "If I complete my e-portfolio better, I will get a higher grade" (plan). Students thought about the necessary actions to reach their goals rather than only setting goals.

Susan (a female student) mentioned:

> In the beginning, I did not have any plan for the process and any idea with the expectation of my e-portfolios because I was not aware of any e-portfolio template resources from the university's online platform. Since I could not imagine the final product, I simply followed the course requirement and completed each assignment on time.

However, after reading through the course rubric, Susan aimed to get a higher grade in this course. She decided to spend extra time planning the content, inputting text for easy reading, and developing better presentation ideas for the audience.

4.2.2.3 Information and practice encourage students' planning

Gollwitzer (1996) believed that planning is a "mental strategy" that students use to think

about their future actions and tasks in order to achieve their goals. However, students may have difficulty planning if they do not know about the courseworks, the expected learning outputs, and the requirements. When e-portfolios become one of the assignments for higher education year 1 students, the first question they may ask is "What is an e-portfolio?" Most students in the sample did not have much knowledge or experience with e-portfolios before their higher education studies. They were novice learners of e-portfolios and also the Mahara platform. The GEFC's first lecture, tutorial, workshop, and online resources give initial information to students. After learning about the basic information and technique, students may have thought about the procedures for achievement, the digital resources for enriching the outcome, and techniques for searching and developing the online platform.

Mary (a female student) said:

> It is not an immediate need to work for the e-portfolios. I may explore how to use the platform after the workshop. After getting more information and understanding with the platform as well as sharing from a few classmates' work, I start planning before every action. I decided to upload something that is meaningful in Year 1—for example, photos—to have a better visual impact.

Mary planned to place all of her photos in chronological order to tell a clear story to readers. After she practiced more, she understood the e-portfolios and the platform's functions that are. When she understood the benefits, she was eager to plan before every action. In Year 2, she thought that the prior planning really helped her in some courses and assignments, such as GE essay and subjects of great interest. She trusted that prior planning helped her to obtain a better grade and better understanding of the subjects. She said, "Now I plan before every action if there is sufficient time."

Paul (a male student) also had no idea about the e-portfolios at the beginning: "I have no idea how to complete it. Feeling the requirement is relatively not high, I just capture whatever comes to mind without any pressure." Nonetheless, he planned to follow the course requirement. When starting to develop his e-portfolio, he decided to improve the visual impact even though this was not a specific requirement. He thought it would be easier for the teacher to read and shape the whole page clearly at the end of the task before submission.

4.2.2.4   Fostering the motivation of planning due to the cyclical movement of SRL

Each of the four stages "planning and goal-setting," "self-monitoring," "controlling," and "reflecting" will directly influence the next stage in a cyclical movement (Pintrich, 2004; Zimmerman, 2000). Researchers have found that each process is very important and may bring improvement to the next process (Zimmerman, 2000).
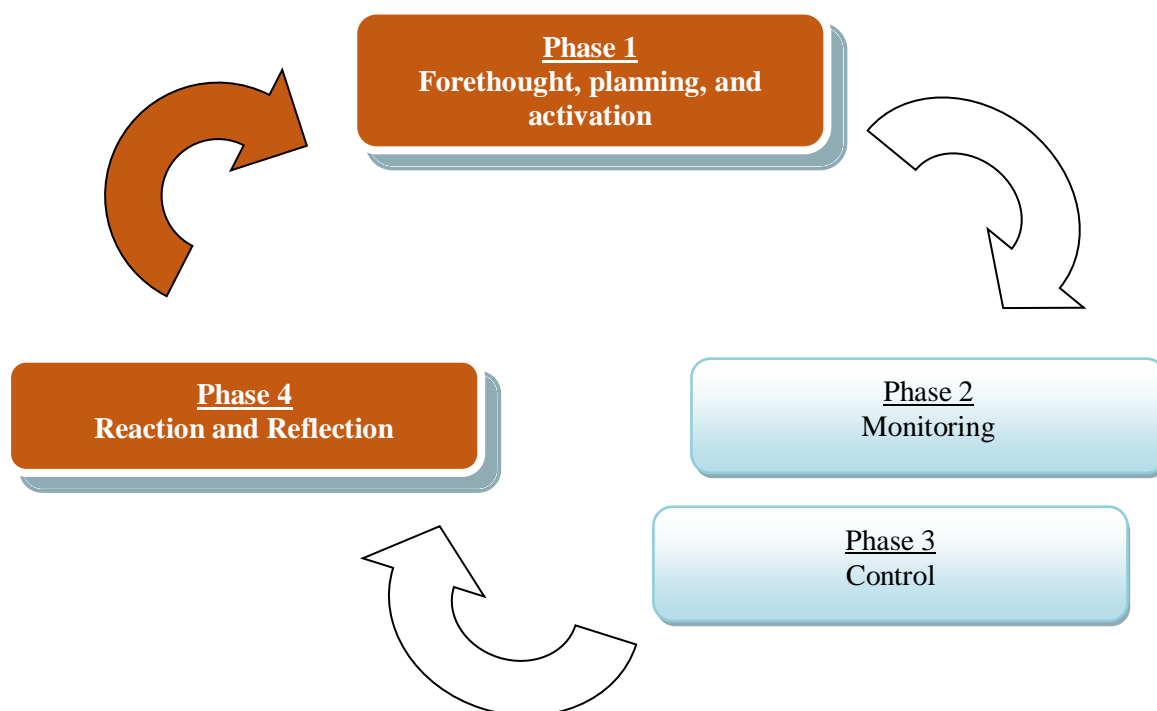
Figure 14 Cyclical movement of SRL (Pintrich, 2004; Zimmerman, 2000).

In this research study, some students did not have a plan before developing their e-portfolios for various reasons. After students practiced and submitted their reflections, they were aware of the benefit of planning; therefore, they decided to plan for the next action.

David (a male student) was majoring in IT. He knew the Mahara platform, which appeared to be too simple for him:

> I do not have a specific plan for each step in developing my e-portfolio. I just follow the course requirement—for example, putting the information in a Word document before uploading to Mahara. After some progress, I walk through the Mahara instruction website and have tried each functionality to understand how to utilize it, such as the main page design, adding columns, adding photos, etc. After reading through the rubric, I decided to follow it and completed all requirements well. After uploading all materials, I also touch up to improve the visual impact.

David checked and made improvements in his next entries based on the reflection. Based on the course requirement, students are required to upload at least their personal information, 11 e-journals, and one essay into their e-portfolios. While performing these actions, David felt improvement through planning after different entries and submissions, especially the content of his e-portfolio. Now, he continues to use planning in other courses in year 2.

4.2.3   E-portfolios unsuccessfully benefit higher education students' self-monitoring

The results of the one-within-one-between-subject ANOVA for self-monitoring are significant ($F = 8.321$, $p < 0.01$) with a close to moderate effect size ($n2 = 0.059$). The result of mean score, for both the 84 female students ($M = 1.46$ & 1.06) and 50 male students ($M = 0.5$ & 0.29) showed a decrease in the posttest. The t test mean score also showed a result of

1.10 in the pretest and 0.77 in the posttest. From the quantitative research, all results indicated that students had negative improvement in self-monitoring after their perception of e-portfolios. The qualitative interviews with students were used to supplement the weaknesses of the quantitative method and gather more information so as to support further studies of students' self-monitoring after the perception of e-portfolios.

In his private interview, John (a male student) mentioned:

> Normally, I do not check or correct any mistakes in assignments because of my lazy behavior. However, when I started to work on the e-portfolio, I reviewed it 1 or 2 times to check, make changes, and correct mistakes while inputting e-journals. I really feel good and have been applying this behavior for all other courses in year 1 and 2.

None of the other students in this research study showed improvement in their self-monitoring after the perception of e-portfolios because of students' personal behavior, design of interface, curriculum, and assessments.
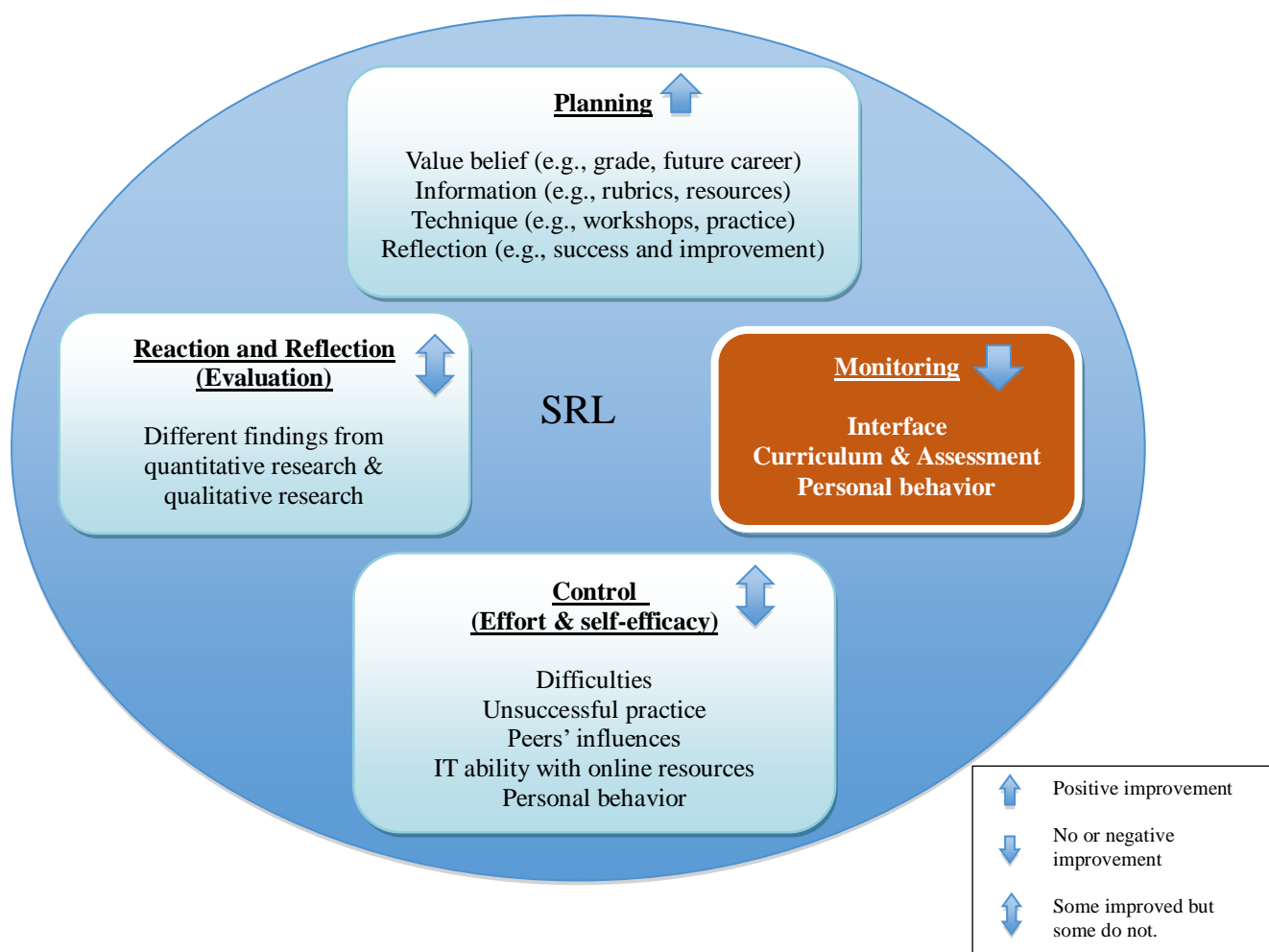
Figure 15 Findings of the impacts of e-portfolios on higher education students' SRL – monitoring.

4.2.3.1 The design of interface, curriculum, and assessment discourage students' motivation in self-monitoring

According to EdUHK, students use Mahara to construct their e-portfolios. Mahara is an online platform that allows students to store text, digital files, photos, and video. The platform allows direct input, copy and paste, and also Word files to be uploaded as content, which allows students to complete 11 e-journal entries and one essay based on the course requirement.

Ann (female) mentioned that she was directly typing in the Mahara platform. When she discovered errors, such as in spelling and formatting, she corrected them at once. Susan (female) also said that she checked for mistakes or errors while writing and reviewing at the end after uploading and before e-journal submission. However, she never reviewed after submission unless the teacher alerted her to a submission problem. She did not make any improvement throughout the practice with the e-portfolio. She submitted homework on time but normally without any checking. She did not think she needed to check her photos because they appeared onscreen automatically upon uploading.

On the other hand, Ann (female) did not check regularly because of the low frequency of usage of the Mahara platform: "No other course for undergraduate year 1 students uses this platform. I only access this platform when working on the GEFC assignment."

4.2.3.2   Higher education students' behavior already fostered in secondary education

The participants in this research study are digital natives who were born after 1980 and grew up using different kinds of digital applications including computers, the Internet, smartphones, and search engines (Houston, 2011). Because of the awareness of IT in education, their learning, teaching, and use of IT began before their higher education studies (EDB, 2002, 2017a). The higher education students may already have built up and developed their working behavior in online learning environments and digital coursework. Most of the interviewees did not think they had experienced any improvement in self-monitoring because of the perception of e-portfolios.

David (male) did not see much difference from before to after developing his e-portfolio:

"I usually write one paragraph and check. Then, I check the whole content thoroughly at the end and subsequently submit it the following day. I only check the flow of the whole article before submission and make relevant changes." He said that his normal behavior is to split work into modules, for example, one hour per module. After a break, his mind becomes clear and the task can be completed easily. He considered this to be a very effective and efficient way to work on assignments. He can be very focused on one subject within an hour without any pressure. He has shared this behavior with classmates, but they do not feel it is as effective as he does. He applies this behavior to almost all courses.

Mary (female) checked while inputting e-journals in order to make revisions simultaneously while working on her e-journal to avoid huge mistakes upon submission. Before finalization, she also went through the whole e-journal to make a better visual result. "Although it may not affect my grade, I like the better presentation." She loved to search and make changes upon discovering mistakes. If her teacher had not yet read her work but she discovered mistakes, she would improve it for a better result. She adopted this checking behavior in secondary school, and she applies it to all courses, not just the e-portfolios.

Paul (male) has had the same behavior since high school. He prefers to submit nice work; therefore, he always corrects his mistakes upon discovery: "I check and review while doing the e-journals for every paragraph. For the essay writing, I am direct inputting for easy reading. Because of easy reading, normally I discover typo mistakes." Paul uses the same behavior in all other subjects.

4.2.4   Different Result of the Improvement on *Control*

The effort and self-efficacy subscales of the SRL-SRS were combined and placed under Phase 3, control, based on Pintrich's (2004) social cognitive perspective of SRL framework (see Chapter 2 for details.

We rejected all of the hypotheses regarding effort and self-efficacy in both the *t test* and the ANOVA. The results indicated that they were insignificant. The reports reflected that no participants showed any difference in effort or self-efficacy before and after the experiences and perception with e-portfolios for two semesters. The *t* test provided scores for the pretest ($M = 1.16$) and posttest ($M = 0.99$) for effort and the pretest ($M = 1.19$) and posttest ($M = 1.25$) for self-efficacy. The ANOVA one-within-one-between-subject analysis of variance result provided scores for effort ($F = 3.223$), female students ($M = 1.37$ & 1.18) and male students (mean = 0.80 & 0.68); self-efficacy ($F = 2.235$), female students ($M = 1.38$ & 1.51) and male students (mean = 0.86 & 0.80). This result clearly indicated that only female students have improvement in self-efficacy.

Ann (female) was willing to spend more effort working on the follow-up task in a course when she had already received a pass. This demonstrated that effort is not only applied on "getting marks." This good behavior change applied in her studies in Year 2. On the other hand, learning experience is put into practice through the development of e-portfolios, such as by adding video and audio to a presentation other than just words or the basic course requirements.

However, some students showed negative improvement because of their ability to use the

application and resources. They also easily gave up because of peer influences, difficulties, and unsuccessful practice with the e-portfolios. On the contrary, students who had better IT abilities, IT self-efficacy, and satisfaction with the e-portfolios were willing to put more effort into improving their e-portfolios.
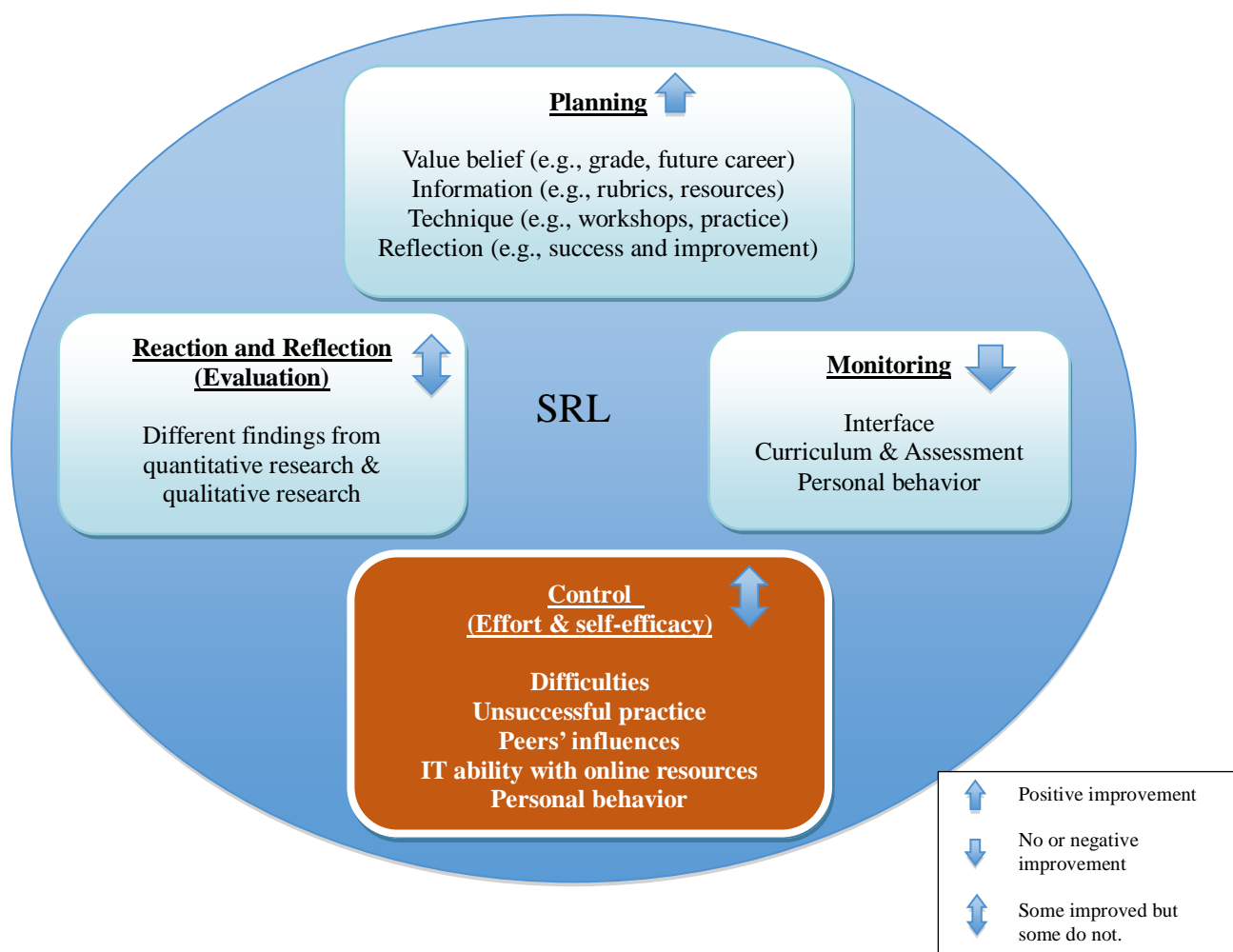
Figure 16 Findings of the impacts of e-portfolios on higher education students' SRL – control.

4.2.4.1 Difficulties and unsuccessful practices discourage students' effort and self-efficacy

Mungania (2003) reported that self-efficacy is the most significant predicator of e-learning. Self-efficacy means students' belief that they can be successful in e-learning. Students with

low self-efficacy often believe that many problems will appear during learning and take action with a negative attitude. On the other hand, self-efficacy judgments (Bandura, 1997) can be adjusted based on actual performance and feedback. In this research study, some students gave up on improvement after practice.

Ann (female) commented:

> The platform was so boring, and I found it very difficult to use. My initial plan was to follow the template arranged by the university. Unfortunately, I failed to complete after action. Although I asked classmates and friends, I still could not complete the photo editing after I uploaded them to the platform. After creating three subtitles, it automatically jumped out, which was not expected, and I failed to correct it. It was too time-consuming. For videos or audio, it needs to be uploaded to YouTube first and then downloaded to Mahara again. I gave up when it was close to the assignment deadline.

Susan (female) also tried with the functionality and buttons usage upon uploading by herself. Even though she directly sought help from friends after several trials, she still had difficulties.

In the beginning, John (male) did not worry whether he could complete the e-portfolio well since it was only worth 5 marks. He decided to simply follow the basic steps and submit on time. He thought that he could easily seek help from peers upon facing any kind of difficulty. However, when he started to work on his e-portfolio, he could not find solutions to overcome his difficulties and failed to make an improvement based on either his peers' or his own ability, let alone overcome the platform interface problem. He decided not to

put in extra effort and gave up the improvement because of the peer influences and his time management problem.

4.2.4.2   The importance of peers' influences on students' motivation of effort

Researchers have found that students may communicate and interact with peers during the process of making an e-portfolio. Peer influence may affect their motivation to achieve and improve (Lin, 2008).

John (male) said, "Most of my group-mates thought that the e-portfolios were meaningless, so none of them were willing to put in much effort. I did not put in much effort on the e-portfolio either because most of my peers treated it as not crucial." On the other hand, when he had difficulties, he preferred to check with his friends and classmates. However, they did not know the solution and had no desire to improve or overcome problems. Finally, they decided to give up all together.

However, many other students trusted that their peers could provide information for problem-solving. When they sought help from peers and received useful information and suggestions, they were willing to try again.

4.2.4.3   Students' IT abilities using online resources directly affects their effort and self-efficacy

Peng et al. (2006) mentioned that students with higher Internet self-efficacy had better performance. Satisfaction also directly affects students' positive feelings and can-do attitude.

All students could read and download useful information from both Moodle and LTTC's platform. In fact, there is a lot of useful information available for students who are willing to search online, such as on Google, wikis, and the library.

In other courses and secondary school, Mary (female) had sought help from classmates or teachers whenever facing difficulties because of lack of available information or materials from other sources. However, when she was developing her e-portfolio, she trusted that her problems could be resolved and answers should be available from the Mahara instructions or the Internet: "I did not have big difficulties and never felt upset during the whole process of e-portfolios. I read the instructions from Mahara again and solved all problems by myself." She preferred not to ask classmates who did not know the answers, and she never asked the teacher for help because she trusted she could resolve the problems by herself. This became her normal behavior. For all subjects in years 1 and 2, she found solutions by accessing Google or YouTube first. If she failed to get the answer, she would seek advice from classmates or the teacher.

David (male) followed the course requirement and also included video and photos in his e-portfolio. He selected suitable materials that related to the content. Although it was his first time using Mahara and creating an e-portfolio, he did not have any difficulties. In addition, he thought that video would be a good tool to demonstrate his real actions and way of learning in the e-portfolio.

4.2.4.4   Students' intrinsic behavior directly influences their effort

Researchers have stated that self-efficacy is a major predictor of academic achievement and behavior (Cleary & Kitsantas, 2017). In this research study, we found that students' intrinsic behavior may influence their effort during the development of e-portfolios.

Paul (male) has had the same attitude since high school, but this behavior is very obvious in Education Institution because of the agile situation. His "must do" attitude tends to be higher with much improvement. Even when they say unforeseeable situations, he still decides to continue and get it completed. For example, he put a lot of effort into completing the second assignment according to the teacher's comments on the first assignment. Moreover, he put more thought into doing the subsequent assignments. He prefers not to push everything to the end of the submission, and he seeks advice from teachers whenever he has questions or problems.

4.2.5 Different findings from quantitative and qualitative research on reaction and reflection

The evaluation and reflection subscales of the SRL-SRS were combined and placed under Phase 4, reaction, and reflection based on Pintrich's (2004) social cognitive perspective of SRL framework (see Chapter 2 for details).

The t test showed significant results for both evaluation ($t = 3.703$, $p < 0.001$) with a small effect size (Cohen's $d = 0.320$) and reflection ($t = 2.208$, $p < 0.05$) with a small effect size (Cohen's $d = 0.191$). The one-within-one-between-subject ANOVA also indicated that

evaluation ($F = 8.434$, $p < 0.01$) was significant with a moderate effect size ($n2 = 0.060$).

For evaluation, a t test ($M = 1.63$ & 0.88) and ANOVA were carried out. The mean was 2.00 & 1.27 for female students and 1.02 & 0.23 for male students. For reflection, a t test (Mean = 1.69 & 1.08) and ANOVA were also carried out. The mean was 1.96 & 1.44 for female students and 1.23 & 0.47 for male students. All results showed a decrease in the posttest.

According to the literature, Deneen and Shroff (2014) showed evidence that e-portfolios have potential to foster students' reflection. Researchers have also suggested that students could benefit from the reflection process by sharing digital learning artifacts in e-portfolios (Park & Lim, 2007). However, the result of the quantitative portion of this research study showed a decrease in reflection. All results indicated that students had negative improvement in evaluation and reflection after the perception with e-portfolios.

To gather more information in order to supplement the findings from the quantitative research, we focused on studying the responses from students, which gave more information to understand students' evaluation and reflection behavior after the perception with e-portfolios. The interviewees' responses revealed different findings than the results of the quantitative method. Most responses were positive, especially reaction attitude and self-awareness.
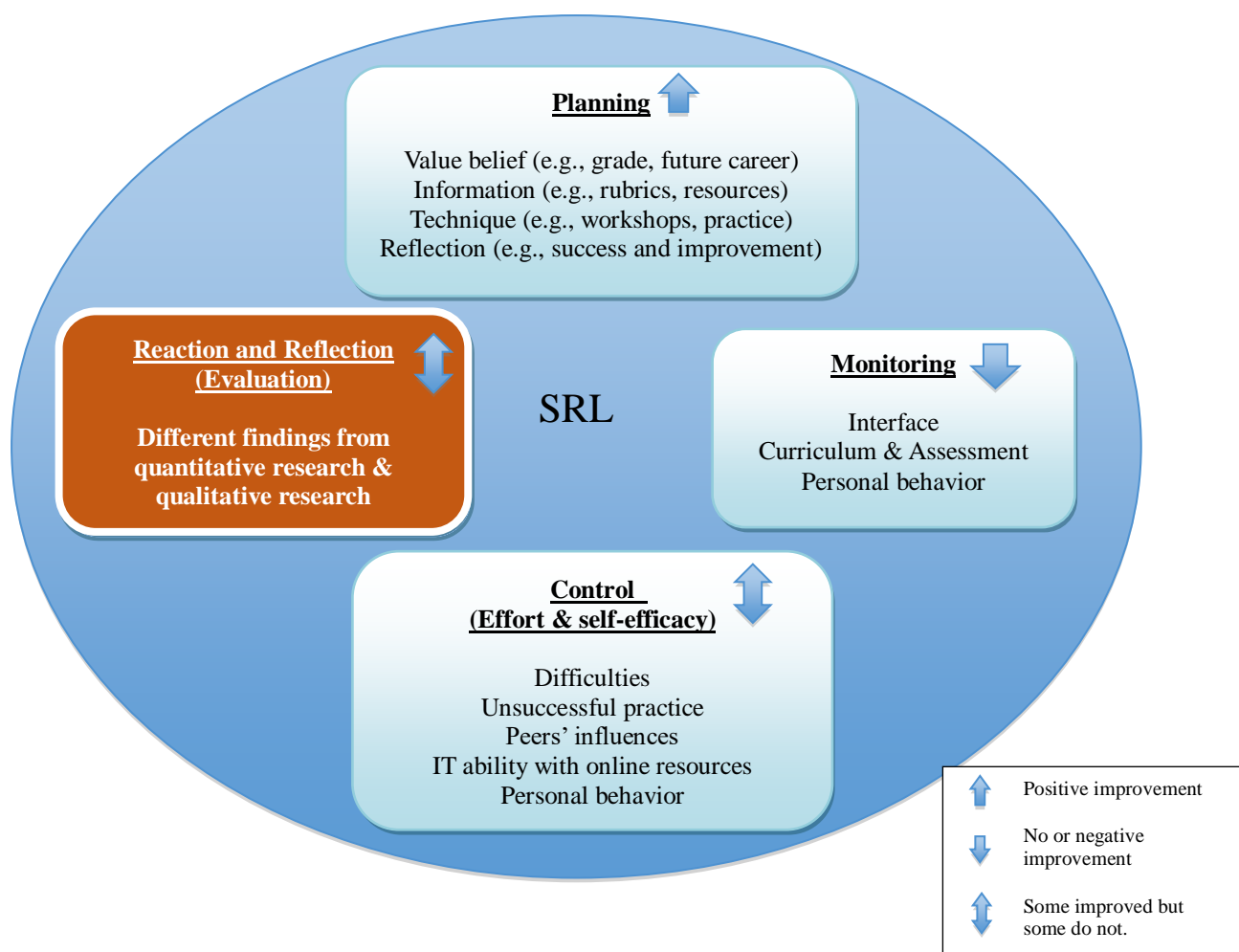
Figure 17 Findings of the impacts of e-portfolios on higher education students' SRL – reaction and reflection.

4.2.5.1 E-portfolios improve students' reflection and reaction

Students' reaction is based on their judgments and self-evaluations of their performance. It may involve their emotions; success and failure will directly affect their further action (Schunk, 2005). The application of e-portfolios provides opportunities for reflection on the effectiveness of artifacts and outcomes, which may enhance students' performance (Park & Lim, 2007).

In this research study, Ann (female) changed her sequence of steps to achieve quicker and better results based on her actual practice with the e-portfolios. She became more flexible about accepting changes. She also learned best practices when the teacher shared other people's good approaches. Her learning was not restricted to this subject, as she also applied such behavior in doing other tasks after then.

During the two semesters, John (male) found the best way to complete each task through the process and development of his e-portfolio. He changed the procedures and added more steps that might help improve the output.

David (male) improved with every e-journal because of his self-demanding attitude to improve every time, such as by changing the direction of comparison or use of words. Once he evaluated the process that was applicable, he decided to follow up and put everything in his e-portfolio to be consistent. He also improved his e-portfolio's layout by checking his classmates' e-portfolios. He believed that he learned self-exploration and problem-solving through the development of e-portfolios. He thought that an e-portfolio is a good reflection tool for memories, self-reflection and reminders of self-change. It is a good learning tool.

However, other students did not change the steps in their development of their e-portfolios during the two semesters. They thought that the procedure of their first submission was fine and that there was no need for any change in the following submissions.

4.2.5.2 E-portfolios improve students' self-awareness

Metacognition involves self-awareness, which is important for students' learning and may help students improve their further planning, select learning strategies, and develop problem-solving methods (Cohen, 2012).

Although the results of the quantitative study showed negative improvement, some students benefitted from self-awareness after the perception of e-portfolios.

Ann (female) felt that she changed in personality by jumping outside her comfort zone because of seeking help from people who were not close friends. In the past, she had talked to best friends only, whereas now she was seeking help from friends who were more knowledgeable about the topics of concern and could offer the most efficient and effective methods. Susan (female) was aware of her improvement target for essay writing in English as a result of this course. John (male) also admitted that he had improved his time management skills and was now improving in his studies in year 2.

4.2.6 Summary

The findings of our quantitative and qualitative research are categorized under the four factors of Pintrich's (2004) social cognitive perspective of SRL framework, namely planning, monitoring, control, and reaction and reflection.

For planning, the ANOVA one-within-one-between-subject analysis of variance indicated that planning showed a significant difference ($F = 5.878$, $p < 0.05$) with a weak effect size ($n2 =$

0.043). All mean scores in the *t* test and ANOVA showed increases. Both the qualitative and quantitative findings show a positive impact—that is, students improved on planning after the perception of e-portfolios. Some factors, such as their progress, activation, and experiences of e-portfolios fostered students' planning.

Unfortunately, both quantitative and qualitative research revealed the same finding: that students showed negative improvement in self-monitoring after the perception of e-portfolios.

For the control subscale, the mean scores on both the *t* test and ANOVA showed that female students improved in self-efficacy. Computing ability and satisfaction directly affected the level of self-efficacy and quality of effort.

For the evaluation and reflection subscales, the quantitative and qualitative methods yielded absolutely opposite findings. Possible errors may have been caused by the small sample size, preset interview questions, self-report questionnaires, or any unexpected issues.

The result of the overall SRL was decreased, indicating that students' overall SRL showed negative improvement after the perception of e-portfolios. All mean scores on the ANOVA showed the males had higher SRL than males for all six factors: planning, self-monitoring, effort, self-efficacy, evaluation, and reflection. This result may have been caused by the limited sample size or a gender difference in self-evaluation behavior on the self-report paper questionnaire, therefore further studies are needed.

We also found that the overall SRL showed a decrease after students' perception with the e-portfolios. Female students showed higher SRL than male students for all subscales of SRL.

This finding positively aligned with Bozpolat's (2016) finding that female students used more self-regulated learning strategies than male students. She suggested that gender is an important variable in SRL.

Moreover, we also found that each of the subscales of SRL may not influence the next stage based on the direction of cycle movement (Zimmerman, 2000). They may also be influenced by other subscales or other factors.

4.3 Student-related, university-related, and course-related factors influence students' SRL with e-portfolios

Researchers have stated that self-regulated learners have a strong concept of cognitive and regulatory strategies, including help seeking, elaboration, environmental structuring, and planning. These factors may depend on their self-beliefs, levels of self-efficacy and interest, and perception of the learning environment (Cleary & Kitsantas, 2017).

Akcil and Arap (2009) found that higher education students thought that the usage of e-portfolios could increase and enrich their motivation for learning. However, the online platform, support, and teacher and peer influences may also affect students' motivation.

This section will discuss the factors that may influence students' SRL. Some factors are personal, such as ability and beliefs. These factors may already be fostered by a student's family or education before his or her higher education studies. Some factors are related to university, such as the university's resources, support, and curriculum and assessment design. If these factors could be improved, well prepared, and arranged before students started to construct their e-portfolios, students might show more enhancement in SRL. Also, some

factors may influence students' SRL during the course implementation and construction process.   Further studies should be undertaken to gather more information and discussion on this topic Educators may also have references for the improvement and design of curriculum, assessments, and implementation in this area.
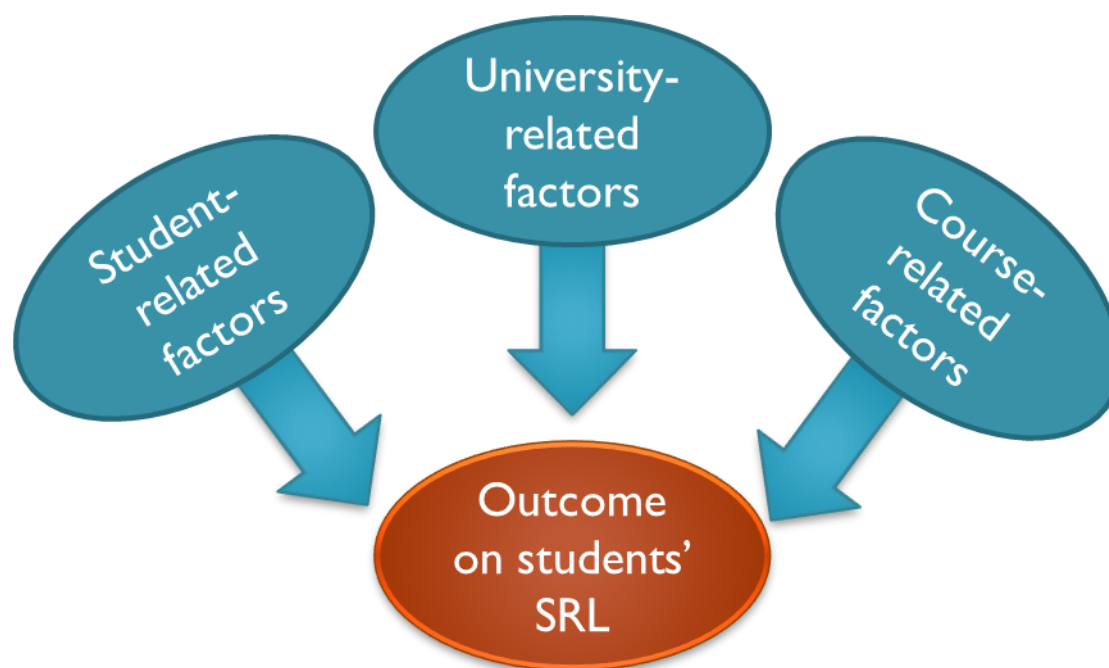
Figure 18 Factors may influence students' SRL before and during the e-portfolio process.

4.3.1 Student-related factors

All of the participants in this research study were higher education students aged 16 to 23. They had their own behaviors, interests, abilities, knowledge, and beliefs, which were fostered by family, culture, and the media as well as their kindergarten, primary, and secondary education. The students may have had different motivations for developing e-portfolios because of their different backgrounds and personalities (Hsieh et al., 2015). Researchers have also stated that students seldom use SRL strategies during their

self-learning at home, although it is necessary to investigate and further consider the reasons for this (Zimmerman, 2008).

4.3.1.1   Students' intrinsic interests and behaviours

Cleary and Zimmerman (2004) stated that self-regulated learners proactively control their behavior or strategies to achieve their goals. In this study, we found that most students' planning showed positive improvement; however, some students did not plan before working on each task because of their intrinsic interests and behavior. Some students loved to plan before all actions for all other courses but not for their e-portfolios because of lack of experience in using e-portfolios.

David (male) is a bachelor of education (honours) (secondary) (five-year full-time) student who is majoring in information and community technology. He usually searches for in-depth information through IT specialized websites rather than common search engines, such as Yahoo and Google, because he thinks their information is too basic and general. He had no specific plan for the development of his e-portfolio. He just followed the course requirement because he believed it was relatively simple.

Mary (female) likes to present things in a good format. Her high self-demand for giving a good presentation has been normal practice for her since high school. She really likes to put her thoughts in different fonts, colors, paragraphs, and subject titles. She also puts all photos in chronological order. She believes formatting things well can draw readers to read in an easier way and make it easier to understand the subject matter. Therefore, she planned to write all of her e-journals and essays in Word files before uploading them to the platform

because she was familiar with using word processing applications that have word count and grammar checking functions.

The findings showed no improvement in the self-monitoring phase.

Mary (female) said that checking for mistakes while working on any kind of assignments is her normal practice. She prefers to correct all of her mistakes before submission. She has adopted this checking behavior since secondary school.

Paul (male) also said that he has had the same behavior since high school. He prefers submitting nice work; therefore, he always corrects mistakes upon discovery. He checked and reviewed his work after every paragraph while writing the e-journals. When writing the essay, he input it directly for easy reading. This allowed him to discover his typos. He has the same behavior in all other subjects.

Our findings also showed most students did not face difficulties, worries, or pressures during the control phase.

David (male) knew the terms of the Mahara platform and e-portfolio before his year 1 studies. Although he had never practiced making an e-portfolio before, he did not worry about this project. He just went through the Mahara instruction website, trying each function by himself to understand how to utilize it in future, such as creating a main page, adding columns, and adding photos. He did not have any difficulties and enjoyed the process very much because he is interested in IT.

4.3.1.2   Students' Values and Beliefs

Hsieh et al. (2015) believed that perception is an attitudinal factor that will be influenced by students' behavioral beliefs, such as beliefs about outcomes and evaluation of outcomes. In this research study, most interviewees focused on their academic results, and they did not agree with the benefits of e-portfolios. Only a few interviewees thought that the e-portfolios could be valuable in their future development and careers. Most of them believed that they would not have worked on it or spent extra time to improve it if it had not received any marks.

John (male) commented, "Marks and grades are very important from all students' point of view. Normally, it is difficult to put effort into subjects that are unrelated to marks." Since this e-portfolio was worth only 5 marks of his grade, he did not worry about this assignment and decided to complete only the basic requirements. If it had been worth more marks, he would have focused on the requirements and checked for deliverables. In addition, he might have sought help from other channels, such as the teacher and supporting resources, to solve his problems successfully and improve on the assignment. Marks directly affected his level of effort.

Although Susan (female) did not enjoy the process of making her e-portfolio very much, her only motivation was to get marks and a grade. Getting marks and a grade is the only encouragement to complete the task.

Mary (female) trusted that prior planning helps to improve one's grade and understanding of the subject. One of her reasons for adding photos to her e-portfolio was the teacher's prior

acknowledgment of the better grade of a submission with photos. She really wished to get a high grade in this course. Thus, she tried to improve her output according to the hints from the teacher. Ann (female) also spent effort designing a template. She believed that spending time would make it work. Although not keen on computers, she still aimed to get full marks in this course.

Besides focusing only on the results of the assessment, David (male) had fostered his SRL based on a Chinese sentence that he read in a newspaper during his teenage years, 「人無我有，人有我優」 [What I have, they don't! What they have, I do better]. He agreed with this concept and applied it to his studies. For example, when all of his classmates were completing task A, he would try to complete tasks B and C. When all of his classmates were completing all tasks, he would try to improve the layout, overall appearance and sentences.

4.3.1.3   Students' interests in and abilities with IT

E-portfolios are a type of assessment in higher education that require students to use a computer, different applications, an online platform, a search engine, and electronic artifacts. Students' interest in and ability to use IT directly affects their SRL. Researchers have suggested that students' interests motivate their learning activities and help them achieve learning goals (Huang et al., 2011). Pintrich and Zusho (2002) found that when students have a greater interest in the topic, they will think that the performance of the topic is more important and be willing to change and use more strategies to complete the task.

David (male) enjoyed making his e-portfolio very much because he is a bachelor of education student majoring in information and community technology. He enjoyed creating his own

interface with capability of re-enter the platform. He enjoyed creating something himself. It seemed like an art piece created by him.

However, for students who are not majoring or interested in IT, they may only use a computer or smartphone for social communication, such as Instagram, YouTube, Facebook, WhatsApp, and email.

Both John (male) and Paul (male) said they use only a computer for course assignments, including information searches through Google, but use a computer and smartphone for social communication regularly, such as via WhatsApp, Facebook, Instagram, games, Internet surfing, and taking photos. Both John (male) and Susan (female) commented that they were not interested in the e-portfolios. Susan (female) only enjoyed and put effort into completing homework and assignment in the elective subjects. John (male) only spent time checking and planning for certain subjects in which he was interested. He also mentioned that although he planned to follow the e-portfolio template at the beginning, his struggles and limited ability directly discouraged his motivation.

4.3.1.4   Students' reading abilities in English

Wong (2015) mentioned that most Hong Kong students seldom use English outside school. Higher education students tend to use Chinese or graphic icons (Emoji) for communication through social networking almost every day. However, most learning platforms in the higher education sector have English interfaces. Schools' course materials, supporting documents, and assessment requirements are provided in English. Some researchers have argued that students' writing in e-portfolios is unreflective and some are only reaching a "moderate" level

of reflection (Sung et al. 2009; Zhu, 2011). In this research study, we also found that students were discouraged from making an effort because of their reading ability in English.

Mary (female) knew that some of her classmates might not seek online solutions because of the English standard: "My classmates have difficulties with the online resources in English and unwillingness to find solutions by themselves. They prefer to seek help from classmates or the teacher, rather than read through the English information." They also suggested that the university prepare video guides, similar to what they watch on YouTube, to show all of the procedures used in developing e-portfolios rather than using text only. For some students who are weak in English, their self-learning motivation directly decreases because information is written in English.

4.3.2 University-related factors

Yen et al. (2016) reported that although students completed all requirements in the online learning environment, the level of initiative was very low. Students lacked knowledge and skills for using the learning environment. They did not understand the requirements and idea of the assignments or activities, which directly decreased their motivation and intention. They suggested that educators should consider issues such as knowledge, skills, sense, need, and value and prepare the students well to foster students' self-regulated learning skills and achieving strategies through online learning environments. The researchers mentioned that a major educational goal is to foster students' cognitive transfer of both knowledge and skills through the design of learning environments (McCrudden, 2011).

4.3.2.1   The interface of e-portfolio system influence students' self-monitoring and control

There are different kinds of e-portfolio systems, including the Open Source Portfolio Initiative, the DU Portfolio Community system, eFolio Minnesota, and Indiana@Work. (Lorenzo & Ittelson, 2005). In this research study, all participants developed their e-portfolios through the Mahara system. The system allows users to directly input text in the text box, copy and paste, or upload digital files in Word, Excel, or PowerPoint format.

Ann (female) mentioned that she was directly typing in the Mahara platform. When she discovered errors in spelling or formatting, she corrected them at once. Susan (female) also said that she checked for mistakes or errors while writing and reviewed her work after uploading and before e-journal submission. Neither of them thought they should check again after submission.

David was majoring and interested in IT. Although he did not have much difficulty with the e-portfolio system, he still had a problem using the platform. Most students commented that interface problems directly decreased their efforts.

David (male) thought that the Mahara platform was quite user friendly, and it was not as difficult to use as he expected. However, shooting videos takes extra time, and the Mahara platform did not provide some functions to fulfill his plan for a layout.

Ann (female) said that although she was not interested in computers, she was interested in learning about e-portfolios at first because they were new to her. However, when she started

to use the platform, she discovered that it was boring and difficult. For example, after she posted three topics to the e-portfolio platform, it automatically exited, which she had not expected. Sometimes, she wanted to edit and improve the layout. However, there were not many choices for the e-portfolios. Finally, she gave up. Paul (male) also advised that he had difficulties with the platform. He was not familiar with the functionality and buttons usage upon uploading. Mary (female) also commented that there was no easy access from the website, such as instructions or icons for simple clicking.

4.3.2.2 Online resources influence students' control

Based on information from the university, online resources are available on the Moodle, LTTC, and Mahara online platforms. Moreover, the teacher explained and mentioned the information and requirements of e-portfolios in both of the first lecture and tutorials. Students knew about the online resources prepared by the university. However, they commented that the information might not suitable for all kinds of students.

Ann (female) commented that the information, online resources, and workshops that were arranged by the university were too basic. She did not find helpful information on either LTTC or Mahara's website. The resources would need to be more sophisticated and well designed for students to make more of an effort at self-exploration and self-learning, for example by explaining techniques for adding photo or video to the platform.

Susan (female) commented that insufficient instructions were provided by the university. She knew that some teachers arrange better information with written handouts for all procedures clearly. For teachers who did not prepare additional information, students borrowed from

other classes and found help with the additional materials.

On the other hand, John (male), David (male), and Susan (female) were not aware of LTTC's resources or any useful information, websites, online resources, hotlines, rubrics, or requirements for e-portfolios that were available, and they never accessed LTTC's website.

Students' suggestions to the university were in line with the concept of cognitive motor skills identified by Zimmerman and Bonner (in press). Starting from 1978, researchers began suggesting the use of cognitive motor skills and learning through observation, such as learning from video demonstrations and then developing students' internal "process" standards of correct performance by imitation (Zimmerman & Kitsantas, 1997).

Observation → Imitation → Self-Control → Self-regulation

Figure 19 Four phases of cognitive motor skill (Zimmerman & Kitsantas, 1997).

At first, Mary (female) was quite worried about not completing the task because of not knowing Mahara, although she had used similar platform to create e-portfolios before. She read the instructions from both LTTC and Mahara's website. After rereading the instructions, she recapped the concept, understood it well, and solved the problem successfully. Her second attempt was better than the first upload. However, some of her classmates had difficulties with the online resources because of their English level and unwillingness to find solutions by themselves. She suggested that the university could develop online resources on video, similar to resources from YouTube, which students feel are interesting, fun, and easy to understand. This would foster students' problem-solving and self-learning. Putting all

procedures on video might encourage students to be motivated to learn by themselves.

4.3.2.3 Curriculum and Assessment Design

Educators have commented that assessment design is one difficulty of e-portfolios. It is an ongoing challenge of the project because of issues such as weighting, number and duration of submissions, grades and credits, and validity and reliability. However, it is essential for students because of their beliefs about outcomes (Deneen & Shroff, 2014).

Ann (female) commented that the frequency of use of Mahara was too low. Only biweekly submission is required by GEFC, so students seldom access Mahara. Furthermore, Susan (female) said that if the instructions and requirements were more clearly stated, students would work out properly how to complete the tasks. Group projects might also arouse more motivation to put in more effort.

4.3.2.3.1 Assessment design benefits planning, control, reflection, and reaction

Researchers have suggested that students' attention could be shifted toward performance outcomes and also from goals to learning outcomes (Zimmerman & Kitsantas, 1997). The timing of outcomes is a critical consideration, and Schunk and Swartz (1993) suggested using a multistep strategy for writing short essays.

Susan (female) said that this course's assignment was really different from the requirements of other subjects that had only one assignment. The pressure to prepare more assignments was lower than just one assignment for a full course rating. Students had a chance to seek

advice on how to better deliver their work, and this was an effective learning process. Moreover, she really appreciated that the teacher commented after each assignment so that students might learn how to do better on the next assignment.

David (male) also appreciated writing 11 e-journals and then one assignment submission at the end of the course. The biweekly basis gave students sufficient time to think through their topics and search for useful materials. Teachers' comments on each e-journal helped students to rethink the and make improvements in their next assignments. On the other hand, when students submitted one assignment at the end of course, sometimes they did not know their problems or mistakes because no comments were received from the teacher. Moreover, students needed to start other courses. In addition, he also said that tutorials helped students very much. Students might not understand certain topics well in lecture. After tutorials and discussion with classmates, this could be resolved.

Mary (female) also felt good receiving an assignment that allowed her not only to reflect in text but also to share photos and other kinds of media files. The e-portfolios allowed students to format the assignment the way they wanted. She also uploaded and stored her special activities, such as activities during the Joint selection for Committee. She thought the teacher could learn more about students through the e-portfolios and build a better relationship for understanding.

4.3.2.3.2 Clear concept of e-portfolio may encourage students' planning and effort

Researchers have also suggested that it is important for e-portfolios to have a clear purpose, not only a focus on implementation and support (Lamont, 2007). The term *e-portfolio* was

unclear in Taiwan because of the translation from English to Chinese. Students developed a definition and meaning based on their own ideas. Universities and teachers have a responsibility to help students to realize the potential benefit of e-portfolios (Hsieh et al., 2015).

John (male) commented that students did not clearly understand e-portfolios. Many of them thought that they are a type of task-oriented assessment without understanding anything beyond that. He suggested that the university should explain the importance and value of e-portfolios well. Therefore, students might put more effort into creating their e-portfolios regardless of marks. On the other hand, there were not many compulsory requirements for the e-portfolios, so most of the students decided to follow the standardized template without thinking critically before they started working on it.

4.3.2.3.3 Course workload during the control phase

In this research study, students commented that they had too much coursework and assignments; this was in line with researchers' arguments. Cleary and Zimmerman (2004) argued that students may develop negative self-motivational beliefs because of a struggle with great academic demands. Lin, Yang, and Lai (2013) commented that time limitations and the complexity of tasks may influence the performance and outcome of e-portfolios.

John (male) said that students faced different course assignment deadlines at the same time. In this course, students had to submit e-journals to their e-portfolios biweekly, so John just followed the basic steps and made simple amendments to the background.

Ann (female) commented that the development of e-portfolios was too time consuming. For example, videos had to be uploaded to YouTube first and then downloaded to Mahara again. She encountered difficulties in editing photos after uploading, too. Although she checked with classmates, she gave up when close to the assignment deadline. She personally liked to have good organization of information that might facilitate searching for information. However, her effort was limited, and she was unwilling to spend time improving her e-portfolio because of time constraints.

Both John (male) and Mary (female) said that if there had been sufficient time, they would have planned have improved before taking action. They would improve the quality of their e-portfolios, such as by adding related videos and audio to e-journals, accessing Google to search for useful key words, and improving the background and layout. Although they were aware of their mistakes while working and felt improvement could be made, they had no time to work on it.

4.3.3 Course-related factors

After students received the fundamental information from the school/teacher, they started developing their e-portfolios independently. Although they had face-to-face class with the teacher every week, they needed to handle and solve all of their problems with the e-portfolios after class and without the teacher's direct support.

Researchers have stated that although SRL is essential for students' learning, seeking help from peers and teachers is also important (Zimmerman, 2008). Besides of the factors that may have already affected the higher education students during their teenage years, they also

focused on different kinds of problems during the process of e-portfolio development. Although the university arranged proper information for students during class and workshops, students needed to work independently on their e-portfolios outside class. When problems arose, some of them were encouraged by classmates or the teacher's reply. However, some of them decided to give up because of the influence of peers.

4.3.3.1 Supporting channel is essential during the control phase

The feeling of knowing (FOK) is one type of metacognitive awareness (Nelson & Narens, 1990). It refers to students who cannot recall what they have learned when they intend to use that knowledge. During the e-portfolio experience, students had to learn about the use, steps, and technique of the Mahara platform with necessary informational techniques, different digital artifacts, and Information and Communications Technology literacy. The main cognitive strategies for improving memory was seeking help from peers, the teacher, the school, or online information.

Paul recalled that at the beginning, he was quite worried about the e-portfolio assignment because he felt that the Mahara platform was very complicated. Although the lecture and workshop explained the basic information and procedures, he failed to remember it and had difficulty starting any steps afterwards. Luckily, during the tutorials, the teacher explained and taught in detail with a clear PowerPoint and showed all procedures step by step. Moreover, all information was placed on Moodle, where the students could easily follow the steps and try to work it out. After he worked out something by himself successfully, he had motivation to try other techniques and aimed to improve his e-portfolio.

Susan (female) said that although the teacher had already showed the steps in class, written instructions with clear pictures would have helped students who might successfully follow them to work on their e-portfolios at home. Paul (male) thought that it would be better to have clearer instructions from the teacher followed by more explanation in class.

Besides the online resources and tutorials, students could directly contact the university support offices, such as GEO and LTTC, by email, phone call, or face-to-face contact. However, students reported that they seldom checked with these resources. Some students did not even know about these offices that the university had arranged to support them.

Moreover, Mary (female) thought that no students wanted to check with the university's supporting offices, either GEO or LTTC. She preferred to find information from online sources first. If she failed to find an answer, she would check with her classmates. If they also did not know the answer, she preferred to check with the teacher, and her last resort was the office.

4.3.3.2   New communication channel positive for the control and reflection phase

Nowadays, people are using smartphones for communication with others. Different kinds of applications for smartphones have been created and promoted to the market. In the 21st century, higher education students bring along their smartphones every day, not only for phone calls but also for checking email, online shopping, and social networking. The applications are similar to computer applications. WhatsApp is a new communication application for smartphones that is free and popular. Nawal's (2017) study found that it may

encourage interaction between students and enrich motivation for problem-solving, help seeking, and information and experience sharing.

Ann (female) said that she communicated with her classmates and teacher by using WhatsApp rather than other channels. Her teacher created a WhatsApp group for all classmates to communicate together where the teacher could share information about the course, topics or assignments directly and all students could ask questions and share ideas. On the other hand, students could also communicate with the teacher or a classmate independently through the WhatsApp interface. She found it helpful and convenient; therefore, she sought advice and solutions about assignments from the teacher through WhatsApp rather than another channel. Very often, the teacher would send information or reminders to students by email; however, many students did not read the emails. Moreover, some students seldom communicated by phone calls, especially about assignments. But they read the information, shared items, or discussions from the teacher and other classmates that were placed in the WhatsApp group.

John (male) also used WhatsApp to communicate with classmates. His teacher also created a WhatsApp group for the whole class. He preferred to check with the teacher individually about the assignment requirements rather than in the group.

4.3.3.3 Teacher's support and feedback directly encourages students' control, reflection, and reaction

In online learning environments, students should work independently without direct support from teachers (Timothy & Zimmerman, 2004). However, teachers still play an important role

in supporting students with the development of e-portfolios (Wray, 2007). Researchers have found that after students receive feedback about the results of their learning or complete a task, students stay in a target-performance comparison stage. This will positively enhance students' self-awareness of their learning (Labuhn, Zimmerman, & Hasselhorn, 2010).

At first, John (male) worried about not completing the task. He proactively sought the teacher's advice on rubrics and solutions to his problems. Although he was not aware of the online resources arranged by the university, his teacher showed information such as an e-portfolio template in class. He said that his teacher taught them in a very interesting way, and he enjoyed the class very much. The teacher's influence successfully encouraged his motivation and interest even though the project was not attractive for him.

David (male) learned a planning method, "cross planning," from the teacher of the GE course. He proved that this will is useful through practice in GEFC. He continues to use this tool during planning. He also thought that the feedback and comments by teacher were extremely important for him, as he could critically rethink his work to improve future work.

Susan (female) loved to follow the teacher's comments on the first assignment and made an effort to complete the second assignment.

For Paul (male), he worried about Mahara and felt it was very complicated at first. During tutorials, he got more information from the teacher. After practicing, he successfully worked out his problems one by one. He was confident that his teacher and classmates would help him whenever he had a problem.

4.3.3.4   Peers' influence on students' control

Lin et al. (2016) found that self-regulated learning with group awareness and peer assistance provides significantly more active participation, better self-regulated behavior, and better learning achievement.

Ann (female) checked with classmates and friends directly when facing technical problems, such as editing photos after uploading, that she could not solve independently. She did not prefer to check with the university's support team, such as the GEO, LTTC, or teacher, although she understood they were more professional than her peers. She did not like to call or email them, and avoided the face-to-face approach.

David (male) did not worry during the process of developing his e-portfolio because he knew that besides online resources and the teacher's support, he could also ask for classmates' help to check the validity of links before submission. His classmates gave suggestions for improving the format of his e-portfolio.

However, when friends, classmates, or group-mates have negative judgments or ideas, sometimes students will be affected.

John (male) was not willing to put effort into his e-portfolio because all of his group-mates thought that the e-portfolio was meaningless and treated it as unimportant. Moreover, when he had difficulties, he preferred to check with his friends and classmates. Very often, they did not know the answer and had no desire to improve or overcome problems. Finally, all of them decided to give up together. He thought that the key reason was that all of his group-mates

were boys. He believed that girls would work harder and have a more positive attitude about learning than boys. Therefore, he preferred to have female group-mates in other courses.

4.4 Chapter Summary

Kuo and Hwang (2014) believed that e-portfolios provide researchers and educators with a better understanding about students' learning behaviors. The Internet and information technology are necessary in the 21st century. This provides ideas for higher education innovation and reform (Kahn, 2014).

In this research study, we identified factors that influence students SRL during the process of developing the e-portfolios. We suggest that further studies should also consider the factors before the process, which may affect students' SRL in the perception of e-portfolios.

Researchers suggested that fostering students' metacognitive, motivational, and behavioral responsibility for their learning is the best way to improve knowledge and skill achievement. Studies have been strongly proven the linkage between SRL, self-efficacy, intrinsic task interest and academic achievement. The use of SRL can improve students' performance (Labuhn et al., 2010).

The findings showed that some students' behaviors, interests, abilities, and beliefs may already have been fostered before their higher education studies. Most interviewees stated that some of their learning behaviors, interests, and beliefs were developed when they were teens. We found that some factors affected students' SRL during their process of constructing

e-portfolios. We believe that further studies could focus on how students' SRL can be fostered by primary or secondary education, parenting, culture, the media, and other factors.

Another issue that directly affect students' SRL is the preparation done by university. We believe that consideration of the design and improvement of interfaces, resources, curriculums, and assessments may enhance students' motivation in online and self-learning environments. Therefore, students' SRL may show positive improvement as well.

In addition, these factors may affect students' SRL before the process of developing the e-portfolios. Some factors may encourage or discourage students' SRL during course implementation. Some factors may be improved by educators, but other factors come from students themselves or peers. Further studies are required; for example, additional training, positive thinking, or values education might help to resolve the negative influence.

CHAPTER 5

CONCLUSION

From "A Review of the Literature on Portfolios and Electronic Portfolios", Butler (2006) gathered different opinions from researchers and reported that the benefits of e-portfolios include skill development, evidence of learning, feedback, reflection, psychological benefits, assessment, artefacts, maintenance, portability and sharing, access, an audience, organization, storage, cost, standardization, and privacy. Researchers also stated that e-portfolios are a medium for students' learning, increased cognitive demands, and perceived better learning outcomes (Hyland & Kranzow, 2012; Lin, Yang, & Lai, 2013). Based on the literature, we believe that e-portfolios may foster and develop students' SRL. However, my research findings indicate that some factors may influence improvement in higher education students' SRL with e-portfolios.

5.1 Overview of the Findings

In this research study, we aimed to collect information directly from higher education students who had practice and experience with e-portfolios for two consecutive semesters. We collected data for quantitative and qualitative research within Pintrich's (2004) social cognitive framework with an SRL perspective. We also considered the whole process and those issues that may affect procedures in the development of an e-portfolio. We decided to use a new measurement tool—the self-regulation of learning self-report scale (SRL-SRS; Toering et al., 2012)—covering six core factors of SRL, which are planning, self-monitoring, evaluation, reflection, effort, and self-efficacy, for the quantitative research pre- and posttest, assuming no interaction among any two factors.

5.1.1 Findings for Answering Research Question One

From the findings, we answered the first research question: "What are the pre and post impacts of e-portfolios on students' SRL as they progress through their first year of study?" We found that most year-1 undergraduate students showed positive improvement in planning after developing their e-portfolios for two semesters. Value beliefs, information from the university, practice, experience, improvement, and satisfaction may affect students' motivation in planning. However, students' learning behaviour, learning patterns, habits, and normal use of IT and communication networks may already have been fostered before their attendance at a university. Most students in this research study did not think the perception of e-portfolios improved their monitoring. On the other hand, the interface of the e-portfolio system, curriculum, and assessment design also discouraged their motivation in monitoring. For the control (effort and self-efficacy), students' ability levels in IT and English, actual practice, success or failure when setting up an e-portfolio, supporting channels, and peer influence directly affected their improvement. For instance, some students were willing to give extra effort because they found success in the action. Unfortunately, some students gave up because of failure to achieve what they had planned to do even though they sought help from their classmates or teacher.

A very interesting finding was from the reaction and reflection (evaluation). The quantitative and qualitative findings were totally opposite. Both findings from the paired sample t-test and one-within-one-between subject analysis of variance (ANOVA) showed negative improvement. However, most interviewees stated that they had positive improvement, especially in reaction attitude and self-awareness. This inconsistency may be a result of the limited sample size, the design of the self-report questionnaires, or other hidden factors.

Although most studies support the qualitative data, further studies are required for a more comprehensive understanding in this area.

On the other hand, the phases of SRL may not move in the same direction as Zimmerman's (2000) cyclical model of self-regulation. In this research study, the e-portfolio system allowed students to amend the layout or upload updated versions of work an unlimited number of times before the submission deadline. Moreover, based on the assessment design, students were required to upload 11 e-journal entries and 1 essay into their e-portfolios on a biweekly basis for two consecutive semesters. Some students planned their studies again after problem solving and taking subsequent actions with their e-portfolios. Some students were willing to check their work again after reflecting and received from teachers.
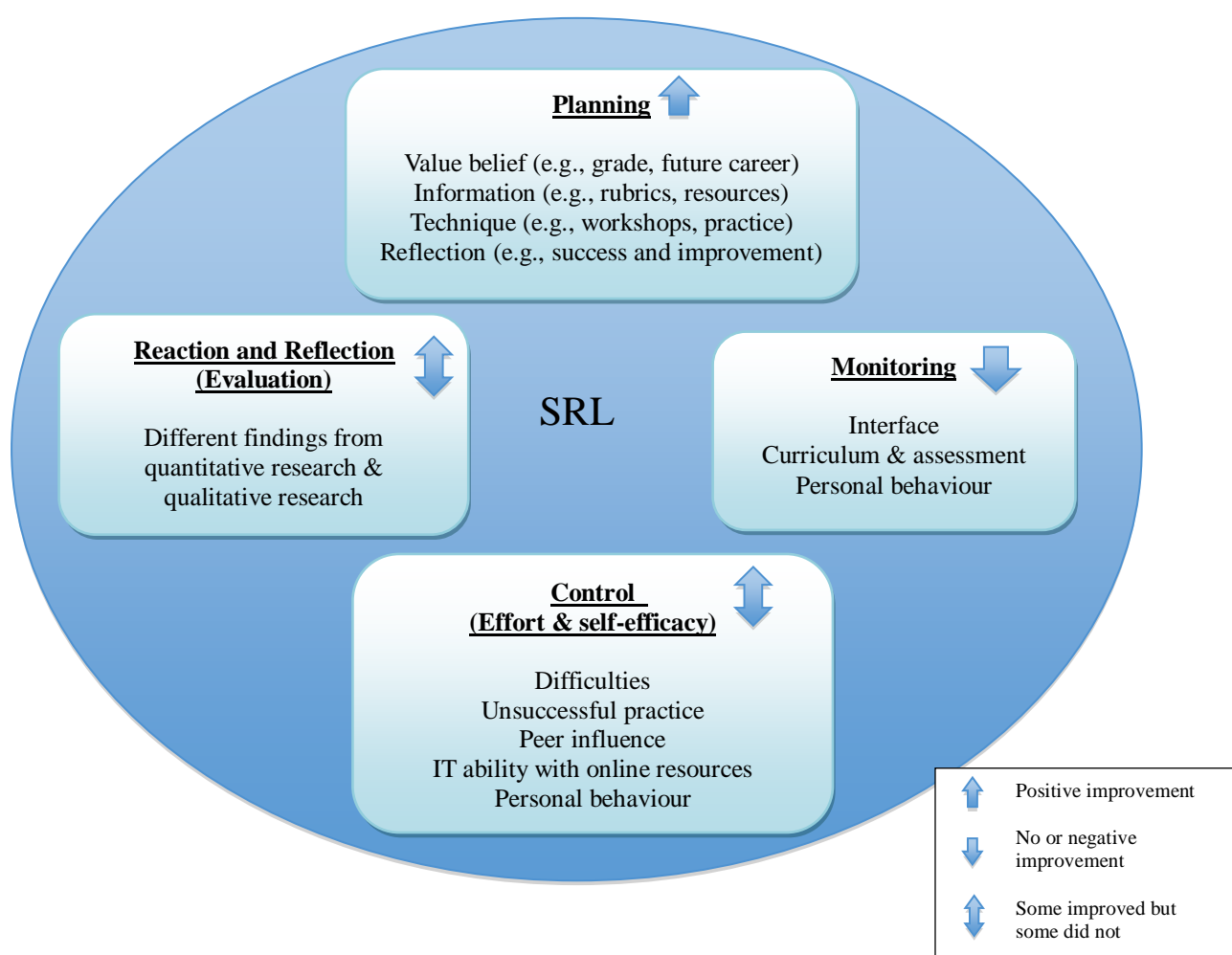
Figure 20 Findings of the impacts of e-portfolios on higher education students' SRL.

5.1.2 Findings for Answering Research Question Two and Three

Besides the findings about the impacts of e-portfolios on students' SRL as they progress through their first year of study, we also found some factors may influence students' SRL before and during their progress. For example, if students' value beliefs, behaviours, and abilities had already been fostered before entering higher education, these factors may influence students' SRL in their actual experience with e-portfolios. On the other hand, their university may have a better e-portfolio system with a more user-friendly interface, improve their information and support channels, or redesign curriculum and assessments before and during the progress of the e-portfolio project. All these factors may influence students' SRL.

The findings show positive and negative influence; for example, students may decide to give up or they may be encouraged to expend more effort because of peer influence. The findings answered the second and the third research questions together: "How are students' SRL experiences supported as they construct their e-portfolios?" and "How do barriers prevent students from developing their SRL as they construct their e-portfolios?"
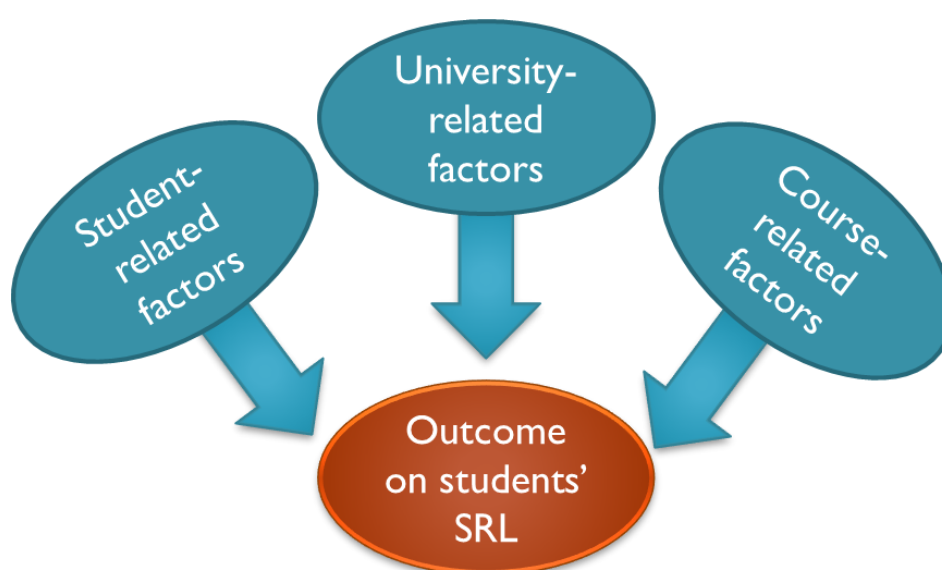
Figure 21 Factors may influence students' SRL before and during the e-portfolio process.

5.2 E-Portfolios Developed Higher Education Students' SRL

Currently, the use of IT in communication, entertainment, business, and education is growing rapidly. Researchers reported that 95% of adolescents age 12 to 17 are online users, spending 70% of their study time online daily (Lenhart et al., 2011). All participants in this research study were born between 1990 and 2000. They have grown up with different kinds of technology use throughout their daily lives, schooling, and social communication, such as smartphones, computers, digital applications, the Internet, Web 2.0, search engines, and so forth.

According to the Hong Kong Education Bureau's official website,

> Since 1998, the EDB [Education Bureau] has introduced a series of strategies on IT in Education to facilitate schools' incorporation of IT in learning and teaching. In 2000, a set of IT Learning Targets, highlighting the use of IT and information, was developed to serve as a set of guidelines for schools to organize relevant learning and teaching activities.

They aim at students' mastering of not only IT skills, but also the knowledge of IT, such as applying IT skills in information processing and developing a proper attitude towards IT usage (Education Bureau, 2002, 2017a, 2017b).

5.2.1 Higher Education Students' SRL Can Be Improved, Although the E-portfolio Is New to Them

We do not question the 21st century's higher education students' ability or knowledge of IT. In this research study, all participants had basic IT ability and knowledge before entering

higher education. They have used computers with different applications for school assignments since secondary school, such as Word, Excel, and PowerPoint. They also love to use different search engines, such as Google, Wikipedia, or the library's website. However, we found that not all higher education students' SRL benefitted from their secondary school IT training when it came to the e-portfolios.

According to interviewees' responses in this research study, most students love to surf online and use IT for leisure, such as online games, watching videos, listening to songs, and shopping. They also use the IT applications learned in secondary school for their coursework.

Most of the interviewees had no experience with an e-portfolio system or development of a web page. The interface and the concept of e-portfolios were new to them. Some of them did not know how to plan their e-portfolio, although the university has provided instructions, workshops, and explanations available from teachers. However, after they practiced with the e-portfolios, they received direct outcomes from the e-portfolio system. For instance, they could immediately see any alignment problems after they confirmed the action with the e-portfolio system. If the result was not what they intended, they could try again or seek help from peers, teachers, or other resources. If they still had problems, they were willing to practice again after receiving clarification on instructions from peers or teachers. When they completed the task successfully, their motivation for planning, self-efficacy, effort, and self-reaction evolved towards further improvement.

Because students got feedback from teachers regarding their e-portfolios and some of them shared the experience with peers, most of the interviewees in this research study experienced increased motivation to adjust their strategies for future action.

Some of the interviewees had difficulties with the e-portfolio system and online platforms, not only language problems but also issues with the user-unfriendliness of the interface. Some of them were not willing to seek out and read the online resources again even when they did not understand information from lectures and workshops. However, they would seek help from peers or teachers, which was faster than self-learning from the online resources. Nowadays, connecting with peers or teachers directly, by phone, Whatsapp, or face to face is so easy. Students can pick the most suitable channel or method to solve problems by themselves.

5.2.2 Higher Education Students Intentionally Adjust Language in Problem Solving and Task Achievement

Researchers mentioned that online learning offers potential benefits to three types of skill training for graduates: communication in English, problem solving, and IT. Moreover, it also offers students opportunities for reading and writing in second languages (Donoghue, 2006). However, we found students facing difficulties in reading because the e-portfolio system and online resources were written in English, which is a second language for all the interviewees.

In this research study, all participants were year-1 undergraduate students from Hong Kong (84.3%) and the mainland (15.7%). English was their second language. Some students had difficulties with the English interface, course material, and online resources arranged by the university. Therefore, they were unwilling to learn and solve problems by themselves. They preferred videos or PowerPoints with pictures provided by the university or teacher to show the steps and process for developing the e-portfolios rather than only instructions written in

English.

Social networks may also influence students' reading and writing preferences. Students can easily install and use different applications on smartphones and computers. They can read, receive, and share information they are interested in from online resources. They spend time on what draws their interest. They can select their preferred language. They prefer to watch videos, view images, or listen to songs rather than read or write. In this research study, most students stated that they preferred to share or seek help through a new communication channel, Whatsapp, with peers and teachers. Users can easily ask questions by simple text (in any language they like) with lovely symbols- Emoji with no need to worry about grammar. Moreover, they can send voicemails rather than write. They are not willing to write sentences or paragraphs in emails to seek help or share with peers.

However, as suggested by some researchers, the e-portfolio could provide a technologically enhanced language learning environment (Bartolome & Steffens, 2011). Teachers observed that students were reluctant to read and write in English during the process of problem solving while using e-portfolios. However, students in this research study still used English to complete all of the requirements in the GE course, including personal information, 11 e-journal entries, and 1 essay. None of them had difficulties in completing the assignments in English. In addition, most of the interviewees preferred the biweekly submissions to only submitting one assignment at the end of the course. They were willing to write in English for assignments. They also found that comments and suggestions from the teacher improved their second submission after gaining more understanding of the topics. Reflection may enrich their motivation to learn topics and write in English.

Based on the findings in this research study, although the interface and resources in English discouraged some students' SRL, they found solutions from peers and teachers by using a communication channel they liked that allowed them to not care about language and grammar. Nonetheless, they enjoyed writing the assignments in English.

5.2.3 Higher Education Students' Motivation Can Be Improved Due to the Value of E-Portfolios

Based on the *Basic Education Curriculum Guide* (P1–P6; Education Bureau, 2014) and *Secondary Education Curriculum Guide* (Education Bureau, 2017b), schools and teachers should foster students' positive values and attitudes, such as perseverance, respect for others, responsibility, national identity, commitment, integrity, and care for others beginning in primary and secondary education. Although higher education students' positive values and attitudes have been fostered, there are differences in students' motivations, intentions, interpersonal perceptions, personal causations, and impersonal causations because of their different environments (Ryan & Connell, 1989).

All of the higher education students were responsible for managing their learning time, monitoring their work, intentionally seeking help when facing a problem, and learning online outside the classroom without the teacher's direct support. In this research study, students faced a large amount of coursework and assignments in their year-1 studies. They preferred to spend extra time and effort on the work and assignments they were interested in or that had more impact on their final grade.

Most of the students did not know or agree with the benefits of the e-portfolios. They did not

think it would benefit their learning or future development. They thought it was minor coursework because it comprised only 5% of their total grade. Most of them did not have any interest in developing their e-portfolios. They commented that the assignments could also be submitted by email, Moodle, or other convenient channel rather than by developing their e-portfolios. Their only motivation to complete the e-portfolio requirement came from the marks in this compulsory GE course. They believed that they would obtain a zero mark in this course if they did not complete it. Moreover, they gave up easily because of failures or peer influence.

5.2.4 Higher Education Students' SRL Cyclical Movement was Moving Faster and Continuously Repeated Due to the E-Portfolios

Most interviewees in this research study already had a learning pattern, behaviour, and attitude that had been fostered in their secondary school. Most students loved to write and check their assignments at the same time, such as by using the spelling- or grammar-checking function in Word. However, they did not think they should read or check the work again after submitting it. The infrequent use and unfriendly interface of the e-portfolio system discouraged their interest in exploring the e-portfolios. Certainly, a heavy coursework load from other courses was another reason. Although both the quantitative findings and interviewees' responses showed negative improvement in self-monitoring, they did check their work right away through the e-portfolio platform because of the direct outcomes available from the system. They were aware of their errors immediately in every task they had completed. They adjusted their strategies and corrected the mistakes at once, and intentionally checked their work again before uploading to the platform or submitting.

The quantitative findings may not reflect the actual results of SRL cyclical movement. However, from interviewees' responses, we believe that the speed of movement is faster because of the immediate outcome of e-portfolios. Students may adjust their plan, strategies, and effort immediately upon seeing the output from the screen in the e-portfolio system. On the other hand, SRL cyclical movement may repeat and continue moving because of the practice, experience, and reflection motivated by the e-portfolios.

5.3 Recommendations to Educators for Improving Higher Education Students' SRL with E-Portfolios

According to the findings from Hong Kong year-1 undergraduate students, some factors influenced their SRL before and during their actual practice with the e-portfolios. Some issues may be resolved by possible improvement, and recommendations are presented below for Hong Kong Education Bureau researchers' consideration.

5.3.1 Satisfaction with the Practice and Outcomes of E-Portfolios

Computer literacy is an essential ability in 21st century education. Today's higher education students have already had IT training in their secondary schools. Some of them started learning IT-related skills before their secondary education and have the proper IT knowledge and training (Education Bureau, 2002, 2017a, 2017b). They intentionally search for information by keyword through online search engines. They are familiar with using different applications for their coursework, such as Word, Excel, and PowerPoint. Based on teachers' observations and responses from interviewees, students do not have any difficulties with these kinds of applications.

Besides the general applications that students have learned and used before entering higher education, the e-portfolios can provide space for storing students' learning output and reflections by use of computerized text, graphics, sound, and video (Awwad et al., 2013). The e-portfolio project and online platform are new to students. Students should learn to use the system to fulfil the e-portfolio requirement. Some e-portfolio systems may not have been developed as user-friendly for students with different IT capabilities. Some students may find difficulties when working independently outside the classroom even though they have basic training from a workshop, tutorials, or online supporting information. According to a research study in Hong Kong, students' motivation dropped because of difficulties in learning new knowledge or techniques (Kember et al., 2011).

Although a user-friendly interface in an e-portfolio system may enhance students' satisfaction with the achievement of short-term goals, some students with low IT abilities may still find difficulties. According to the feeling of knowing (FOK) concept (Nelson & Narens, 1990), students may not recall what they learned from the workshop when they start to work on the e-portfolios. Suitable online supporting information is very important. Universities may consider preparing information not only in text but also in the form of photos or videos showing all steps of the development of the e-portfolios in the system. Interesting visuals with movement may improve students' understanding, which will further increase their motivation to learn. It is also in line with the four phases of cognitive motor skills, learning starting from observation, and then moving to imitation and self-control and benefit to self-regulation (Zimmerman & Kitsantas, 1997).

Findings from this research study also show that students' SRL was fostered by 11 biweekly

assessments to be uploaded to the e-portfolio system over two semesters, according to the course requirement. Most of the students did not feel pressure because each assessment's weighting was lighter than having one assessment for the whole course. They also benefitted from the repeated interaction with the e-portfolio system; moreover, they amended their plans after receiving teachers' comments and practicing self-reflection and self-evaluation.

Teachers may also group students of different IT abilities and let those with higher IT abilities help those with lower abilities through face-to-face interaction or some other convenient communication channel, such as Whatsapp.

When students solved problems, whether by self-effort, watching online videos, seeking help from a teacher or peers through any channel, or collaborating with others, we believe that students' SRL was fostered when they enjoyed, found interest in, and embraced the satisfaction of achievement with the e-portfolios.

5.3.2 Value Approach for E-Portfolios

Researchers suggested thinking about the theory of reasoned action (TRA), which was proposed by Fishbein and Ajzen (1975), to examine e-portfolio users' behaviours and intentions (Hsieh et al., 2015). Students' intentions, attitudes, behaviours, and motivations could be influenced by their beliefs of outcome. E-portfolios' predicted future use is one of the considerations.

E-portfolios provide opportunities for students to learn a new online application, gain digital literacy, have independent practice, use intentional learning, work with an online collection of

learning outputs, be reflective, and share with others (Alexander & Golja, 2007; Dennis & Hardy, 2006; Lorenzo & Ittelson, 2005). However, findings of this research study showed that most students' motivation to develop their e-portfolios stemmed from the academic result. Most of them did not know or agree with the value of e-portfolios, which is in line with the study by Yastibas and Cepik (2015), who also found that students do not clearly understand the principles of the use of e-portfolios. Most interviewees in this research study were only aware of this assignment's worth of 5% in one course only. Although the course was compulsory for all year-1 undergraduate students, they commented that all assignments in this course could also be submitted by other methods rather than uploading to the e-portfolio platform, such as by email submission or upload via Moodle.

Researchers suggested the e-portfolios could also become a student's official record for applying for jobs after graduation (Lorenzo & Ittelson, 2005; Mautadin, Santally, & Boojhawon, 2011). It could become not only a personal learning collection, but also a reflection of the owner's current work experience and progress, as well as future career and lifelong learning plan (Abrami & Barret, 2005; Hsieh et al., 2015).

When e-portfolios become official student records, it may enhance students' motivation to develop their e-portfolios, and they may think more critically about their goals. For example, students who plan to be primary English teachers after graduation may carefully and intentionally plan the relevant contents and artefacts to include in their e-portfolios, such as suitable teaching methods, their teaching experience, as well as insights, new ideas, and suggestions for teaching primary English. Their motivation may be fostered because of the value to their future career and not just the academic result of one course.

However, universities will face different challenges if e-portfolios become official student records. Many issues of the e-portfolio system should be considered, such as homegrown or open source systems, implementation, long-term maintenance, licensing, ownership, security, privacy, database, duration, and financial considerations (Lorenzo & Ittelson, 2005).

On the other hand, when e-portfolios become official student records, they may not only be collections of one course's learning outcomes. They should be a full collection of learning outcomes from all courses that students have completed. Therefore, universities may face other challenges because of the potential for different departments to be involved in a single project. The curriculum and assessment designs should be amended or improved to make e-portfolios comprehensive and useful.

An additional issue for universities is to acquaint employers in the market with the use of e-portfolios. If universities really solve all of the difficulties and let all students develop their e-portfolios until graduation, students will expect that this official record will provide benefit upon application for a job. It is difficult for a university to promise that this official record will be welcomed and accepted by employers in the market. Universities may need to arrange possible promotions of this e-record for all employees in the market (Lorenzo & Ittelson, 2005).

5.4 Limitation and Implications for Further Study

Further studies are needed to address the limitations of this research. In this study, we aimed to collect findings for all major factors of SRL, which are planning, self-monitoring, effort, self-efficacy, evaluation, and reflection, regarding higher education students' experiences and

perceptions of e-portfolios. Each finding may not have been discussed in detail or subjected to in-depth analysis with the relevant literature. Further in-depth studies are recommended for each factor on top of the initial findings in this research study.

On the other hand, we assumed each factor did not interact with the others, and we investigated each factor individually. Further studies with other data analysis methods should be considered, such as correlation, regression, or MANCOVA.

The findings in this research study were based on 134 year-1 undergraduate students in one course at one Hong Kong higher education institute only. The number of participants is too small to reflect the whole picture in the area. Larger samples from different countries, cultures, languages, and institutes are necessary for future studies.

In addition, there was no control group in this research study. The result fails to understand the difference between students who have practiced and those who have not practiced with e-portfolios.

We have only collected data from participants in year 1. Follow-up research is also important for understanding students' SRL after a few years in higher education.

On the self-report questionnaires used in this research study, all students scored themselves. The weighting of every score may not be equal among all individuals. Further studies with other measuring instruments and research methods should be considered as online or paper self-report questionnaires are also an issue. Teachers' observations and perspectives may also be included in further studies.

In this study, we believed the SRL cyclical movement was faster and continuously repeating because of the e-portfolios' immediate outcomes. Furthermore, the four phases of SRL may influence other phases that may not necessarily be in one direction based on the actual action with the e-portfolios. For instance, students may plan again after becoming aware of mistakes. Further studies may also aim to investigate whether other disciplines and specializations have similar or different results of the SRL cyclical movement.

5.5 Conclusion

Over the past decade, pedagogical practices in higher education have significantly moved towards student-centred and community-based modes of learning (Rovai & Jordan, 2004). In the 21st century, student learning has a new pattern. Although students go online every day, they love to learn about what interests them. However, they are still willing to expend effort on what they think is important even though they may not have interest in it. They find their favourite methods with different kinds of applications in problem solving. Researchers suggested that understanding students' beliefs and regulatory behaviours with problem solving frameworks is necessary (Cleary & Kitsantas, 2017). Despite the small sample of participants in this study and although the results may not successfully apply to all higher education students, the findings provide some interesting information that may give insight to researchers for further studies, such as the higher education students' online behaviour, communication channels, and value beliefs.

Many researchers found potential benefits of the e-portfolios for students' SRL, self-directed learning, learning outcomes, and assessments (Hyland & Kranzow, 2012; Lin, Yang, & Lai,

2013). Findings from this research study cover a wide picture of six core factors of SRL and support the statements and opinions from researchers in SRL with e-portfolios. A recent SRL measuring instrument, SRL-SRS, was applied. Moreover, many factors may influence and discourage the results, including students' background and personalities, which influence their motivation for developing the e-portfolios (Hsieh et al., 2015). Findings and information may benefit researchers and educators in this area.

Further studies using different perspectives, concepts, directions, focuses, methods, models, and measurements are important and necessary, and should aim to provide better understanding of the actual situation. Then, educators can make proper adjustments and improvements to reinforce the use of e-portfolios in higher education.

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Appendix A: Ethical Application Approval Letter

The Hong Kong Institute of Education
香 港 教 育 學 院

Powering Education

28 October 2014

Ms CHING Mei Ying
Doctor of Education Programme
Department of Curriculum and Instruction

Dear Ms Ching,

Application for Ethical Review <Ref. no. 2014-2015-0011>

I am pleased to inform you that approval has been given by the Human Research Ethics Committee (HREC) for your research project:

Project title: E-portfolios and Self-regulated Learning (SRL) – Case Study of Hong Kong College Students

Ethical approval is granted from the approved project start date to the project end date. If a project extension is applied for lasting more than 3 months, HREC should be contacted with information regarding the nature of and the reason for the extension. If any substantial changes have been made to the project, a new HREC application will be required.

Please note that you are responsible for informing the HREC in advance of any proposed substantive changes to the research proposal or procedures which may affect the validity of this ethical approval. You will receive separate notification should a fresh approval be required.

Thank you for your kind attention and we wish you well with your research.

Yours sincerely,

Cherry Ng (Ms)
Secretary
Human Research Ethics Committee

c.c.   Professor Dennis McInerney, Chairperson, Human Research Ethics Committee

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Appendix B: Participant Consent Form

THE HONG KONG INSTITUTE OF EDUCATION

Department of Curriculum and Instruction (C&I)

CONSENT TO PARTICIPATE IN RESEARCH

E-Portfolios and Self-regulated learning (SRL) – *Case study of Hong Kong College Students*

I _____ hereby consent to participate in the captioned research supervised by Prof. Lim Cher Ping and conducted by Ms. Ching Mei Ying.

I understand that information obtained from this research may be used in future research and may be published.   However, my right to privacy will be retained, i.e., my personal details will not be revealed.

The procedure as set out in the **attached** information sheet has been fully explained.   I understand the benefits and risks involved.   My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without negative consequences.

Name of participant

Signature of participant

Date

Appendix C: Original Version of SRL-SRS
(with factor loadings and explained variance)

		Planning	Self-monitoring	Evaluation	Reflection	Effort	Self-efficacy	R^2
1	I determine how to solve a problem before I begin.	.48						.22
2	I think through in my mind the steps of a plan I have to follow.	.55						.30
3	I try to understand the goal of a task before I attempt to answer.*	.38						.14
4	I ask myself questions about what a problem requires me to do to solve it, before I do it.	.66						.44
5	I imagine the parts of a problem I still have to complete.	.66						.44
6	I carefully plan my course of action to solve a problem.	.68						.46
7	I figure out my goals and what I need to do to accomplish them.	.55						.31
8	I clearly plan my course of action to solve a problem.	.74						.55
9	I develop a plan for the solution of a problem.	.76						.57
10	While doing a task, I ask myself questions to stay on track.*		.41					.17
11	I check how well I am doing when I solve a task.		.56					.48
12	I check my work while doing it.		.65					.43
13	While doing a task, I ask myself how well I am doing.		.62					.39
14	I know how much of a task I have to complete.*		.43					.19
15	I correct my errors.		.50					.25
16	I check my accuracy as I progress through a task.		.66					.44
17	I judge the correctness of my work.		.63					.40
18	I look back and check if what I did was right.			.73				.53
19	I double-check to make sure I did it right.			.69				.48
20	I check to see if my calculations are correct.			.57				.32
21	I look back to see if I did the correct procedures.			.67				.45
22	I check my work all the way through the problem.			.69				.47
23	I look back at the problem to see if my answer makes sense.			.67				.45
24	I stop and rethink a step I have already done.			.60				.36
25	I make sure I complete each step.			.50				.25
26	I reappraise my experiences so I can learn from them.				.66			.44

		Planning	Self-monitoring	Evaluation	Reflection	Effort	Self-efficacy	R^2
27	I try to think about my strengths and weaknesses.				.72			.51
28	I think about my actions to see whether I can improve them.				.72			.52
29	I think about my past experiences to understand new ideas.				.62			.39
30	I try to think about how I can do things better next time.				.70			.49
31	I keep working even on difficult tasks.					.58		.33
32	I put forth my best effort when performing tasks.					.70		.48
33	I concentrate fully when I do a task.					.64		.40
34	I don't give up even if the task is hard.					.55		.31
35	I work hard on a task even if it is not important.					.76		.58
36	I work as hard as possible on all tasks.					.77		.60
37	I work hard to do well even if I don't like a task.					.74		.55
38	If I'm not really good at a task I can compensate for this by working hard.					.63		.40
39	If I persist on a task, I'll eventually succeed.						.56	.31
40	I am willing to do extra work on tasks in order to learn more.					.64		.41
41	I know how to handle unforeseen situations, because I can well think of strategies to cope with things that are new to me.						.53	.28
42	If someone opposes me, I can find means and ways to get what I want.*						.34	.11
43	I am confident that I could deal efficiently with unexpected events.						.54	.29
44	If I am in a bind, I can usually think of something to do.						.54	.30
45	I remain calm when facing difficulties, because I know may ways to cope with difficulties.						.62	.39
46	I always manage to solve difficult problems if I try hard enough.						.71	.50
47	It is easy for me to concentrate on my goals and to accomplish them.						.50	.25
48	I can solve most problems if I invest the necessary effort.						.74	.54
49	When I am confronted with a problem, I usually find several solutions.						.60	.36
50	No matter what comes my way, I'm usually able to handle it.						.56	.31

Note: All factor loadings were statistically significant ($t > 2.00$).
*Items that are suggested to be removed from the SRL-SRS.

(Toering et al., 2012)

Appendix D: Final Version of SRL-SRS

THE HONG KONG INSTITUTE OF EDUCATION

Questionnaire about student's experiences and perceptions of the e-portfolio

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About this questionnaire

You are invited to participate in a research study conducted by Ms. Ching Mei Ying in the Department of Curriculum and Assessment at the Hong Kong Institute of Education. This is a part of a Doctor of Education research study and all data collected will only be used for the purposes of the study.

The purpose of this questionnaire is to collect your views about how you develop your e-portfolio. To better understand your experiences and perceptions of the e-portfolio, potential follow-up and interviews will be conducted during the two semesters in 2014/2015. Therefore, you are invited to provide your student number that will be used for data matching and follow-up research arrangements only.

All data collected in this questionnaire will be treated in confidence. Identifying information will only be used for data matching and follow-up research. Your participation is voluntary. If you have any questions or concerns about this research study, please feel free to contact the Principal Investigator, Ms. Ching Mei Ying, by her mobile number: ▮▮▮▮▮▮ or email: ▮▮▮▮▮▮▮▮▮▮ or the Secretary of Human Research Ethics Committee (HREC), Ms. Cherry Ng by email: cherryng@ied.edu.hk.

Please read all the instructions carefully and provide your responses to each question.

Section A

Please provide correct information for each item. Please fill in the blank space or choose the correct answer.

1	Student Number:	
2	Age:	
3	Year of study:	Year
4	Programme:	Bachelor of
5	I am a student from:	Local / Mainland / Overseas
6	Gender:	Male / Female

Section B

Please check the answer that is the most appropriate to describe how you work on the e-portfolio:

		Never	Almost never	Sometimes	Almost always	Always
		1	**2**	**3**	**4**	**5**
1	I determine how to complete each task of my e-portfolio before I begin.					
2	I think through in my mind the steps of developing my e-portfolio that I have to follow.					
3	I ask myself questions about what a difficult task requires me to complete when developing my e-portfolio, before I start.					
4	I imagine what difficulties I may encounter during developing my e-portfolio.					
5	I carefully plan my course of action to develop my e-portfolio.					
6	I figure out the goals of my e-portfolio and what I need to accomplish.					
7	I clearly plan my course of action to develop my e-portfolio.					
8	I work out a plan for developing my e-portfolio.					
9	I check my work while developing my e-portfolio.					
10	I check how well I am doing upon					

		Never	Almost never	Sometimes	Almost always	Always
	completion of all tasks of my e-portfolio.					
		1	**2**	**3**	**4**	**5**
11	While developing my e-portfolio, I ask myself how well I am doing on each task.					
12	I correct errors of my e-portfolio.					
13	I check my accuracy as I progress through my e-portfolio.					
14	I judge the correctness of my e-portfolio.					
15	I keep working even on difficult tasks of my e-portfolio.					
16	I put forth my best effort when developing my e-portfolio.					
17	I concentrate fully when I do each task of my e-portfolio.					
18	I don't give up even if the task of my e-portfolio is hard.					
19	I work hard on a task of my e-portfolio even if it is not important.					
20	I work as hard as possible on all tasks of my e-portfolio.					
21	I work hard to do well even if I don't like a task of my e-portfolio.					
22	If I'm not really good at a task of my e-portfolio, I can compensate for this by working hard.					
23	I am willing to do extra work on tasks of my e-portfolio in order to learn more.					
24	If I persist on each task of my e-portfolio, I'll eventually succeed.					
25	I know how to handle unforeseen situations when developing my e-portfolio, because I can think of strategies to cope with things that are new to me.					
26	I am confident that I can deal efficiently with unexpected events when developing my e-portfolio.					

		Never	Almost never	Sometimes	Almost always	Always
		1	**2**	**3**	**4**	**5**
27	If I am tied up when developing my e-portfolio, I can think of something to do.					
28	I remain calm when facing difficulties during developing my e-portfolio, because I know many ways to cope with difficulties.					
29	I manage to complete difficult tasks in my e-portfolio if I try hard enough.					
30	It is easy for me to concentrate on the goals of my e-portfolio and to accomplish them.					
31	I can complete most difficult tasks of my e-portfolio if I invest sufficient effort.					
32	When I am confronted with a difficult task of my e-portfolio, I find several solutions.					
33	No matter what comes my way during developing my e-portfolio, I'm able to handle it.					

		Never	Sometimes	Half of the time	Frequently	Always
		1	**2**	**3**	**4**	**5**
34	I look back at what I did to my e-portfolio and check if everything was right.					
35	I double-check to make sure I did my e-portfolio right.					
36	I check to see if my expectations for my e-portfolio are correct.					
37	I look back to see if I followed the correct procedures of my e-portfolio.					
38	I check my work all the way through each task when developing my e-portfolio.					
39	I look back at each task of my e-portfolio, to see if my action makes sense.					

		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
40	I stop and rethink each step I have already done to my e-portfolio.					
41	I make sure I have completed all procedures of my e-portfolio.					
		1	**2**	**3**	**4**	**5**
42	I evaluate the experiences of my e-portfolio so I can learn from each task.					
43	I assess my strengths and weaknesses when developing my e-portfolio.					
44	I think about how the actions of developing my e-portfolio can be improved.					
45	I utilize my past experiences to generate new ideas in completing my e-portfolio to achieve better results.					
46	I explore how I can develop my e-portfolio in better ways next time.					

End of the questionnaire.

Thank you for your participation.

Appendix E: Interview Questions

Semistructured: some preset questions and additional questions in response to participant's comments and behaviour.

Because participants are local students, interview will be conducted in Cantonese; therefore, they can express feelings and comments clearly and aim to have better communication and understanding.

After interview, all responses from participants will be translated to English. English expert will help to proofread the translated responses.

* Questions/contents that have been underlined may be changed based on different participants.

Topic	Subthemes	Interview question
Factors may affect students' SRL	~Personal behaviour and interest	~Which activities do you often do by using a computer or smartphone?
	~Knowledge and experience	~Had you ever heard about e-portfolio before you joined HKIED? ~ (If yes) Why? Can you tell something about your experience with e-portfolio?
Showing student's e-portfolio in computer	~May overlap different elements of SRL ~May get some information about the impact of SRL on the development of e-portfolio ~May not relate to the framework but benefit future study	This is your e-portfolio that you completed in the year-1 GE course. Can you tell me the procedure of your development of this? Any comments for your works, the platform, etc.?
Planning & goal setting (Framework) **Planning (SRL-SRS)**	Strategic planning Deciding the specific course of plan	~What have you done after the briefing from GEO and workshop from LTTC early in semester 1? ~How about before you upload e-journals and essay? ~What kind of artifices have you applied to your e-portfolio?

Planning Process		~Why and how do you choose these artifices?
	Goal setting Choosing a destination	~Have you gone through the e-portfolio template from LTTC's website? ~(If yes) Did you decide to follow this template? Why? ~Have you gone through the e-portfolio rubric in the GE course? ~(If yes) Which part(s) do you aim to reach? ~At that moment, did you imagine your e-portfolio? Is it similar to what you imagined?
	Forethought Forecasting Evaluating alternative routes	~Have you worried about this e-portfolio? Why? ~How do you overcome your worries? ~Besides the course's requirement, is there anything you wanted to achieve?
	About the responses from self-report questionnaires	~From your completed questionnaires', you changed from 'sometimes' to 'almost always' after you developed your e-portfolio for 2 semesters. What do you think about this change?
	The use of SRL to other courses, year 2, and future studies	~Have you applied this behaviour in other courses and also in your year-2 studies? Why?
Self-monitoring (Framework & SRL-SRS)	Perceive the action	~When will you check your e-portfolio, during the developing process, after completion, or when a tutor asks you to check? Why?
	Checking for comprehensive	~Which part(s) did you check during the process? Why? ~Which part(s) did you check after you completed a task? Why?
	Being aware	~How did you discover mistakes in the e-portfolio, by yourself or by your tutor's message?
	Checking for changes	~How many times did you double-check those contents or assessments after uploading to your e-portfolio?
	About the responses from	~From your completed questionnaires', you 'almost always' check, correct errors, and judge your correctness of

	self-report questionnaires	your e-portfolio before and after you developed it for 2 semesters. Is that your behaviour for all of your work? When and why do you have this behaviour?
	The use of SRL for other courses, year-2, and future studies	~Have you applied this behaviour in other courses and also in your year-2 studies? Why?
Controlling (Framework) Effort & Self-efficacy (SRL-SRS)	Restructuring the task	~Have you changed the steps of development during 2 semesters? Why? ~(If yes) How?
	Increasing and decreasing effort	~What kind of difficulties have you had during the process? ~How can you solve them?
	Selecting and adapting strategies for making meaning, controlling motivation and interest	~Do you enjoy developing your e-portfolio? Why? ~(If no) How do you motivate yourself to complete it?
	About the responses from self-report questionnaires	~From your completed questionnaires', you dropped from 'almost always' to 'sometimes' for continuing to work on difficult tasks and working to do well. What do you think about this change? ~From your completed questionnaires', you chose 'almost always' for working hard, persisting in unforeseen situations, confidence, etc. What do you think about this change?
	The use of SRL in other courses, year 2, and future studies	~Have you applied this behaviour in other course and also in your year-2 studies? Why?
Reflecting (Framework) Evaluation & Reflection (SRL-SRS)	Making judgment about understanding	~What have you thought after you completed every task of your e-portfolio? ~Have you thought of ways to improve? ~(If yes) How?
	Assessing the task within the context	~Can you give some examples of any changes you made in your e-portfolio?

	Reacting	~Why and how have you arranged these changes?
	Analysing feedback	~Have you taken any action after receiving your tutor's comments?
	Noticing, making sense, making meaning, working with meaning, and transforming learning to represent learning map	~What have you learned from this process? ~Can this benefit your next action?
	About the responses from self-report questionnaires	~<u>From your completed questionnaires', you have a big improvement in looking back and checking if your expectations are correct and stopping and rethinking what you have done.</u> What do you think about this change? ~<u>From your completed questionnaires', you have negative improvement in assessing your strengths and weaknesses, and exploring how to develop your e-portfolio in better ways next time.</u> What do you think about this change?
	The use of SRL in other courses, year-2, and future studies	~Have you applied this behaviour in other courses and in your year-2 studies? Why?

End