# SELF-REGULATED LEARNING IN MASSIVE OPEN ONLINE COURSES

by

**Daeyeoul Lee**

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**STATEMENT OF COMMITTEE APPROVAL**

Dr. Sunnie Lee Watson, Chair

Department of Curriculum and Instruction

Dr. William R. Watson

Department of Curriculum and Instruction

Timothy J. Newby

Department of Curriculum and Instruction

Judith Lewandowski

Director of Learning Design and Curriculum

**Approved by:**

Dr. Janet Alsup

*Dedicated to God and my family*

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# ABSTRACT

This three-article dissertation aims to examine self-regulated learning (SRL) in Massive Open Online Courses (MOOCs) through the conduct of a systematic literature review and two empirical studies. The first article is a systematic literature review study that investigates the current status of studies on SRL in MOOCs, SRL strategies employed by MOOC learners, and interventions and design guidelines that have been proposed to support SRL in MOOC environments. The second article is a quantitative study that examines the relationships between the use of SRL strategies, self-efficacy, and task value in MOOCs. This research notes that there is a positive relationship between the use of SRL strategies and self-efficacy as well as that between the use of SRL strategies and task value in MOOCs. The third article is a quantitative study that investigates the influence of successful MOOC learners' SRL strategies, self-efficacy, and task value on their perceived effectiveness of one particular MOOC. The results show that successful MOOC learners' perceived effectiveness of the MOOC is significantly predicted by their task value belief and use of SRL strategies. The findings of these three articles provide empirical evidence of the importance of SRL in MOOCs as well as a variety of practical implications for MOOC instructors and instructional designers.

# CHAPTER 1: INTRODUCTION

## My Interest in This Topic

As an educator, I always wanted to help students succeed in their own learning. When I taught students in a middle school for a teaching practice in South Korea, I observed that many middle school students were not aware of what it meant to be an effective learner. For example, they usually crammed and stayed up all night for preparing for exams. They did not know which learning strategies were effective for them. In addition, some students have lost their confidence as they have consistently received low grades. Based on this experience, I got interested in self-regulated learning (SRL). When online learning has been prevalent with the rapid development of the Internet, I observed that some students slept during taking online courses or procrastinated to watch lecture videos. I found that students faced more difficulties with regulating their learning in online learning environments than those in traditional classrooms. Since then, I especially wanted to do research on SRL in online learning environments.

When Massive Open Online Courses (MOOCs) have received much attention from educators, I found that they are more complex phenomenon than traditional online courses. It is because they are open to hundreds of thousands of learners who have diverse motivations and backgrounds. Due to high dropout rates, MOOCs have been criticized. However, I thought that MOOCs have greater potential to broaden educational opportunities to people all over the world. I also learned a lot from a MOOC which addresses learning analytics that was interesting to me. If people effectively learn in MOOCs, they could get benefits for their career goals, academic goals, or their personal growth, etc. While I took a MOOC, the following questions came into my mind: “How do other students manage their learning in MOOCs?”, “Which learning strategies do other students use to succeed in MOOCs?”, and “Which motivational factors affect other

students' learning in MOOCs?" Although a lot of researchers have focused on completion rates of MOOCs or learners' motivation to enroll in MOOCs, I looked at MOOCs in the context of SRL. If people do not have an ability to regulate their own learning in MOOCs, they cannot succeed in MOOCs. As a researcher, I wanted to help many learners succeed in MOOCs by researching SRL in MOOC environments as well as help MOOC practitioners offer better quality of MOOCs based on the understanding of learner behaviors and offer better support for their learners.

## Why Are MOOCs Something That We Should Care About?

MOOCs have attracted diverse learners all over the world without time and space constraints. They are free and provide an opportunity for learners to be members of a global community (Conole, 2015). Empirical study findings show that students positively perceive their experiences with MOOCs. For example, 84 college students responded to open-ended survey questions that MOOCs could contribute to lifelong learning (Cole & Timmerman, 2015). In addition, in a survey study by Milligan and Littlejohn (2017), benefit to their future career was a motivating factor for students who took three MOOCs. Faculty members also think that MOOCs are beneficial for students. For instance, 396 faculty members perceived student benefits from MOOCs in the following aspects: Access to high quality education, flexibility in education, self-paced learning with no grade pressure (Baker, Nafukho, McCaleb, Becker, & Johnson, 2015). Institutions and programs could also gain benefits from offering MOOCs. For example, 396 faculty members perceived that MOOCs offer opportunities for faculty professional development as well as for instructors to improve the quality of MOOCs (Baker, et al., 2015). However, as there are drawbacks and challenges to MOOCs, including the lack of resources and institutional leadership support (Baker, et al., 2015) and high dropout rates (Jordan, 2013), more research is

needed to better understand how to overcome the challenges and maximize the benefits of MOOCs.

The popularity of MOOCs was demonstrated by the New York Times, which proclaimed 2012 as the "Year of the MOOC" (Pappano, 2012). By the end of 2019, the total number of MOOC learners reached 110 million excluding China (Shah, 2019). In 2020 when the coronavirus has spread around the world, MOOCs have received much more attention from educators. People all over the globe who were staying at home to reduce the spread of the coronavirus diseases have used MOOCs as a tool to continue their education, sharpen their skills, or learn something new. Between March 17 and April 16 in 2020, overall U.S. enrollments of MOOCs offered by Coursera have increased by 607% from the same period in 2019 (McCluskey, 2020).

## Research Background

### Self-Regulated Learning

SRL theory emerged to "answer the question of how students become masters of their own learning processes" (Zimmerman, 2008, p. 166). Because several SRL models have been developed over the past two decades (e.g., Boekaerts, 1996; Pintrich, 2000; Zimmerman, 1989, 2000), definitions of SRL vary. For example, according to Zimmerman (2000), SRL refers to "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (p. 14). Pintrich (2000) defined SRL as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate and control their cognition, intentions and behavior, guided and constrained by their goals and the contextual features of the environment" (p. 453). In a recent review of existing SRL models,

Panadero (2017) explained that SRL generally "includes the cognitive, metacognitive, behavioral, motivational and emotional/affective aspects of learning" (Panadero, 2017, p. 1).

SRL has been considerably emphasized in education because numerous studies have shown that it is positively associated with students' academic achievement in face-to-face classroom settings (e.g., Wolters & Pintrich, 1998; Zimmerman & Schunk, 2001). Educators and researchers got very interested in how to develop self-regulated learners. "Self-regulated learners are proactive learners who incorporate various self-regulation processes (e.g., goal setting, self-observation, self-evaluation) with task strategies (e.g., study, time management, and organizational strategies) and self-motivational beliefs (e.g., self-efficacy, intrinsic interest)" (Cleary & Zimmerman, 2004, p. 538). To develop self-regulated learners, researchers have actively examined how to support students' SRL processes. Because an ability to self-regulate learning can be taught (Kitsantas, Winsler, & Huie, 2008), several interventions including undergraduate courses (e.g., Hofer & Yu, 2003), school-based programs (Cleary, & Zimmerman, 2004), and trainings (Dörrenbächer & Perels, 2016) have been developed and implemented.

**Self-Regulated Learning in Traditional Online Learning Environments**

With the rapid development of the internet, online learning has become more prevalent. Because online learning requires students to be more autonomous than in traditional face-to-face classrooms, they need to take greater responsibility to manage and control their own learning processes (Dabbagh & Bannan Ritland, 2005; Moore & Kearsley, 2012). Therefore, an ability to self-regulate learning has been more emphasized in online learning settings than in face-to-face classrooms. SRL has been identified as one of the vital factors that positively influence online learners' success (Cho & Shen, 2013; Dabbagh & Kitsantas, 2005). For example, SRL strategies, including time management, metacognition, effort regulation, and critical thinking, had

significant positive correlations with academic achievement in online higher education settings (Broadbent & Poon, 2015). Due to its positive effects, SRL has been considered a key factor in teaching online courses. In Bonk and Kim's (2006) survey, 22% of online instructors, instructional designers, and administrators responded that supporting their students' SRL processes was important. Considering differences between online learning environments and face-to-face classrooms, researchers have examined how to support online learners' SRL. For example, various instructional design strategies (e.g., Fisher, & Baird, 2005) or Web 2.0 technologies (e.g., Kitsantas, & Dabbagh, 2011) have been suggested as interventions to promote online learners' SRL.

**MOOCs**

As Open Educational Resources (OER) have been offered to educators, MOOCs have emerged as a new type of online learning. The term "MOOCs" originated in 2008 to describe an experiment about online courses offered to anyone for free by the University of Manitoba in Canada. At that time, around 2,300 learners enrolled in the courses. The original MOOCs covered several topics as follows:

> "connectivism and connective knowledge (CCK); personal learning environments and networks and knowledge (PLENK); online learning for today and tomorrow (EduMOOC); education, learning and technology (Change11); learning analytics (LAK12); the more technically involved on mobile learning (MobiMOOC) and digital storytelling (known as DS106) form the work of Groom & Levine (2011)" (Rodriguez, 2012, p. 2).

The initial MOOCs are commonly referred to as connectivist MOOCs or cMOOCs. The "c" in cMOOCs refers to connectivism. cMOOCs are designed based on a connectivism theory

Siemens (2005) proposed. According to connectivism, “the starting point for learning occurs when knowledge is actuated through the process of a learner connecting to and feeding information into a learning community” (Kop & Hill, 2008, p. 2).

Another type of MOOCs is called xMOOCs. The "x" in xMOOCs refers to extended. xMOOCs differ from cMOOCs in terms of pedagogy: xMOOCs are based on cognitive behaviorist pedagogy, while cMOOCs are based on connectivism pedagogy (Rodriguez, 2012). xMOOCs are “more traditional, content based, and more closely resemble traditional educational models” (El-Hmoudova, 2014, p. 30). xMOOCs were introduced by two professors at Stanford University in 2011: Thrun and Novig. They offered an online course about artificial intelligence to anyone around the world, which attracted over 160,000 (Friedman, 2012). Because of the subject, xMOOCs are sometimes called "AI MOOC." Since then, MOOC providers including Coursera, Edx, and Udacity have emerged, and several universities have joined in offering xMOOCs. The term "MOOCs" in this paper specifically refers to xMOOCs as used in news media (Kay, Reimann, Diebold, & Kummerfeld, 2013) and other empirical studies (e.g., Milligan & Littlejohn, 2016).

**Traditional Online Courses and MOOCs**

MOOCs are distinguished from traditional online courses in several ways. In terms of course structure, most MOOCs usually include short lecture videos, online discussion forums, and auto-graded quizzes (Glance, Forsey, & Riley, 2013). They offer open access to learning to anyone without previous qualifications (Milligan, & Littlejohn, 2016). Students can enroll in MOOCs for free except a small fee to earn a verified certificate. MOOCs have a large body of heterogeneous learners with different backgrounds and a variety of motivations (Breslow, et al., 2013). By putting hundreds of thousands of learners from all over the world into an online

learning space, MOOCs have changed the way students learn in traditional online courses (Johnson, Becker, Estrada, & Freeman, 2014). In MOOCs, learners do not necessarily need to follow linear learning paths recommended by MOOC instructors. They can complete MOOCs at their preferred pace (Johnson, Becker, Estrada, & Freeman, 2014). According to Hew and Cheung (2014), high dropout rates of MOOCs and the lack or low levels of instructors' presence or support are also main differences between MOOCs and traditional online courses.

**The Importance of Self-Regulated Learning in MOOCs**

Because MOOCs place "control of learning at the discretion of the learner" (Terras & Ramsay, 2015, p. 1), it is imperative to understand learners' behaviors required for autonomous learning in MOOCs (Terras & Ramsay, 2015). While little has been discovered about MOOC learners' behaviors, SRL has attracted attention as one of the core theories related to learner behaviors in earlier discussion of MOOCs (deWaard, 2011; Terras & Ramsay, 2015). For example, Terras and Ramsay (2015) claimed that individual learners' differences in motivation and self-regulation are key characteristics of learners in MOOCs. MOOCs require learners to "be autonomous and manage their own learning by making their own social and conceptual connections to suit their own needs" (Tschofen & Mackness, 2012, p. 126). Learners should determine when and how they study MOOC contents and choose in which learning activities they participate (Milligan & Littlejohn, 2014). In addition, there are low levels of instructors' guidance or support (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017) and social interaction (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014) in MOOCs. Therefore, individual learners' ability to regulate their learning is more important in MOOCs than in traditional online learning settings.

MOOCs have suffered from high dropout rates or low completion rates (Jordan, 2013). The results of an unofficial study showed that around 50,000 people typically enrolled in MOOCs, but average completion rates were lower than 10 percent (Jordan, 2013). Student retention has been an issue in online learning (Angelino, Williams, & Natvig, 2007). However, such a high level of MOOC dropout rates far exceeds that reported in traditional online courses, which makes it difficult to solve. To understand this unusual phenomenon, researchers have investigated why people drop out of MOOCs and found that lack of SRL skills is one reason. For example, results of a survey study by Nawrot and Doucet (2014) indicated that poor time management was one of the main reasons for dropping out of a MOOC. Additionally, SRL positively affects learners' completion of MOOCs. For instance, successful MOOC learners employed SRL strategies including effort regulation strategy to complete a MOOC. Future MOOC learners were advised to use them (Kizilcec, Pérez-Sanagustín, & Maldonado, 2016).

## Statement of the Research Problems

Despite the importance of SRL in MOOCs, there still is a lack of understanding of this topic compared to a large body of empirical research on SRL in traditional online courses. It might be in part attributed to the fact that most initial studies of MOOCs have mainly focused on retention, completion rates, or learning progress, which can be easily measured (Liyanagunawardena, Adams, & Williams, 2013). Results of a recent analysis of research proposals submitted to the MOOC Research Initiative (MRI) indicated that SRL and social learning are among five main themes that could provide a theoretical framework for future MOOC research (Gasevic, et al., 2014). However, the findings were limited to MRI research proposals, and completed empirical studies were not covered. Although reviews of literature on MOOCs have been conducted (e.g., Gasevic, et al., 2014; Liyanagunawardena, et al., 2013), no

review on empirical studies that have investigated SRL in MOOCs exists. Therefore, there is a need to identify the current state of research on SRL in MOOCs and offer recommendations for future research through a systematic review.

In addition, most studies on MOOCs have investigated SRL with a limited understanding of SRL theory. For example, theoretical frameworks of SRL have been missing in studies investigating SRL in MOOCs (e.g., Morales Chan, Hernandez Rizzardini, Barchino Plata, & Amelio Medina, 2015). One of the theoretical frameworks of SRL that can be applied in the context of MOOC is the social cognitive model of SRL. In traditional online learning environments, social cognitive models of SRL have been widely used as a theoretical framework to examine relationships between self-efficacy, task value, and SRL strategies (Artino, 2007b). According to social cognitive models of SRL, SRL is determined by personal factors such as self-efficacy and task value, behavioral factors such as use of SRL strategies, and environmental factors such as teacher feedback in a reciprocal way (Zimmerman, 1989). The relationships between self-efficacy, task value, and SRL strategies provide new insights on how to support online learners' SRL. For example, Artino (2008) suggested practical guidelines for online instructors based on literature published from 1995 to 2007, one of which is to increase students' self-efficacy and clarity task relevance. In MOOCs, several design principles or SRL interventions have been proposed to facilitate students' self-regulation processes (e.g., Milligan & Griffin, 2016; Nawrot & Doucet, 2014). However, motivational components of SRL such as self-efficacy and task value have been underestimated in designing MOOCs. To better support MOOC learners' SRL, there is a need to investigate the relationships between self-efficacy, task value, and SRL strategies in the context of MOOCs from a social cognitive perspective.

Although several empirical evidences have shown the effectiveness of SRL in traditional online courses, there lacks study bodies investigating the effectiveness of SRL in MOOC environments. One of the outcome variables that could be examined in MOOCs is perceived effectiveness. Perceived effectiveness is an important factor that significantly predicts learner retention of MOOCs (Sujatha & Kavitha, 2018). Although instructional design components have been revealed as critical factors that positively affect MOOC learners' perceived effectiveness (Hone & El Said, 2016; Jung, Kim, Yoon, Park, & Oakley, 2019), they have been investigated mainly from the perspective of instructors. Given that SRL and self-efficacy are also instructional design considerations for effective online courses (Liaw & Huang, 2013), they should be explored in MOOCs from the perspective of students. SRL strategies, self-efficacy, and task value have been identified as factors that positively influence perceived effectiveness in traditional online courses (e.g., Artino, 2007a; Artino, 2008; Cho & Cho, 2017). Results of studies on MOOCs show that learners used SRL strategies, self-efficacy, and task value to succeed in MOOCs (e.g., Littlejohn, Hood, Milligan, & Mustain, 2016; Milligan & Littlejohn, 2016). However, little is known about their effectiveness on perceived effectiveness of MOOCs. In addition, although successful MOOC learners' SRL has positive effects on other learners' success in MOOCs (Davis, Chen, Jivet, Hauff, & Houben, 2016), most studies have mainly focused on learners who did not complete MOOCs. Therefore, there is a need to examine the effects of successful MOOC learners' SRL strategies, self-efficacy, and task value on their perceived effectiveness of MOOCs.

The overall purpose of this dissertation is to examine SRL in MOOCs.

## Significance of the Study

This dissertation investigated SRL in MOOCs through three studies. Although SRL has been increasingly emphasized in MOOCs, research of SRL in MOOCs is still scarce. Findings of the three studies will not only contribute to the literature on SRL in MOOCs but also will offer guidance on future research on MOOCs. They also provide new insights into perspectives that could be applied in MOOCs and MOOC learner behaviors with instructors, researchers, and instructional designers. MOOC practitioners will be able to get information that may help them design MOOCs to support students' self-regulatory processes from the studies' findings. Additionally, since little is known about successful MOOC learners' SRL, the findings will help MOOC instructors and instructional designers better understand how successful learners use SRL strategies and motivational beliefs in MOOCs.

The next section describes the organization of this dissertation.

## Dissertation Organization and Overview of Chapters

This dissertation is a three-article dissertation (TAD). TAD generally consists of five chapters. Chapter Two, Chapter Three, and Chapter Four represent each research article. All three research articles were published in peer-reviewed journals. The three articles are related to each other under the umbrella topic of SRL and the context of MOOCs. Chapter Two provides a foundation for Chapter Three and Chapter Four by offering a systematic literature review on SRL in MOOCs and guiding future research on the topic. Chapter Three is a quantitative study examining relationships between components of SRL commonly found in empirical studies on SRL in MOOCs through Chapter Two. Chapter Four is a quantitative study investigating the effects of SRL components commonly identified in previous studies on SRL in MOOCs through Chapter Two.

## Chapter Two Overview

Chapter Two offers a systematic literature review of SRL in MOOCs. The study followed the procedures of systematic reviews Petticrew and Roberts (2008) proposed. Pintrich's (2000) SRL model was used as a theoretical framework to analyze literature published in peer-reviewed journals from 2008 to 2016. Research questions in the study are as follows:

1. What is the status of studies on SRL in MOOCs?
2. What effects of SRL on learning in MOOCs have been identified?
3. What SRL strategies have been identified in studies on SRL in MOOCs?
4. What supports have been suggested to promote SRL in MOOCs?

The results of the content analysis showed that the body of empirical studies on SRL in MOOCs has been growing, particularly since 2014. Empirical studies showed that SRL have positive effects on MOOC learning. In terms of SRL strategies, self-efficacy and task value were identified as motivational regulation strategies. Although particular cognitive regulation strategies were not identified, goal setting was found to be a metacognitive regulation strategy. Help seeking, time management, and effort regulation were identified as behavioral regulation strategies. In addition, several SRL interventions and design principles to support SRL have been suggested.

## Chapter Three Overview

Chapter Three presents a research study examining the relationships between SRL strategies, self-efficacy, and task value from a social cognitive perspective. Zimmerman's (1989) social cognitive model of SRL was employed as a theoretical framework to investigate relationships between SRL strategies, self-efficacy, and task value in two probability MOOCs. The study addresses the following research questions:

1. Are there relationships between learners' self-efficacy and their use of SRL strategies in MOOCs?
2. Are there relationships between learners' task value and their use of SRL strategies in MOOCs?

The participants were 184 learners who enrolled in two Probability MOOCs offered on the edX platform. The results of Pearson's correlation analysis indicated that there was a positive correlation between self-efficacy and the use of SRL strategies and a positive correlation between task value and the use of SRL strategies. The results of hierarchical multiple regression analysis revealed that both self-efficacy and task value significantly predicted the use of SRL strategies. The results of independent sample *t*-test showed a statistically significant difference in the use of SRL strategies between MOOC learners who had high self-efficacy and those who had low self-efficacy. In addition, they showed a statistically significant difference in the use of SRL strategies between MOOC learners who had high task value and those who had low task value.

**Chapter Four Overview**

Chapter Four offers a research study investigating influences of successful MOOC learners' self-efficacy, task value, and SRL strategies on their perceived effectiveness of a MOOC. The study addresses the following research questions:

1. Do successful MOOC learners' SRL strategies, self-efficacy, and task value predict their perceived effectiveness of a MOOC?
2. Which SRL strategies are positively related to successful learners' perceived effectiveness of a MOOC?

Participants of this study were 353 learners who were identified as completers of Mountain 101 MOOC offered on the Coursera platform. The results of stepwise multiple

regression analysis showed that perceived effectiveness was significantly predicted by both SRL strategies and task value. On the other hand, self-efficacy did not significantly predict perceived effectiveness of a MOOC. In addition, the results of another stepwise multiple regression analysis showed that metacognitive activities after learning, environmental structuring, time management significantly predicted perceived effectiveness.

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# CHAPTER 2: SYSTEMATIC LITERATURE REVIEW ON SELF-REGULATED LEARNING IN MASSIVE OPEN ONLINE COURSES

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**Abstract**

Despite arguments about the importance of self-regulated learning (SRL) in massive open online courses (MOOCs) (Terras & Ramsay, 2015), understanding of the topic is limited. This study offers a systematic review of empirical research on SRL in MOOCs. It revealed that the body of literature on SRL in MOOCs has grown from 2014 to 2016. The content analysis findings show that SRL was a factor positively influencing learning in MOOCs. SRL strategies were identified, including motivational regulation strategies, specifically self-efficacy, task value, and goal setting. Particular cognitive regulation strategies were not identified, and goal setting was found as a metacognitive regulation strategy. Regarding behavioural and contextual regulation strategies, help seeking, time management, and effort regulation were identified. In addition, several MOOC designs and SRL interventions that consider unique characteristics of MOOCs were proposed to promote SRL. Implications of these findings and future research are discussed.

## Introduction

A massive open online course (MOOC) generally refers to "a model for delivering learning content online to virtually any person-with no limit on attendance-who wants to take the course" (Educause Learning Initiative, 2011, para 4). MOOCs have changed traditional online learning by putting hundreds of thousands of learners from different geographical locations into an online space where they study at their preferred pace and according to their own learning style (Johnson, Becker, Estrada, & Freeman, 2014). Traditional online courses and MOOCs are distinguished by the fact that MOOCs are open to all applicants with freely accessible information and resources and do not typically require registration fees except for those learners seeking more formal certifications (Schulze, 2014). There is also a difference in goals and structures between regular online courses and MOOCs (Perna et al., 2014).

In MOOCs, "learners are expected to be autonomous and manage their own learning by making their own social and conceptual connections to suit their own needs" (Tschofen & Mackness, 2012, p. 126). Glance, Forsey, and Riley (2013) and Barnes (2013) explained that most MOOCs usually include short lecture videos with embedded questions, auto-graded quizzes, peer reviewing or assessment, and online discussion forums. As MOOCs place "control of learning at the discretion of the learner" (Terras & Ramsay, 2015, p. 1), it is essential to understand the learner behaviors required for autonomous learning in MOOCs (Terras & Ramsay, 2015). While little has been discovered about learner behaviors in MOOCs, self-regulated learning (SRL) has recently gotten attention as a crucial factor related to learner behaviors in MOOCs (deWaard, 2011; Terras & Ramsay, 2015).

SRL has been identified as one of the vital factors positively affecting students' success in traditional online learning environments (Cho & Shen, 2013; Dabbagh & Kitsantas, 2005). In

addition, how to support online learners' SRL has been widely examined (e.g., Artino, 2008; Fisher & Baird, 2005). Considering commonalities and differences between traditional online courses and MOOCs, there is a need for more empirical investigation of SRL in MOOCs. The findings of a recent analysis of research proposals submitted to the MOOC Research Initiative (MRI) show SRL and social learning is one of the five main topics for future MOOC research (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014). Although the analysis shed new light on the direction of future research on SRL in MOOCs, the results were limited to research proposals submitted to the MRI and did not cover completed empirical studies. The purpose of this study is to systematically analyse and report on the current state of research on SRL in MOOCs.

## Background Literature

SRL is generally defined as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate and control their cognition, intentions and behavior, guided and constrained by their goals and the contextual features of the environment" (Pintrich, 2000, p. 453). While researchers have developed several SRL models with different constructs (e.g., Boekaerts, 1996; Butler & Winne, 1995; Schunk, 1989 Zimmerman, 2000a), Pintrich (2000) developed a model classifying phases that other SRL models commonly shared (e.g., Zimmerman, 2000a) and areas for SRL. The model explains different aspects of SRL according to four phases: forethought, planning and activation; monitoring; control and reaction; and reflection.

The first phase of Pintrich's (2000) model consists of goal setting, planning, and activation of prior knowledge of the task, the context, and the self in connection to the task. The second phase involves monitoring processes. The third phase consists of controlling and regulating different parts of the task, the context, and the self. And the fourth phase consists of

reaction and reflection on the task, the context, and the self. Areas of SRL consist of motivation/affect, cognition, behavior, and context. SRL strategies identified in Pintrich, Smith, Garcia, and McKeachie's (1991) study are categorized in these areas. Motivational regulation includes intrinsic goal orientation, extrinsic goal orientation, control belief, self-efficacy, and text anxiety. Cognitive and metacognitive regulation consists of rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation, which consists of monitoring, regulating, and planning, including goal setting and task analysis. Behavioral and contextual regulation are composed of time and study environment, effort regulation, peer learning, and help seeking.

SRL has been identified as one of the important factors for students' success in traditional online learning environments (Cho & Shen, 2013). The findings of review research investigating empirical literature published from 1994 to 2006 indicated that self-efficacy had a positive correlation with the use of learning strategies, satisfaction with online courses, the likelihood of enrolling in future online courses, and academic performance (Artino, 2007). Broadbent and Poon's (2015) systematic review of research investigating SRL strategies related to academic achievement in online higher education settings published from 2004 to December 2014 found that time management, metacognition, effort regulation, and critical thinking had significant positive correlations with academic achievement in online higher education.

In terms of theoretical frameworks used in studies on SRL in online learning environments, the social cognitive model of SRL was particularly useful in analyzing SRL and students' success in traditional online courses (Artino, 2007). According to social cognitive models of SRL (Schunk, 1989; Zimmerman, 2000a), learning occurs with reciprocal interaction between personal variables such as self-efficacy, behavioral variables such as use of learning strategies, and environmental variables. Using social cognitive models of SRL, studies on SRL in

traditional online learning have focused on motivational components, especially self-efficacy and task value and the relationship between variables (Artino, 2007).

## Methods

### Procedure

This research was conducted based on the procedures of systematic reviews in social science, proposed by Petticrew and Roberts (2008). Systematic reviews are defined as literature reviews that stick closely to "a set of scientific methods that explicitly aim to limit systematic error (bias), mainly by attempting to identify, appraise and synthesize all relevant studies (of whatever design) in order to answer a particular question (or set of questions)" (Petticrew & Roberts, 2008, p. 9). The study followed Petticrew and Roberts' (2008) seven stages of systematic review: defining the research questions or the hypothesis, determining the types of studies, conducting a comprehensive literature search, screening the search results, appraising the included studies, and synthesizing the studies and assessing heterogeneity among the studies. The study also incorporated snowball methods (Greenhalgh & Peacock, 2005), which were used after the fifth stage, and involved reviewing citations and references of the studies included in the systematic review.

For this study, first, research questions were clearly defined. The following research questions were drawn from the literature on SRL in traditional online learning environments:

RQ1. What is the status of studies on SRL in MOOCs published from 2008 to 2016?

RQ2. What effects of SRL on learning in MOOCs have been identified?

RQ3. What SRL strategies have been identified in the studies on SRL in MOOCs?

RQ4. What supports have been suggested to promote SRL in MOOCs?

Second, criteria were established to determine the types of studies. Papers were limited to studies written in English and published in peer-reviewed journals in order to focus on quality, practicality and accessibility. The publication years were limited to between 2008 and 2016 based on the fact that academic papers on MOOCs first began to emerge in 2008 (Downes, 2008). In addition, inclusion and exclusion criteria were defined to screen the results of the search and select the most appropriate studies. Table 2. 1 shows the inclusion and exclusion criteria that were set.

Table 2. 1. Inclusion and Exclusion Criteria

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| Empirical studies investigating SRL in MOOC learning environment | Empirical studies examining SRL outside of MOOC learning environment |
| Empirical studies partially examining SRL in MOOC learning environment | Articles that present the same subcomponents of SRL but were grounded in other theories |
| Empirical studies that use SRL as a theoretical framework | Papers that provide only abstract |
| Empirical studies that apply components of SRL | Papers that are presentation materials |
| Publications that represent sub-components of SRL based on the SRL theory | Papers that do not offer study results |
| Articles that provide results | Duplicate report of the same study |
| Approved manuscripts which meet above inclusion criteria | |

**Databases and Search Terms**

After determining the types of studies to include or exclude, several databases and search terms were chosen to carry out the literature search. The search was modelled after a previous systematic review on SRL in online learning environments, which was conducted by Broadbent and Poon (2015). In terms of databases, the following databases were used for searching: Education Source, Education Full text, CINAHL, MEDLINE, ERIC, PsycINFO,

PsycARTICLES, Web of Science, and Google Scholar. With respect to search terms, a total of 23 search terms were used to comprise the search strings with the following Boolean expression (A1 OR A2 OR A3…OR A23) AND (B1 OR B2). Search terms for SRL were partially adapted from Broadbent and Poon's (2015) study. The asterisk was used in the search terms to broaden a search by discovering words that begin with the same letters. Table 2. 2 shows the terms that were used for searching.

Table 2. 2. Search Terms

| | |
|---|---|
| A1. Self regulat* learning strategy* | B1. Massive Open Online Course* |
| A2. Metacog* | B2. MOOC* |
| A3. Learning strategy* | |
| A4. Self regulat* | |
| A5. Rehearsal | |
| A6. Elaboration | |
| A7. Critical thinking | |
| A8. Monitoring | |
| A9. Time management | |
| A10. Effort regulation | |
| A11. Peer learning | |
| A12. Help seeking | |
| A13. Goal setting | |
| A14. Environment structur* | |
| A15. Self efficacy | |
| A16. Task value | |
| A17. Planning | |
| A18. Intrinsic goal orientation | |
| A19. Extrinsic goal orientation | |
| A20. Control belief | |
| A21. Test anxiety | |

**Search Results**

Papers on SRL in MOOCs were searched through a Midwestern university's library website and the Google Scholar website. In October 2016, the search of the selected databases

was completed. The search query resulted in 1467 hits in Education Source, Education Full text, CINAHL, MEDLINE, ERIC, PsycINFO, and PsycARTICLES. It also resulted in 295 hits in Web of Science. In addition, there were 510 hits in Google Scholar according to relevance. In the first selection step, titles, keywords, and abstracts of searched articles were read and the inclusion criteria were applied to screen the inappropriate articles. Through this process, many articles were eliminated, and a total of 47 articles remained: 15 (Education Source, Education Full text, CINAHL, MEDLINE, ERIC, PsycINFO, and PsycARTICLES), 7 (Web of Science), 0 (Dissertations & Theses), and 25 (Google Scholar). In the second selection step, titles and abstracts as well as contents of the 47 articles were read. Using the inclusion and exclusion criteria, 8 articles were excluded from the Education Source, Education Full text, CINAHL, MEDLINE, ERIC, PsycINFO, and PsycARTICLES. And an additional 19 articles were also excluded: 6 articles from Web of Science and 13 articles in Google Scholar. In the third step, the snowballing technique was performed on the remaining 20 articles. Reference lists of the 20 articles were scanned and citations to the papers were also tracked through the Web of Science database. This process resulted in an additional 3 articles. Two papers were excluded based on the exclusion criteria; one paper was presentation material, while another provided only the abstract. In the final step, the snowballing technique was implemented on the two papers, which gave rise to an additional paper. However, this paper was excluded as it did not provide study results. Finally, a total of 21 articles was selected as the most appropriate studies in this systematic review.

## Results and Discussions

Based on the research questions that were defined, the contents of the 21 articles were analyzed. The results and discussions are provided below.

### RQ1. What is the Status of Studies on SRL in MOOCs Published from 2008 to 2016?

Twenty out of 21 studies on SRL in MOOCs were published from 2014 to 2016. One paper was an approved manuscript which would be published in 2017. Among the total of 21 studies, two papers were published in 2014 and 7 papers were published in 2015. In addition, 11 papers were published in 2016. These results indicate that the topic of SRL in MOOCs has increasingly received attention from researchers and educators, and the body of empirical research on SRL in MOOCs has been growing, particularly since 2014. These findings are consistent with previous findings that SRL is one of the main themes of future research on MOOCs (Gasevic et al., 2014).

### RQ2. What Effects of SRL on Learning in MOOCs Have Been Identified?

Two studies show the effectiveness of SRL on MOOCs. In Magen-Nagar and Cohen's (2016) study, the results of the structural equation modelling path analysis show that learning strategy was a significant mediator for motivation and a sense of academic achievement in a MOOC for high-school students in flipped classroom settings. Kizilcec, Pérez-Sanagustín, and Maldonado (2016) found that goal setting and strategic planning were significant positive predictors of learners' goal achievement for three personal course goals: earning a course certificate, completing assessment, and watching lectures in the course. In addition, they discovered that learners who reported a high level of SRL skills in goal setting, strategic planning, self-evaluation, task strategies, and elaboration were apt to revisit course materials,

especially in course assessment. Studies on SRL in regular online learning found that SRL has positive effects on academic achievements (Artino, 2007). On the other hand, findings in this review show that SRL positively affects a sense of academic achievement, as well as motivation and learner behaviors. In light of these findings, MOOC instructors and designers should recognize the importance of SRL in MOOCs and should be able to support learners' SRL in MOOCs.

## RQ3. What SRL Strategies Have Been Identified in the Studies on SRL in MOOCs?

### *Motivational regulation strategies: Self-efficacy and task value*

Self-efficacy is defined as one's own beliefs in the ability to compete academic tasks (Pintrich, 1999). Five studies reported findings about self-efficacy. Three out of the 5 studies indicated that MOOC learners have high self-efficacy. Littlejohn, Hood, Milligan, and Mustain (2016) found that participants who were working as data professionals both with overall high SRL levels and low SRL levels had high self-efficacy scores in the Self-Regulated Learning at Work Questionnaire (SRLWQ). According to Morales Chan, Hernandez Rizzardini, Barchino Plata, and Amelio Medina (2015), all participants recorded high self-efficacy scores in the Motivated Strategies for Learning Questionnaire (MSLQ) in their SRL profiles. The results of the interviews in Milligan and Littlejohn's (2016) study indicate that 28 out of 35 participants identified as health professionals mentioned their high self-efficacy.

Findings from two studies provide evidence that self-efficacy is highly connected to familiarity with the task (Zimmerman, 2000b). The results of the interviews in a study by Littlejohn et al. (2016) revealed that high self-efficacy scores particularly relate to previous exposure to MOOC content. Hood, Littlejohn, and Milligan (2015) also found that the most

significant difference in self-efficacy scores in SRLWQ in a MOOC on teaching data science was between learners who were data professionals and those who were not. In addition, the results revealed that familiarity with MOOC platforms was also related to high levels of self-efficacy (Littlejohn et al., 2016). This is explained by the concept of online technologies self-efficacy, which has been actively examined in traditional online learning (Artino, 2007). Learners who feel comfortable with MOOCs do not need to spend much time figuring out how to watch lecture videos, use discussion boards, and assess peers' performances and feel confident in their ability to complete tasks in MOOCs.

In addition, self-efficacy for English was identified as a new form of self-efficacy. Liang-Yi (2015) found that there was a positive correlation between non-English learners' self-efficacy for English and cognitive learning strategies and motivation strategies. In traditional online SRL studies, many researchers have explored how the subcomponents of SRL relate to each other as well as how SRL relates to academic achievements as reviewed in Artino (2007). However, little has been uncovered about self-efficacy for English and SRL in traditional online learning environments. Considering that most MOOCs are offered in English and people around the world take them (Daniel, Cano, & Cervera, 2015), non-native English learners' self-efficacy for English could be one of the factors influencing learner behaviors in MOOCs. Therefore, the findings of Liang-Yi's (2015) study suggest that MOOC practitioners could consider self-efficacy for English as one of the unique characteristics of MOOC learners when they design a MOOC offered in English.

Task value refers to beliefs about the importance of the task and interest in the task (Pintrich, 1999). Findings from two studies demonstrated task value. According to Morales Chan et al. (2015), the highest mean values of MSLQ were shown in task value, and there was a

significant positive correlation between the task value, intrinsic goal orientation, and self-efficacy. In addition, qualitative findings specifically showed what values learners who have high levels of SRL place on tasks. The results of interviews in a study by Littlejohn et al. (2016) indicated that learners who worked as data professionals with high SRL levels placed greater value on the acquisition of skills and content knowledge in a MOOC than those with low SRL levels. Learners with high SRL levels were also more likely to connect the value of learning in a MOOC with professional contexts and roles because they perceived the usefulness of what they learned in the MOOC for their workplace. In light of these findings, it behooves MOOC instructors and designers to provide opportunities for learners to recognize the usefulness of MOOC content or how the content aligns with their interests so that learners recognize the task value.

In summary, studies on SRL in MOOC settings have investigated the extent to which learners have self-efficacy, task value, the values they place on MOOC learning, and what is related to their self-efficacy. On the other hand, studies on SRL in traditional online settings have focused on the relationships between variables such as self-efficacy, task value, and academic performances (Artino, 2007). This difference may be attributed to different theoretical frameworks. While social cognitive models of SRL have been mainly used in regular online courses, SRL models based on varied constructs (e.g., Pintrich, 2000; Zimmerman, 2000a) have been adopted in the selected studies. In addition, as SRL in the workplace has been increasingly emphasized (Margaryan, Littlejohn, & Milligan, 2013), professionals' motivational regulation strategies in MOOC environments have actively been investigated. MOOC practitioners and researchers could promote the forethought and planning phase for MOOC learning by considering self-efficacy and task value.

### *Cognitive and metacognitive regulation strategies: Goal setting*

Cognitive regulation strategies consisting of rehearsal, elaboration, organization, and critical thinking were not identified in the selected studies. However, task strategy, which is regarded as a cognitive regulation strategy, was examined in three studies (Hood et al., 2015; Littlejohn et al., 2016; Milligan & Littlejohn, 2016). Littlejohn et al. (2016) discovered through interviews that high SRL level learners who identified as data professionals were apt to have more flexibility in their approach to learning and determined their learning paths by themselves. In contrast, low SRL level learners were more apt to be linear and followed a structured approach to learning. Hood et al. (2015) found that learners who identified as data professionals had higher scores in task strategy in SRLWQ than those who took a MOOC for higher education qualifications. In Milligan and Littlejohn's (2016) study, 20 out of 35 participants stated in interviews that they took notes while taking a MOOC. However, there were differences between learners in terms of approach to learning. In terms of modification of learning approach, 20 out of 35 stated that they did not change their approach to the course because of their familiarity with the content and previous experiences with taking MOOCs. On the other hand, 15 out of 35 participants responded that they had changed their approach to learning while taking a MOOC.

Goal setting refers to setting task-specific goals that can provide guidance for cognition and metacognition (Pintrich et al., 1991). Five studies reported findings about goal setting. Findings of two studies showed that there are significant differences in the types of goals set. A study by Littlejohn et al. (2016) revealed that 12 out of 16 data professionals with high SRL levels mentioned in interviews that their goals focused on improving skills and knowledge in data science, which were tied to their workplace. In contrast, 7 out of 16 data professionals with low SRL levels tended to have goals related to extrinsic motivation, including certifications. In Milligan and Littlejohn's (2016) study, 28 out of 35 health professionals taking a MOOC

responded that they set specific goals for a MOOC. The results of interviews revealed that the type of goals significantly varied, including extrinsic outcomes and specific goals related to course content or intrinsic benefits of learning to their career, current role or personal satisfaction. Another two studies showed that goal setting positively affected MOOC learning. The results of Jo, Tomar, Ferschke, Rose, and Gasevic's (2016) study revealed that learners following appropriate goal setters participated longer in a MOOC, actively engaged in hands-on learning activities, and tended to review previous course materials more. Kizilcec, Pérez-Sanagustín, and Maldonado (2017) found that goal setting and strategic planning predicted learners' goal achievement for personal course goals. The results of a study by Onah and Sinclair (2016) indicated that 27 undergraduate students taking a blended MOOC had mean scores of 3.6 in the Online Self-regulated Learning Questionnaire (OSLQ) developed by Barnard, Lan, To, Paton, and Lai (2009). Based on findings about goal setting, it is recommended that MOOC instructors and designers provide activities where learners set their own goals for MOOCs even if the individuals' goals vary considerably.

In summary, cognitive regulation strategies were not identified and goal setting was identified as a metacognitive regulation strategy. These do not align with findings of a review study on SRL in regular online settings, which showed that rehearsal, elaboration, and organization, critical thinking, metacognition were actively examined to identify if they are related to academic achievements (Broadbent & Poon, 2015). This inconsistency is explained by different conceptualizations of SRL. The selected three studies used Zimmerman's (2000a) model of SRL, which includes task strategy as a subprocess. However, findings identified in this review suggest that MOOC instructors or designers should also provide support for cognitive and

metacognitive regulation processes based on the fact that MOOC learners used task strategies such as changing their approach to learning, taking notes, and setting goals.

### *Behavioral and contextual regulation strategies: Help seeking, time management, and effort regulation*

Help seeking involves seeking help from others (Pintrich et al., 1991). Findings of a study showed that there were differences between health professionals taking a MOOC in using the discussion forum (Milligan & Littlejohn, 2016). For example, 17 out of 35 stated in interviews that they actively participated in the discussion forum in a MOOC. While 12 out of 17 viewed the discussion forum as a positive experience, five out of 17 were less positive. Findings from another study indicated that 27 undergraduate students taking a blended MOOC recorded mean scores of 3.25 in the OSLQ (Onah & Sinclair, 2016). Considering MOOC learners should actively make connections with others, online discussion forums or social networking services could be vital sources of help seeking behaviors.

Time management refers to "scheduling, planning, and managing one's study time" (Pintrich et al., 1991, p. 25). Three studies showed that time management is a vital factor influencing MOOC learning. Survey results in Nawrot and Doucet's (2014) research showed that poor time management was the main cause of dropping out of a MOOC. In addition, the results of a study by Onah and Sinclair (2016) revealed that 27 undergraduate students taking a blended MOOC had low-level of time management scores in the OSLQ, showing mean scores of 2.95. These results are supported by several MOOC study findings that issues with time were one of the reasons for disengaging from MOOCs (Kizilcec & Halawa, 2015). However, traditional online course findings showed that students who completed traditional online courses differed significantly from dropout students with respect to academic locus of control and metacognitive

self-regulation (Lee, Choi, & Kim, 2012). These differences in dropout reasons might be explained by the more autonomous structures of MOOCs or personal reasons such as workplace workload and requirements, which could lead to poor time management. In addition, in a study by Kizilcec et al. (2016), a survey of successful MOOC learners revealed that time management was considered as one of the most important SRL strategies for succeeding in MOOCs. This finding is supported by the results of a review study on SRL in online higher education settings showing that time management was positively related to academic performances (Broadbent & Poon, 2015). Based on these findings, MOOC designers and practitioners should examine how to effectively support time management in a broad range of MOOC learners.

Effort regulation refers to controlling one's own effort and attention (Pintrich et al., 1991). The results of a survey in a study by Kizilcec et al. (2016) showed that effort regulation was the most important SRL strategy recommended by successful MOOC learners. While conclusions cannot be drawn from this single study, effort regulation strategy could be important in MOOC learning in light of previous findings that effort regulation strategy was positively correlated with improvement of academic achievement in regular online learning settings (Broadbent & Poon, 2015). Learners are likely to complete a course and succeed in MOOCs if they are able to persist when they face distractions such as other websites while watching lecture videos and undertaking uninteresting tasks.

### *New type of SRL behaviors emerging from MOOC data*

Findings from two studies showed that a new type of SRL behaviors which has not been identified in existing SRL models (e.g., Pintrich, 2000, Zimmerman, 2000a) emerged from MOOC data. In Diana, Eagle, Stamper, and Koedinger's (2016) study, results showed that attempting activities during video playback and re-reading page views were predictive of final

exam performance. Campbell, Gibbs, Najafi, and Severinski (2014) found that learners used lecture videos and discussion forums as resources for SRL strategies while repeatedly attempting to take quizzes from clickstream MOOC data. Little has been uncovered about these new types of SRL behaviors in regular online settings. It could be attributed to the unique structures of MOOCs. As most MOOCs are designed with short lecture videos that include embedded questions, auto-graded quizzes and online discussion forums, behaviors related to them could be a new indication of how learners regulate their MOOC learning.

## RQ4. What Supports Have Been Suggested to Promote SRL in MOOCs?

### *SRL interventions*

SRL interventions were identified in four studies. Two interventions were software programs: a Learning Tracker prototype widget designed with features that allow MOOC learners to compare their behaviors with successful MOOC learners' behaviors (Davis, Chen, Jivet, Hauff, & Houben, 2016), and ProSOLO software, which provides tracking of students' learning processes and course competencies (Dawson, Joksimović, Kovanović, Gašević, & Siemens, 2015). One intervention consisted of prompts of study tips on recommended SRL strategies in MOOCs (Kizilcec et al., 2016). Another intervention was a discussion of SRL strategies in a face-to-face MOOC study group (Chen & Chen, 2015). In addition, there were two types of interventions: retrieval practice cues embedded in a video lecture and a study planning module consisting of questions, examples, and reflection prompts (Davis, Chen, van der Zee, Hauff, & Houben, 2016).

Among these SRL interventions, only the Learning Tracker prototype widget significantly increased students' success in terms of the final grade and engagement in the

dimension of timeliness of the quiz answers (Davis, Chen, Jivet, et al., 2016). Learning Tracker is a dashboard, the main features of which are providing feedback and promoting metacognition through data visualizations of learners' own behaviors and successful learners' behaviors. On the other hand, four studies did not find any positive effects from SRL interventions. In a study by Kizilcec et al. (2016), there was no statistically significant difference in course outcomes and persistence between groups who were presented with study tips on SRL strategies employed by successful MOOC learners and those who were not. Dawson et al. (2015) revealed that the number of completed competencies in a MOOC was low in the ProSOLO software, which was developed based on the principles of SRL. Davis, Chen, van der Zee, et al. (2016) found that there were no statistically significant differences in weekly quiz grades and final grades between learners who got retrieval practice cues embedded in a video lecture in a MOOC and those who did not. In addition, there were no statistically significant differences in final grades, course persistence, and engagement between MOOC learners who were exposed to a module about study planning and those who were not (Davis, Chen, van der Zee, et al., 2016). Chen and Chen (2015) did not investigate the effectiveness of a discussion of SRL in a MOOC study group.

In traditional online courses, training and prompting have been mainly identified as effective interventions to support students' SRL for academic performances (Rowe & Rafferty, 2013). In addition, web-based pedagogical tools and Web 2.0 tools have been used in online courses to promote SRL (e.g., Dabbagh & Kitsantas, 2005; Kitsantas & Dabbagh, 2011). On the other hand, researchers have tried to design SRL interventions such as a dashboard or platform that could be embedded in MOOCs. In light of these findings, MOOC researchers could design and develop unique software programs which fit in with MOOC platforms and provide personalized support for SRL. In addition, successful MOOC learners' SRL behaviors have been

used as an indication of desired learner behaviors in MOOCs. These findings suggest that MOOC designers could consider the desired SRL behaviors which are applicable to most MOOC learners and how to promote their metacognition.

### *MOOC design*

Five studies proposed different MOOC designs to promote SRL in MOOCs. Park, Cha, and Lee (2016) developed design guidelines for learning analytics to promote learners' SRL in MOOCs, as shown in Table 2. 3.

Table 2. 3. Design guidelines of learning analytics to promote SRL in MOOCs

| Dimensions of SRL strategies | Final design guidelines for facilitating SRL in MOOC environments |
|---|---|
| 1. Self-evaluation | 1.1. Content analysis of learners' reflection |
| | 1.2. Learning history compared to others (achievements, progress, activities, e-portfolio, etc.) |
| 2. Organizing and transforming | 2.1. Learners' preferred contents types (video clips, texts, images, voices, etc.) |
| | 2.2. Student's participant activity records to upload and author contents |
| 3. Goal-setting and planning | 3.1. Setting learning objectives and plans for effective time management |
| | 3.2. Monitoring learners' plans |
| 4. Keeping records and monitoring | 4.1 Records of students' learning activities such as note-taking, searching, downloading, and printing |
| 5. Rehearing and memorizing | 5.1 Details about participation in the exercise, discussion, homework, etc. |
| 6. Reviewing records | 6.1 Quantitative and qualitative analysis of learning exercise such as quiz, discussions and exams for reviewing |
| 7. Seeking information | 7.1. References and links referred by learners and others |
| 8. Seeking social assistance | 8.1. Q&A to overcome problems or solve the problems |
| 9. Self-consequences | 9.1. History of certificates or credits with invested time and earned achievement scores |
| | 9.2. Enrolled and completed rates of courses monthly or annually |
| 10. Structuring personalized learning environments | 10.1. Recommending courses for each learners' level or interest |
| | 10.2. Feedback on learning success and failure appropriate for individual learning |

*Note*. Adapted from Adapted from Park et al., 2016.

Milligan and Griffin (2016) derived four MOOC design principles from progression of developmental continuum of crowd-sourced learning (C-SL) capability, which refers to the capability to create higher order learning. Among them, the second and fourth design principles address how to design a MOOC to promote SRL as shown in Table 2. 4.

Table 2. 4. Design principles to promote SRL in a MOOC

| |
|---|
| Design principle 2: Scaffold activities to generate and support self-regulation, crowd-sourced learning<br>• Redesigned automated assessments as extension activities, exploring application and synthesis rather than recall and understanding of concepts covered in video materials.<br>• Doubled the number of automated quizzes and quiz questions, to cover most aspects of the course, allowing recursiveness, focus, and critical consumption.<br>• Targeted new quiz exercises to areas of confusion identified in first running<br>• Trimmed videos to reduce viewing time overall to encourage time commitment to production and engagement rather than consumption.<br>• Designed quiz exercises to clarity for participants the professional standards inherent in the major assignment, providing practice on using the rubrics provided for peer- and self-assessment. |
| Design principle 4: Support participants' metacognition of how to learn in a MOOC<br>• Messaged through weekly emails about purposes of forums, encouraging dialogues and reciprocity, risk-taking and perspective taking, and production.<br>• Provided a resource site that included description of expert behavior and self-assessment tools. |

*Note*. Adapted from Milligan & Griffin, 2016.

García Espinosa, Tenorio Sepúlveda, and Ramírez Montoya (2015) proposed a template design for MOOCs focusing on self-motivation and self-regulation to increase persistence and active participation of less motivated-students in a MOOC. Table 2. 5 shows examples of a MOOC design template focusing on SRL.

Table 2. 5. Template design of MOOC focusing on self-regulation and self-motivation

| **Type of activity** | **Activity detail** | **OER support activities** |
|---|---|---|
| Recognize low self-regulated or self-motivated students | Describe and justify the procedure to identify such students. | Survey, etc. |
| Self-regulation promotion | Generalized or voluntary call to identify low self-regulated students to perform activities such as reducing distractions, improving organization, distinguishing important information, looking for assistance, etc. Offer at least seven activities. | Corrective activity, monitoring, etc. |

*Note. Adapted from García Espinosa et al., 2015.*

Nawrot and Doucet (2014) proposed MOOC system features as a solution to address time management, which, as Table 2. 6 shows, was identified as a main cause of dropping out from a MOOC.

Table 2. 6. Proposed MOOC system features to support time management

| Phases | System features |
|---|---|
| Planning | 1) Tasks and activities identification<br>: MOOC platforms should offer the possibility to specify the tasks needed to accomplish the goals (specifically courses to take and external resources to check)<br>2) Time allocation<br>: MOOC platform should also provide support for predictive time allocation.<br>3) Scheduling features<br>: MOOC platform should assist their users in scheduling. |
| Practicing and monitoring | MOOC platforms should send reminders, solve potential conflicts and visualize progress. |
| Evaluating | MOOC platforms should provide them with reports on their progress on each course and offer an overall progress report. |

*Note. Adapted from Nawrot & Doucet, 2015.*

Littlejohn and Milligan (2015) proposed two sets of design tools that can guide instructors and instructional designers in designing MOOCs to support professional learners' SRL: MOOC-SRL patterns and MOOC Design Team Questionnaire.

First, SRL patterns were designed based on the results of a survey and interview. They were presented in five categories: adaptable course goals/objectives, reflect on both theory and practice, capitalize on diversity, break down the barriers, and productive MOOCs. First, adaptable course goal/objectives explains that instead of setting rigid course objectives, it is recommended that instructors enable MOOC learners to set their own goals, which increases motivation and academic outcomes. Second, reflect on both theory and practice allows learners to connect what they learned in a MOOC with their professional work. Third, capitalize on

diversity explains that MOOCs designers can allows learners to interact with others and build community unity by changing the challenges resulting from MOOC learners' diverse backgrounds and characteristics into benefits. Fourth, in the break down the barriers category, MOOC designers can encourage learners to bring their professional networks into courses, which can break down the barriers between work and learning. Finally, productive MOOCs explains that designers can provide authentic tasks to make MOOC learning more valuable to learners.

The MOOC Design Team Questionnaire was developed to help platform developers, course design teams, and instructors and course teaching assistants to design MOOCs that better support MOOC learners' SRL. It consisted of five broad categories: pedagogy overall, SRL overall, forethought phase, performance, and self-reflection.

In summary, each study designed a MOOC with a different focus. Perhaps the different theoretical frameworks of SRL such as Zimmerman and Pons' (1986) model and Zimmerman's (2000a) model lead to different forms of design guidelines or principles. As conceptualizations of SRL are diverse, MOOC designers could consider and select an appropriate framework of SRL when designing a MOOC. In addition, designing activities to promote SRL as well as aspects of technology such as lecture videos and automated-assessment could be a possible factor that MOOC designers or instructors could consider when designing MOOCs. While research on designing regular online courses has mainly focused on the integration of Web-based social media technologies with course design (e.g., Fisher & Baird, 2005) or practical guidelines for instructors (Artino, 2008), specific design guidelines or templates have been proposed in selected studies. Findings identified in this review provide new insights on how to design MOOCs to support the SRL of a broad range of MOOC learners.

## Conclusions

This systematic review describes the current state of research on SRL in MOOCs. This study showed that research on SRL in MOOCs has increasingly grown, as evidenced by the fact that articles from 2008 to 2016 were reviewed, but no relevant articles were identified until 2014. However, since 2014, 20 studies on SRL in MOOC have been published and an approved manuscript to be published in 2017 was identified. The findings of the present review confirmed the importance of SRL in MOOCs. It was revealed that SRL positively affected MOOC learning and learners used SRL strategies in MOOCs. Self-efficacy, task value, and goal setting have been examined as motivational regulation strategies. Particular cognitive regulation strategies were not identified and goal setting was identified as metacognitive regulation strategy in selected studies. Help seeking, time management, and effort regulation were identified as behavioral regulation strategies. Findings of SRL in MOOCs tend to be different from those of SRL in traditional online learning with respect to SRL strategy. This is attributed to different frameworks of SRL and the unique characteristics of MOOCs. In addition, it was found that diverse interventions such as dashboard and platform, and design guidelines or principles were suggested. Findings of this review could offer potential new insights and directions for future research on MOOCs. In addition, this study could provide MOOC practitioners with information about MOOC learner behaviors related to SRL and the importance of supporting SRL in MOOCs.

There are limitations when considering the implications of this study. As the search period for identifying potential articles concluded at a certain date, any articles published after that point would not be identified in this review. In addition, the scope of this review is limited to comparisons between empirical studies on SRL in traditional online courses and MOOCs. SRL strategies which were not grounded in Pintrich's (2000) model of SRL were not analyzed. Based

on the findings of this review, directions for future research are provided. First, researchers should investigate SRL in MOOC environments in an ongoing basis to contribute to the growing body of literature. In addition, they should investigate other SRL strategies that were not reviewed in this study, relationships between SRL strategies, and other aspects of SRL such as emotion regulation by using different models of SRL. Another recommendation is to further examine indications of new types of SRL behaviors from other MOOC data. Researchers should also examine the effectiveness of MOOC designs that were proposed in the selected studies. Finally, SRL of different professionals such as teachers in different contexts should be explored.

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# CHAPTER 3: THE RELATIONSHIPS BETWEEN SELF-EFFICACY, TASK VALUE, AND SELF-REGULATED LEARNING STRATEGIES IN MASSIVE OPEN ONLINE COURSES

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**Abstract**

This study examines the relationships between self-efficacy, task value, and the use of self-regulated learning strategies by massive open online course (MOOC) learners from a social cognitive perspective. A total of 184 participants who enrolled in two MOOCs completed surveys. The results of Pearson's correlation analysis show a positive correlation between self-efficacy and the use of self-regulated learning strategies, as well as a positive correlation between task value and the use of self-regulated learning strategies. The results of hierarchical multiple regression analysis show that self-efficacy and task value are significant predictors of the use of self-regulated learning strategies. There was a statistically significant difference in the use of self-regulated learning strategies between learners who possessed high self-efficacy and those who possessed low self-efficacy. In addition, learners who had high task value showed statistically significant higher average self-regulated learning scores than those who had low task value. Implications and future research directions are discussed based on the findings.

## Introduction

Since the evolution of open educational resources (OER), massive open online courses (MOOCs) have emerged as a new platform for online learning. MOOCs differ from traditional online courses, which "charge tuition, carry credit and limit enrollment to a few dozen to ensure interaction with instructors" (Pappano, 2012, p. 2), in several aspects; for example, MOOCs provide open access to education regardless of learners' previous experiences (Milligan & Littlejohn, 2016), and their course structures consist of lecture videos, auto-graded quizzes, and online discussion forums (Glance, Forsey, & Riley, 2013). In MOOCs, more than 1 million learners from all over the world are put into an online space where they complete tasks at their preferred pace (Johnson, Becker, Estrada, & Freeman, 2014). However, in MOOCs, there is a lack of interaction between instructors and learners, as well as the availability of significant learner support. These unique characteristics of MOOCs require learners to have an ability to self-regulate their own learning more than in traditional online courses.

Self-regulated learning (SRL) has been regarded as one of the vital factors positively affecting learners' success in traditional online learning environments (Cho & Shen, 2013). In a recent systematic literature review study by Lee, Watson, and Watson (2019), it has been revealed that SRL positively influences learning in MOOCs as well. In addition, a broad range of learners participating in MOOCs commonly display self-efficacy and task value, as well as employ several SRL strategies to succeed in MOOCs (Lee et al., 2019). However, little is known about the relationships between self-efficacy, task value, and the use of SRL strategies in MOOCs. Studies on SRL in traditional online learning environments have shown that there are positive relationships between self-efficacy and the use of SRL strategies (e.g., Artino & Stephens, 2006). Task value is also positively related to the use of SRL strategies (Hsu, 1997).

These findings provide instructors and instructional designers with new insights on how to design online courses to support learners' self-regulation in terms of motivation and SRL strategies (e.g., Artino, 2008).

Several MOOC design principles or guidelines have been suggested as ways to support MOOC learners' SRL (e.g., Milligan & Griffin, 2016; Nawrot & Doucet, 2014). However, most have underestimated the motivational aspects of SRL such as self-efficacy and task value. For example, Nawrot and Doucet (2014) only focus on how to support MOOC learners' time management. This might be attributed to the use of different theoretical frameworks of SRL in the initial stage of research on SRL in MOOCs, such as Zimmerman and Pons's (1986) model, which focuses on other dimensions of SRL including seeking information (Lee et al., 2019) and the lack of understanding of the relationships among components of SRL. Therefore, the present study employed Zimmerman's (1989) social cognitive model, which has been widely used to examine the relationships in traditional online learning environments.

The purpose of this study is to examine the relationships between self-efficacy, task value, and SRL strategies in MOOCs from a social cognitive perspective.

## Literature Review

### SRL Strategies, Self-Efficacy, and Task Value in Traditional Online Learning Environments

SRL is generally defined as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p.14). SRL has been identified as a vital factor in positively influencing learners' success in online learning environments (Cho & Jonassen, 2009; Dabbagh & Kitsantas, 2005). In a recent review

of literature on SRL in online higher education settings published from 2004 to 2014, it was identified that SRL strategies, specifically time management, metacognition, effort regulation, and critical thinking, were positively correlated with academic outcomes (Broadbent & Poon, 2015). In addition to SRL strategies, self-efficacy and task value have been regarded as important motivational beliefs for online learners' success. Self-efficacy refers to "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994, p. 71). The findings of review studies on self-efficacy in online settings indicate that self-efficacy is positively related to academic performance in online learning environments (Hodges, 2008; Tsai, Chuang, Liang, & Tsai, 2011). Task value is defined as "students' evaluation of how interesting, how important, and how useful the task is" (Pintrich, Smith, Garcia, & McKeachie, 1993, p. 11). The results of empirical studies show that task value is a positive predictor of learners' satisfaction with online courses (Artino, 2007a; Lee, 2002), as well as perceived learning and intentions to enroll in future online courses (Artino, 2007a).

**Social Cognitive Models of SRL**

With the importance of these factors in online learning environments, the relationships among them have received attention from researchers from a social cognitive perspective. According to social cognitive models of SRL, self-regulation is viewed as a triadic relationship among three processes: personal, behavioral, and environmental (Zimmerman, 1989). The models have been reinterpreted by researchers to fit with online environments because of social cognitive models of SRL being identified as applicable in several empirical studies on online learning environments (e.g., Artino, 2007b). According to researchers' reinterpretations of social cognitive models of SRL (Cho, Demei, & Laffey, 2010; Wang & Lin, 2007), motivational

factors, specifically self-efficacy and task value, are commonly identified as personal influences on learning in online settings. Self-efficacy is especially emphasized as a key variable by social cognitive theorists (e.g., Bandura, 1986; Zimmerman, 1989). In addition, the use of SRL strategies, including cognitive and meta-cognitive strategies, is commonly found as a behavioral factor. Suggested environmental factors include peer/teacher feedback, modeling, achievement (Wang & Lin, 2007), social presence, and sense of community (Cho et al., 2010).

### The Relationships Between SRL Strategies, Self-Efficacy, and Task Value in Traditional Online Learning Environments

Using social cognitive models of SRL as a theoretical framework, initial studies on SRL in traditional online learning environments have mainly explored the relationships between self-efficacy, task value, and SRL strategies (Artino, 2007b). They started with the aim of discerning whether relationships found in face-to-face classroom settings are generalizable to online courses (Whipp & Chiarelli, 2004). The findings of several studies on SRL in the context of middle school and college classrooms show students' self-efficacy and task value to be positively related to their use of SRL strategies (e.g., Pintrich, 1999; Pintrich & De Groot, 1990). Based on these findings, Pintrich (1999) has concluded that self-efficacy and task value help students promote and sustain SRL. The role of self-efficacy and task value in self-regulatory processes is also shown in Zimmerman's (2002) model of three cyclical phases of SRL proposed from a social cognitive perspective. For instance, in the first phase of self-regulatory processes, students' self-efficacy and task value start with the use of learning strategies, including goal setting and strategic planning (Zimmerman, 2002).

The findings of studies on SRL in traditional online learning environments parallel those in face-to-face classroom, indicating that self-efficacy is positively related to the use of SRL strategies (e.g., Artino & Jones, 2012; Artino & Stephens, 2006; Cho & Shen, 2013; Joo, Bong, & Choi, 2000; Shea & Bidjerano, 2010). For example, Cho and Shen (2013) found positive correlations between self-efficacy and SRL strategies, including metacognitive regulation and interaction regulation, by administering surveys with 64 students who were taking an online course delivered via Blackboard. Shea and Bidjerano (2010) also discovered a positive correlation between self-efficacy and effort regulation strategy through the analysis of survey responses of 2,418 students who had taken online courses. These findings show that the more self-efficacious students are, the more likely they are to use SRL strategies in traditional online courses. In addition, it was revealed that online learners' self-efficacy was a significantly positive predictor of their use of cognitive strategies (Artino & Jones, 2012; Joo et al., 2000). These findings align with the finding that students' self-efficacy beliefs are a predictor of how they behave (Pajares, 2002).

Task value is also positively related to the use of SRL strategies in traditional online learning settings (e.g., Artino & Jones, 2012; Artino & Stephens, 2006; Hsu, 1997). For example, Hsu (1997) found positive correlations between task value and metacognition, time and environment management, and effort regulation and help-seeking strategies in 169 online learners. Artino and Stephens (2006) also discovered positive correlations between online learners' task value and their use of cognitive strategies, including elaboration and critical thinking, and metacognitive strategies. The more students believe that tasks in online courses are interesting, important, or useful, the more likely they are to use SRL strategies. In addition, study findings show that task value is a significantly positive predictor of use of SRL strategies (Artino

& Jones, 2012; Artino & Stephens, 2006). For example, task value has been revealed as a significant positive predictor of elaboration, critical thinking, and metacognition strategies (Artino & Stephens, 2006).

The relationships between self-efficacy, task value, and use of SRL strategies found in traditional online learning settings offer new insights on how to design online courses to support students' SRL. Online course instructors, as well as instructional designers, recognize that SRL is important for students to succeed in online learning (Kim & Bonk, 2006). However, little has been found about how to support online learners' SRL. Based on study findings about the relationships between self-efficacy, task value, and use of SRL strategies, the importance of roles that motivation such as self-efficacy and task value play in SRL processes (Pintrich, 1999; Schunk & Zimmerman, 1998) as well as how they relate to use of SRL strategies have been considered in designing online courses. For example, Artino (2008) provided online instructors with practical guidelines for supporting students' SRL based on the findings of empirical studies between 1995 and 2007. One of the guidelines was to develop and support students' self-efficacy, clarifying task relevance and design activities that are grounded in authentic problems to generate interest.

**SRL Strategies, Self-Efficacy, and Task Value in MOOCs**

Since the evolution of OER, MOOCs have emerged as a new platform for online learning. MOOCs are different from traditional online courses in several aspects. They provide open access to education for all applicants regardless of their previous qualifications or experiences (Milligan & Littlejohn, 2016), typically without registration fees, except for learners pursuing verified certification (Schulze, 2014). In addition, MOOCs promote online learning at a massive scale by attracting millions of learners (Milligan & Littlejohn, 2016). In terms of course

structure, most MOOCs consist of lecture videos, auto-graded quizzes, and online discussion forums (Glance et al., 2013). A broad range of learners with different backgrounds enroll in MOOCs with diverse motivations. They complete tasks in MOOCs at their preferred pace without following linear learning paths (Johnson et al., 2014). However, individual learners who take MOOCs should be more autonomous than those who take traditional online courses. This is because they need to determine which learning activities they will participate in and when and how they will complete them (Milligan & Littlejohn, 2016). The lack of instructor support (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017) as well as limited social interaction (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014) require learners to have an ability to self-regulate their own learning in MOOCs.

A recent systematic review on empirical studies on SRL in MOOCs has demonstrated the importance of SRL, showing that it has positive effects on MOOC learning (Lee et al., 2019). In the review, it was revealed that a broad range of MOOC learners have self-efficacy and task value beliefs and employ several SRL strategies such as time management. In a recent study, 6,335 MOOC learners reported high self-efficacy and task value scores and high critical thinking scores in the Motivated Strategies for Learning Questionnaire (MSLQ) (Alario-Hoyos, Estévez-Ayres, Pérez-Sanagustín, Kloos, & Fernández-Panadero, 2017). In addition, learners who completed a MOOC reported that effort regulation strategy was the most important SRL strategy to succeed in a MOOC (Kizilcec, Pérez-Sanagustín, & Maldonado, 2016). Although self-efficacy, task value, and SRL strategies have been commonly identified in empirical studies on MOOCs, little has been known about the relationships among them.

The relationships between self-efficacy, task value, and use of SRL strategies could provide new insights on how to design MOOCs to support learners' self-regulation with MOOC

instructors and instructional designers as they did in traditional online learning environments. Several MOOC design principles or guidelines have been suggested to better support MOOC learners' self-regulation (e.g., Milligan & Griffin, 2016; Nawrot & Doucet, 2014). However, motivational aspects of SRL such as self-efficacy and task value have been underestimated in supporting learners' SRL in MOOC environments. This might be attributed to the use of different theoretical frameworks of SRL (Lee et al., 2019), such as Zimmerman and Pons's (1986) model that mainly focuses on other dimensions of SRL strategies including seeking information, and the lack of research on the relationships among components of SRL in MOOCs. Therefore, the present study addresses this gap by adopting Zimmerman's (1989) social cognitive model of SRL, which has been widely used in traditional online learning environments.

The research questions and hypotheses in this study were as follows:

RQ1. Are there relationships between learners' self-efficacy and their use of SRL strategies in MOOCs?

H1. Self-efficacy will positively correlate with the use of SRL strategies of MOOC learners.

H2. Self-efficacy will significantly predict MOOC learners' use of SRL strategies.

H3. There will be a significant difference in the use of SRL strategies between MOOC learners with high self-efficacy and those with low self-efficacy.

RQ2. Are there relationships between learners' task value and their use of SRL strategies in MOOCs?

H4. Task value will positively correlate with the use of SRL strategies of MOOC learners.

H5. Task value will significantly predict MOOC learners' use of SRL strategies.

H6. There will be a significant difference in the use of SRL strategies between MOOC learners with high task value and those with low task value.

## Methods

### Study Setting

This study was conducted on two self-paced probability MOOCs. The courses were offered by a large Midwestern university on the edX platform. The first MOOC, titled Probability: Basic Concepts & Discrete Random Variables, provided an introduction to mathematical probability. The second MOOC, titled Probability: Distribution Models & Continuous Random Variables, addressed continuous random variables and probability distribution models. The MOOCs were fully delivered online, and the same professor taught both. Each MOOC consisted of six units with video lectures, quizzes, examples, and practice activities. The units were designed to be completed according to the suggested schedule of one unit per week. However, students could study and complete each unit at their own pace. They could enroll in each MOOC anytime for free. If they wanted to earn a verified certificate, they could pay a small fee. The research team had no affiliation with the MOOC instructor or the edX platform institution.

### Instruments

A total of seven self-efficacy items and six task value items from the MSLQ were used (Pintrich et al., 1991). MSLQ is one of the most well-known instruments used to measure online learners' self-efficacy and task value, as shown in literature reviews of SRL in traditional online settings (Artino, 2007b; Broadbent & Poon, 2015). Therefore, it has been increasingly used in MOOC environments (e.g., Alario-Hoyos et al., 2017). The items were slightly modified to

better fit with MOOC environments. For example, the item "I'm confident I can do an excellent job on the assignments and tests in this course" was modified to "I'm confident I can do an excellent job on the assignments and quizzes in this MOOC." The items were rated on a 7-point Likert scale ranging from "not at all true of me" to "very true of me." In this study, the reliability with Cronbach's α values of self-efficacy and task value were .91 and .87, respectively.

The use of SRL strategies was measured by the Online Self-Regulated Learning Questionnaire (OSLQ) from Barnard, Lan, To, Paton, and Lai (2009), which consists of 24 items with a 5-point Likert scale ranging from "strongly agree" to "strongly disagree." The OSLQ has been widely used to measure students' SRL strategies in traditional online learning settings (e.g., Barnard-Brak, Paton, & Lan, 2010). Researchers have recently used it to measure students' use of SRL strategies in MOOC environments (e.g., Ohan & Sinclair, 2016). The OSLQ consists of six subscales: environment structuring, goal setting, time management, help seeking, task strategies, and self-evaluation. In the items, the word *online courses* was changed to *MOOC* to better fit MOOC environments. The reliability with Cronbach's α values of OSLQ in this study was .93. The content validity of self-efficacy items, task value items, and OSLQ was verified through content-related evidence by two professors of educational technology who evaluated the modified items and decided whether they adequately represented the content domain. According to Johnson and Christensen (2017), content-related evidence is "validity evidence based on a judgement of the degree to which the items, tasks, or questions on a test adequately represent the construct domain of interest" (p. 172) and must be done by experts.

**Recruitment and Respondents**

Once Institutional Review Board approval was granted, a survey link was posted on the MOOCs' message boards by the MOOC instructor as an announcement. Students were asked to

complete the survey while taking the MOOCs if they were interested in participating in this study. The survey was voluntary, and there was no incentive for students to complete it. The survey responses were collected in 2018 from the spring semester through the fall semester.

A total of 13,465 learners enrolled in the two probability MOOCs. Of the 13,465 learners, 242 responded to the survey. However, 50 people skipped at least one question about self-efficacy, task value, and OSLQ. Their responses were excluded from data analysis. In addition, eight outliers were detected and removed. Finally, 184 learners from 37 countries completed the survey. The age of 184 learners ranged from 18 to 66 years and above: 60 learners were 18-25 years of age (32.6%); 56 learners were 26-35 years of age (30.4%); 38 learners were 36-45 years of age (20.7%); 12 learners were 46-55 years of age (6.5%); 13 learners were 56-65 years of age (7.1%); and 5 learners were over 66 years of age (2.7%). In terms of gender, 130 learners were male (70.7%) and 54 learners were female (29.3%).

**Data Analysis**

The data sets were analyzed by using SPSS statistical software. In order to test hypotheses 1 and 4, Pearson's correlation analysis was conducted. Hierarchical multiple regression analysis was conducted to test hypotheses 2 and 5. Since Zimmerman's (1989) social cognitive model of SRL emphasizes self-efficacy as a key variable positively affecting self-regulatory processes, a hierarchical multiple regression model where the order of the predictor variables is determined based on the theory was used. In order to test hypotheses 3 and 6, two separate independent sample *t*-tests were conducted. All assumptions for Pearson's correlation, multiple linear regression, and independent sample *t*-test were checked and satisfied. They are represented in the following section.

## Results

### Results of Pearson's Correlation Analysis

All assumptions for Pearson's correlation were first checked and met. The Kolmogorov–Smirnov and Shapiro–Wilk tests results showed that the residuals were normally distributed ($p > .05$). Scatterplot graphs confirmed a linear relationship between self-efficacy, task value, and SRL strategies. The Breusch–Pagan test (Breusch & Pagan, 1979) result showed no homoscedasticity ($p > .05$). Scatterplot graphs also confirmed that homoscedasticity did not exist.

The results of Pearson's correlation analysis showed that self-efficacy was positively related to probability MOOC learners' use of SRL strategies ($r = .36$, $p < .01$), which supports hypothesis 1. Pearson's correlation analysis was also revealed that task value was positively related to probability MOOC learners' use of SRL strategies ($r = .45$, $p < .01$), which supports hypothesis 4. Table 3. 1 represents descriptive statistics and the results of Pearson correlation analysis.

Table 3. 1. Means, Standard Deviations, and Pearson's Correlations for Self-Efficacy, Task Value, and Self-Regulated Learning

| Variable | *M* | *SD* | Self-efficacy | Task value | SRL |
|---|---|---|---|---|---|
| Self-efficacy | 5.35 | .95 | — | .52** | .36** |
| Task value | 5.92 | .78 | .52** | — | .45** |
| SRL | 3.54 | .68 | .36** | .45** | — |

*Note*. *M* = mean; *SD* = standard deviation; SRL = self-regulated learning.

** $p < .01$.

**The Results of Hierarchical Multiple Regression Analysis**

Two-step hierarchical multiple regression analysis was carried out with an entrance level of 0.05 and an exclusion level of 0.10 to test hypotheses 2 and 5. Prior to conducting hierarchical multiple regression analysis, all assumptions for multiple linear regression were checked and met. As shown in Pearson's correlation analysis, normality and linearity were met, and there was no homoscedasticity. Multicollinearity was checked by variance inflation factor values, which were lower than 10, indicating no strong correlation between self-efficacy and task value. Finally, the Durbin–Watson statistic was 1.71, indicating that there were no independent errors by the residuals.

The results of hierarchical multiple regression analysis are shown in Table 3. 2. In model 1, self-efficacy was entered based on Zimmerman's (1989) social cognitive model of SRL, which emphasizes the importance of self-efficacy. Model 1 was statistically significant ($F(1, 182) = 27.18$, $p < .01$) and accounted for approximately 13% of the variance of SRL strategies ($R^2 = .13$, adjusted $R^2 = .13$). Self-efficacy was found to be a significant predictor of SRL strategies ($\beta = .36$, $p < .05$). Model 2 including task value was statistically significant ($F(2, 181) = 25.78$, $p < .01$) and accounted for approximately 21% of the variance of SRL strategies ($R^2 = .22$, adjusted $R^2 = .21$). Task value ($\beta = .36$, $p < .05$) and self-efficacy ($\beta = .17$, $p < .05$) were all found to be significant predictors of SRL strategies. Therefore, both hypothesis 2 and hypothesis 5 are supported.

Table 3. 2. Results of Hierarchical Multiple Regression Analysis

| Variable | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|
| | B | *SE* | *β* | B | *SE* | *β* |
| Self-efficacy | .26 | .05 | .36** | .12 | .06 | .17** |
| Task value | | | | .30 | .07 | .36** |
| $R^2$ | | | .20 | | | .22 |
| Adjusted $R^2$ | | | .20 | | | .21 |
| $\Delta R^2$ | | | .13 | | | .01 |
| *F* | | | 27.18* | | | 25.78* |

*Note*. B = unstandardized beta; *SE* = standard error.

* $p < .01$. ** $p < .05$.

**The Results of Independent Sample *t*-Test**

Before testing hypotheses 3 and 6, all assumptions for the independent sample *t*-test were checked. The Kolmogorov–Smirnov test and the Shapiro–Wilk test results showed that the residuals were normally distributed ($p > .05$). The assumption of homogeneity of variance was met by Levene's test of equality of variances ($F = 2.21$, $p > .05$; $F = 3.07$, $p > .05$). MOOC learners were divided into three level groups according to percentile based on their self-efficacy and task value scores: the low group was below the 25th percentile; the medium group was between the 25th and the 75th percentile; the high group was above the 75th percentile.

As shown in Table 3. 3, the results of an independent sample *t*-test indicated a statistically significant difference in the average total scores of SRL between probability MOOC learners who had high levels of self-efficacy ($M = 6.61$, $SD = .34$) and those who had low levels of self-efficacy ($M = 4.15$, $SD = .44$), $t(87) = -5.31$, $p = .00$. Hence, hypothesis 3 is supported.

Table 3. 3. Results of Independent Sample t-Test and Descriptive Statistics for Self-Regulated Learning Scores by Self-Efficacy Levels

| | Self-efficacy level | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low self-efficacy | | | High self-efficacy | | | 95% CI for mean difference | *t* | *df* | *p* |
| | *M* | *SD* | *n* | *M* | *SD* | *n* | | | | |
| *SRL* | 4.15 | 0.44 | 49 | 6.61 | 0.34 | 40 | −.98, −.45 | −5.31 | 87 | .00* |

*Note*. *M* = mean; *SD* = standard deviation; 95% CI = 95% confidence interval; SRL = self-regulated learning.

* $p$ <.05.

In addition, there was a statistically significant difference in the mean scores of SRL between probability MOOC learners who had high task value ($M$ = 6.86, $SD$ = .14) and those who had low task value ($M$ = 4.83, $SD$ = .38), $t(91) = -6.00$, $p$ = .00. Therefore, hypothesis 6 is supported. Table 3. 4 shows the results of the independent sample *t*-test for SRL scores by task value levels.

Table 3. 4. Results of Independent Sample t-Test and Descriptive Statistics for Self-Regulated Learning Scores by Task Value Levels

| | Task value level | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low task value | | | High task value | | | 95% CI for mean difference | *t* | *df* | *p* |
| | *M* | *SD* | *n* | *M* | *SD* | *n* | | | | |
| *SRL* | 4.83 | 0.38 | 43 | 6.86 | 0.14 | 50 | −1.09, −.55 | −6.00 | 91 | .00* |

*Note*. *M* = mean; *SD* = standard deviation; 95% CI = 95% confidence interval; SRL = self-regulated learning.

* $p < .05$.

## Discussion

This study examined the relationships between self-efficacy, task value, and the use of SRL strategies in MOOCs using Zimmerman's (1989) social cognitive model of SRL. The understanding of the relationships between self-efficacy, task value, and SRL strategies in MOOCs is still nascent, which has resulted in limited application in MOOC design and teaching to support self-regulation of MOOC learners with heterogenous backgrounds and experiences. This study marks the first step in applying a social cognitive model of SRL to MOOC environments and extending the relationships found in traditional online courses to MOOCs.

### RQ1. Are There Relationships Between Learners' Self-Efficacy and Their Use of SRL Strategies in MOOCs?

The study findings demonstrate that self-efficacy was positively associated with the use of SRL strategies in two probability MOOCs as found in traditional online learning settings. A

positive correlation between self-efficacy and the use of SRL strategies in the MOOCs is consistent with findings of previous studies on SRL in traditional online courses (e.g., Cho & Shen, 2013; Shea & Bidjerano, 2010). The more that probability MOOC learners are self-efficacious, the more likely they are to use SRL strategies. In model 1 of hierarchical multiple regression, it was revealed that self-efficacy significantly and positively predicted the use of SRL strategies of the probability MOOC learners. When task value was added in model 2, self-efficacy was still a significant predictor of the use of SRL strategies in the MOOCs. These study findings are congruent with previous study findings showing self-efficacy as a significant predictor of SRL strategies in traditional online courses (Artino & Jones, 2012; Joo et al., 2000). In addition, the statistically significant higher average SRL scores of the probability MOOC learners with high self-efficacy support Pintrich's (1999) assertation that self-efficacy promotes SRL behaviors. In summary, although there are differences between traditional online courses and MOOCs such as course structure (e.g., Glance et al., 2013), positive relationships between self-efficacy and SRL strategies found in previous studies on traditional online courses extended to the context of MOOCs studied here. Self-efficacy positively affected use of SRL strategies in the probability MOOC learners, which indicates self-efficacy playing a key role in promoting learners' SRL strategies in MOOCs.

### RQ2. Are There Relationships Between Learners' Task Value and Their Use of SRL Strategies in MOOCs?

Task value was positively related to the use of SRL strategies in two probability MOOCs, as found in traditional online course settings. There was a positive correlation between task value and the use of SRL strategies in the probability MOOCs studied here, which is congruent with previous research findings in traditional online courses (e.g., Artino & Stephens, 2006; Hsu,

1997). Students who believed that the materials in the two probability MOOCs were useful and that understanding the MOOC subjects was important were more likely to use SRL strategies. In model 2 of hierarchical multiple regression, it was revealed that task value significantly and positively predicted the MOOC learners' use of SRL strategies. These findings are consistent with those from earlier studies showing that task value is a significant predictor of SRL strategies in traditional online courses (Artino & Jones, 2012; Artino & Stephens, 2006; Joo et al., 2000). In addition, the statistically significant higher average SRL scores of the probability MOOC learners with high task value support Pintrich's (1999) assertation that task value fosters SRL behaviors. In summary, despite differences between traditional online courses and MOOCs, such as openness (Schulze, 2014) and course goals (Perna et al., 2014), the positive relationships between task value and SRL strategies found in previous studies on traditional online learning settings (e.g., Artino & Jones, 2012; Artino & Stephens, 2006) extended to the context of MOOCs studied here. Task value positively affected use of SRL strategies in the two probability MOOC learners, which indicates the importance of task value to promote learners' SRL strategies in MOOCs.

**Implications for Practice**

The results reported here have practical implications. MOOCs differ from traditional online courses in several aspects, such as lectures formatted as short videos, formative quizzes, and online forums (Glance et al., 2013). The relationships between self-efficacy and SRL strategies found in this study suggest that, considering the unique characteristics of MOOCs, MOOC practitioners should help learners improve their self-efficacy. For example, MOOC instructors could regularly show learners their learning progress through system-generated e-mail notifications as self-perceptions of progress improve learners' self-efficacy beliefs (Ertmer, Newby, & MacDougall,

1996). In addition, as Hodges (2016) has suggested, MOOC instructors could provide persuasive feedback on quizzes rather than simple feedback such as "correct" or "incorrect" in order to better develop learners' self-efficacy. The relations between task value and SRL strategies found here suggest that MOOC instructors or instructional designers should help learners improve their task value or keep their task value high. There is a need to improve the instructional design quality of MOOCs based on instructional design principles (Margaryan, Bianco, & Littlejohn, 2015), which helps MOOC learners place a value on high quality MOOC resources or activities.

**Limitations and Future Research**

This study has a number of limitations. First, only a single topic of probability was investigated, although across two MOOCs. Other MOOCs on the same topic as well as on different topics should be further explored for a better understanding of the relationships between MOOC learners' self-efficacy, task value, and SRL strategies. Second, the scope of this study was limited to relationships between self-efficacy and task value as personal variables and SRL strategy as a behavioral variable in the framework of Zimmerman's (1989) social cognitive model of SRL. Future research should explore other behavioral variables and environmental variables, as well as the relationships among them. Third, the data in this study were derived from self-reported questionnaires. Although these methods have been widely used in empirical research on SRL in traditional online settings (Artino, 2007b), the employment of qualitative methods could enrich the findings of this study by more deeply exploring individuals' use of SRL strategies and their relation to users' self-efficacy and task value beliefs. Finally, this study investigated only the total SRL scores of MOOC learners. Future research should examine SRL subscales to better understand the differences in the use of SRL strategies among MOOC learners with different levels of self-efficacy and task value.

## Conclusions

This study investigated the relationships between self-efficacy, task value, and SRL strategies of MOOC learners from a social cognitive perspective. The results of this study show positive relationships between self-efficacy and SRL strategies in two probability MOOCs. In addition, positive relationships between task value and SRL strategies were found in the two MOOCs. This study sheds new light on research on MOOCs by revealing the applicability of using a social cognitive model of SRL (Zimmerman, 1989) in MOOCs and providing empirical evidence on the relationships between self-efficacy, task value, and SRL strategies in MOOCs. In addition, the findings of the present study highlight the key role of learners' self-efficacy and task value in self-regulatory processes in MOOCs and the necessity of supporting them.

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# CHAPTER 4: THE INFLUENCE OF SUCCESSFUL MOOC LEARNERS' SELF-REGULATED LEARNING STRATEGIES, SELF-EFFICACY, TASK VALUE ON THEIR PERCEIVED EFFECTIVENESS OF A MASSIVE OPEN ONLINE COURSE

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**Abstract**

High dropout rates have been an unsolved issue in massive open online courses (MOOCs). As perceived effectiveness predicts learner retention in MOOCs, instructional design factors that affect it have been increasingly examined. However, self-regulated learning, self-efficacy, and task value have been underestimated from the perspective of instructors even though they are important instructional design considerations for MOOCs. This study investigated the influence of self-regulated learning strategies, self-efficacy, and task value on perceived effectiveness of successful MOOC learners. Three hundred fifty-three learners who successfully completed the Mountain 101 MOOC participated in this study by completing a survey through e-mail. The results of stepwise multiple regression analysis showed that perceived effectiveness was significantly predicted by both self-regulated learning strategies and task value. In addition, the results of another stepwise multiple regression analysis showed that meta-cognitive activities after learning, environmental structuring, and time management significantly predicted perceived effectiveness.

## Introduction

Although massive open online courses (MOOCs) have potential to broaden educational opportunities, their high dropout rates have been a challenging issue. Only a small proportion of learners who enroll in a MOOC complete their course (Alraimi, Zo, & Ciganek, 2015). In order to address this, factors that influence MOOC retention have been increasingly explored. Among them, perceived effectiveness has been identified as a vital factor that predicted learner retention rates for MOOCs (Sujatha & Kavitha, 2018). Due to the important role of perceived effectiveness, researchers have recently examined instructional design factors that positively affect it, including course structure (Jung, Kim, Yoon, Park, & Oakley, 2019) and interaction with instructors (Hone & El Said, 2016). However, these factors have been examined mainly from the perspective of instructors. Self-regulated learning (SRL) and learner characteristics such as self-efficacy should also be considered in instructional design for effective online learning (Liaw & Huang, 2013).

In MOOCs, learners are required to have a greater ability to regulate their own learning because there is a lack of support or guidance from instructors (Hood, Littlejohn, & Milligan, 2015). In a recent systematic literature review study, it was revealed that MOOC learners commonly use several SRL strategies as well as possess self-efficacy and task value beliefs (Lee, Watson, & Watson, 2019). Although perceived effectiveness is associated with learning strategies employed by learners in online learning settings (Venkatesh, Croteau, & Rabah, 2014), empirical evidence of the effects of SRL on perceived effectiveness in MOOC environments is scarce. The results of previous studies on online learning showed that SRL strategies, self-efficacy, and task value are significant predictors of perceived effectiveness, which is a measure of satisfaction with traditional online learning (e.g., Artino, 2007, 2008; Cho & Cho, 2017). In

addition, most studies on SRL in MOOCs have mainly focused on learners who were involved in MOOCs, but did not complete the courses (e.g., Hood et al., 2015; Milligan & Littlejohn, 2016). Considering that successful MOOC learners' behaviors had significantly positive effects on other MOOC learners' success (Davis, Chen, Jivet, Hauff, & Houben, 2016), there is a need to explore successful MOOC learners' SRL strategies, self-efficacy, and task value as well as the relationships of these factors with perceived effectiveness. Findings about the relationships will provide new insight on instructional design for MOOCs as well as how to support learners' self-regulatory processes in MOOCs.

The purpose of this study was to investigate the influence of SRL strategies, self-efficacy, and task value on successful MOOC learners' perceived effectiveness of a MOOC.

## Literature Review

### Perceived Effectiveness in MOOCs

Perceived effectiveness generally refers to students' "evaluation of the overall effectiveness of the course" (Peltier, Drago, & Schibrowsky, 2003, p. 267). It has been widely used in earlier studies on online learning as a measure of satisfaction with online learning environments (Hone & El Said, 2016). Each of the three aspects of perceived effectiveness defined by Peltier et al. (2003) has been utilized as a measure of students' satisfaction with online courses (e.g., Bolliger & Halupa, 2012; Kang & Im, 2013). For example, referral likelihood was used to measure students' satisfaction with online courses in Kang and Im's (2013) study. Therefore, in this study, perceived effectiveness has been operationally defined as students' perceptions of the overall effectiveness of the course and their satisfaction with the course.

It is common to consider perceived effectiveness in contexts where it is impractical to measure students' actual learning behaviors (Hone & El Said, 2016). MOOC researchers have increasingly examined perceived effectiveness, since it is not practical to measure hundreds of thousands of individuals' diverse learning behaviors in MOOCs (e.g., Jung et al., 2019). Findings have shown that perceived effectiveness played a vital role in enhancing MOOC effectiveness by predicting learner retention (Sujatha & Kavitha, 2018) or mediating the effect of course content on retention in a MOOC (Hone & El Said, 2016). Therefore, it is essential to explore factors that influence the perceived effectiveness of MOOCs. Findings reported in previous studies showed instructional design components such as course content (Hone & El Said, 2016), and course structure and transactional interaction between course and student (Jung et al., 2019), as vital factors that positively affect MOOC learners' perceived effectiveness of the course. However, previous studies largely examined factors from the perspective of instructors. According to Liaw and Huang (2013), SRL and learner characteristics such as self-efficacy should also be considered in the design of effective online courses. These aspects were also highlighted during learner characteristics analysis in instructional design models such as Dick and Carey's model (Dick & Carey, 1978) and the ADDIE model (Peterson, 2003), showing that they are critical instructional design considerations.

## Factors Contributing to Perceived Effectiveness

### *SRL strategies*

According to Zimmerman (2000), SRL is defined as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (p. 14). SRL theorists commonly explain that SRL includes meta-cognition, behavior, and motivation

(Zimmerman, 1986). SRL strategies are behavioral components of the SRL theory. SRL strategies refer to "actions and processes directed at acquiring information or skill that involve agency, purpose, and instrumentality perceptions by learners" (Zimmerman, 1989, p. 329).

Previous research findings showed that SRL strategies predicted perceived effectiveness in online learning environments (Amoozegar, Daud, Mahmud, & Jalil, 2017; Puzziferro, 2008). For example, the results of a study by Amoozegar et al. (2017) showed that SRL strategies of Malaysian undergraduate students who were taking online courses significantly predicted their satisfaction with the course. While a few studies on MOOCs have examined the effects of SRL strategies on perceived effectiveness, Magen-Nagar and Cohen (2016) found that SRL strategies were positively correlated with the degrees to which high school students evaluated the quality of their academic achievement in a MOOC. However, this research finding was limited to high school students and flipped classroom settings where students watched lecture videos from a MOOC every week and then studied in small groups in the classroom. Considering that people from all over the world with differing backgrounds, including age and education levels, enroll in MOOCs, there is a need to further investigate the effects of SRL strategies on perceived effectiveness in fully online MOOC settings.

### *Self-efficacy*

Self-efficacy is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994, p. 71). Self-efficacy has been identified as a significant predictor of perceived effectiveness in online learning settings (Artino, 2007; Liaw, 2008). For example, the findings of a survey study by Artino (2007) indicated that self-efficacy of US Navy sailors in self-paced online courses significantly predicted their perceptions of how well they learned in the courses as well as their

satisfaction with the courses. In addition, Liaw (2008) found that Taiwan students' self-efficacy beliefs were a vital factor that influenced their satisfaction with the Blackboard e-learning system. Although self-efficacy has been identified as a factor contributing to perceived effectiveness in online learning settings, there has been a lack of studies examining the influence of self-efficacy on the perceived effectiveness of MOOCs.

***Task value***

Task value refers to "students' evaluation of the how interesting, how important, and how useful the task is" (Pintrich, Smith, Garcia, & McKeachie, 1993, p. 11). Task value has been identified as a significant predictor of perceived effectiveness in online learning environments (Artino, 2008; Joo, Lim & Kim, 2013; Miltiadou, 2001). For example, Artino (2008) found that self-efficacy significantly predicted service academy undergraduate students' satisfaction with self-paced online courses. In addition, Miltiadou (2001) investigated community college students who took an online English course and found task value was a significant predictor of their satisfaction with the courses. Through structural equation modeling, Joo et al. (2013) found direct effects of self-efficacy on satisfaction with online courses offered by an online university in South Korea. Although task value has been identified as a factor contributing to perceived effectiveness in online learning environments, little is known about the predictive power of task value for the perceived effectiveness of MOOCs.

Based on previous studies reviewed above, the present study investigated the influence of successful MOOC learners' SRL strategies, self-efficacy, and task value on perceived effectiveness of a MOOC. This study was framed by the following research questions and research hypotheses:

R1. Do successful MOOC learners' SRL strategies, self-efficacy, and task value predict their perceived effectiveness of a MOOC?

H1. Successful MOOC learners' SRL strategies will significantly predict their perceived effectiveness of a MOOC.

H2. Successful MOOC learners' self-efficacy will significantly predict their perceived effectiveness of a MOOC.

H3. Successful MOOC learners' task value will significantly predict their perceived effectiveness of a MOOC.

R2. Which SRL strategies are positively related to successful learners' perceived effectiveness of a MOOC?

## Methods

### Study Context

The context of the present study was a MOOC titled Mountain 101 offered by the University of Alberta on the Coursera platform. The course was designed to provide a broad and integrated overview of the mountain world. It covered interdisciplinary dimensions of mountain places in Canada and around the world (e.g., physical, biological, and human dimensions). The course was delivered fully online and taught by two instructors. It consisted of 12 lessons with lecture videos, readings, and quizzes. Discussion forums were also provided to allow students to discuss course materials with peers or ask questions of the instructors. It was suggested that students complete one lesson each week. However, they were able to complete all lessons according to their preferred pace. The course was free, but if students wanted to get a certificate

of completion, they could pay a small fee. The research team had no affiliation with the MOOC instructors or the Coursera platform institution.

**Recruitment and Respondents**

Once Institutional Review Board approval was granted, the researchers asked the MOOC instructors to forward an e-mail that included a survey link with a recruitment message to students who were identified as having completed the Mountain 101 MOOC on the Coursera platform. The e-mail was sent out at the end of October in 2018. Since the MOOC launched in January 2017 and ran until the middle of October 2018, by then a total of 4,333 students had completed the course. The survey was voluntary and no compensation was given to participants.

Of the 4,333 students who received the recruitment e-mail from the MOOC instructors, 353 participated in the survey. As 31 students out of the 353 did not complete the survey, their survey responses were excluded. In addition, 31 outliers were detected and removed to conduct stepwise multiple linear regression analyses. Finally, the responses of the 291 students from 26 countries were analyzed. In terms of age, 13 students were 18 to 25 years of age (4.5%); 50 students were 26 to 35 years of age (17.2%); 47 students were 36 to 45 years of age (16.2%); 44 students were 46 to 55 years of age (15.1%); 93 students were 56 to 65 years of age (32.0%); and 44 students were over 66 years of age (15.5%). Regarding gender, 119 students were male (40.9%) and 172 students were female (59.1%).

**Instruments**

The revised version of the Self-Regulated Online Learning Questionnaire (SOL-Q-R) developed by Jansen, Van Leeuwen, Janssen, and Kester (2018) was used to measure MOOC learners' SRL strategies in this study. Janssen, Van Leeuwen, Janssen, Kester, and Kalz (2017)

developed the initial version of the SOL-Q to measure the SRL strategies of learners in MOOC environments. The revised version of SOL-Q consists of seven subscales: (a) meta-cognitive activities before learning, (b) meta-cognitive activities during learning, (c) meta-cognitive activities after learning, (d) time management, (e) environmental structuring, (f) persistence, and (g) help-seeking (Jansen et al., 2018). The items were rated on a 7-point Likert scale ranging from not at all true of me to very true for me. In this study, the reliability with Cronbach's alpha value was .93.

Seven self-efficacy items from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1991) were used to measure MOOC learners' self-efficacy. The items consisted of a seven-point Likert scale ranging from not at all true of me to very true of me. The items were slightly modified to reflect the context of the Mountain 101 MOOC. For example, "I'm confident I can understand the most complex material presented by the instructor in this course" was modified to "I was confident I could understand the most complex material presented by the instructor in the Mountain 101 MOOC." The reliability with Cronbach's alpha value was identified as .95.

Six task value items from the MSLQ (Pintrich et al., 1991) were used to measure MOOC learners' task value. The items utilized a seven-point Likert scale ranging from not at all true of me to very true of me. The items were slightly modified to reflect the context of the Mountain 101 MOOC. For example, "I am very interested in the content area of this course" was modified to "I was very interested in the content area of the Mountain 101 MOOC." In this study, the reliability with Cronbach's alpha value was .75. Three items developed by Peltier et al. (2003) were used to measure MOOC learners' perceived effectiveness.

The items consisted of a five-point Likert scale ranging from strongly disagree to strongly agree. As well, the words "this course" were modified to "Mountain 101 MOOC" to better fit the specific MOOC in question. For example, "I would recommend this course to friends/colleagues" was modified to "I would recommend the Mountain 101 MOOC to friends/colleagues." The reliability with Cronbach's alpha value was identified as .75.

The content validity of the revised version of SOL-Q items, self-efficacy items, task value items, and perceived effectiveness items was established through content-related evidence by two professors in the area of educational technology. They reviewed the modified items and assessed the degree to which each one appropriately represented the content domain. Content-related evidence is "validity evidence based on a judgement of the degree to which the items, tasks, or questions on a test adequately represent the construct domain of interest" (Johnson & Christensen, 2017, p. 380). Judgements of content validity have to be done by experts in the content domain (Johnson & Christensen, 2017).

**Data Analysis**

Survey datasets were analyzed by using the SPSS statistical software program. Stepwise multiple regression was employed to address research questions 1 and 2. While stepwise multiple regression is appropriate for exploratory studies, hierarchical multiple regression is used when the order of entry for predictor variables is determined based on a theory. Since existing SRL models do not explain contributions of predictor variables to dependant variable, stepwise multiple regression was used. In this study, independent or predictor variables were SRL strategies, self-efficacy, and task value. The dependent variable was perceived effectiveness. All assumptions for multiple linear regression were checked. A violation of homoscedasticity was detected by the Breusch-Pagan test ($p < .05$) (Breusch & Pagan, 1979). Therefore, weighted least

square (WLS) where “each case is weighted by a function of its variance” (Field, 2013, p. 222) was used to address homoscedasticity.

## Results

### The Results of Stepwise Multiple Regression Analysis for Research Question One

In order to conduct stepwise multiple regression analysis, all assumptions for multiple linear regression were tested. First, the variance inflation factor (VIF), which was lower than 10, showed that multicollinearity does not exist. In addition, the Durbin-Watson test result, which was 2.00, indicated that the assumption of independent errors was met. After WLS estimation was performed, stepwise multiple regression analysis was conducted with an entrance level of 0.05 and an exclusion level of 0.10. Table 4. 1 shows the results of descriptive statistics and Pearson correlation analysis. The results of Pearson correlation analysis indicated that task value was positively correlated with self-efficacy, SRL strategies, and perceived effectiveness. On the other hand, self-efficacy was not positively correlated with SRL strategies, or with perceived effectiveness.

Table 4. 1. Means, Standard Deviations, and Pearson Correlations for Self-Efficacy, Task Value, SRL Strategies, and Perceived Effectiveness

| | Variable | *M* | *SD* | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| 1 | Self-efficacy | 6.07 | .60 | - | .26** | .05 | .09 |
| 2 | Task Value | 5.96 | .65 | .26** | - | .34** | .31** |
| 3 | SRL strategies | 4.25 | .77 | .05 | .34** | - | .23** |
| 4 | Perceived effectiveness | 4.83 | .38 | .09 | .31** | .23** | - |

*Note.* ** $p < .01$.

Table 4. 2 shows the results of stepwise multiple regression analysis. In the first step, SRL strategies were first entered into the regression model. Model 1 was identified as statistically significant with $F(1, 289) = 36.48$, $p < .01$. It accounted for approximately 11% of the variance of perceived effectiveness ($R2 = .11$, adjusted $R2 = .11$). On the second step, task value was added to the model. Model 2 was statistically significant ($F(2, 288) = 31.03$, $p < .01$) and accounted for approximately 17% of the variance of perceived effectiveness ($R2 = .18$, adjusted $R2 = .17$). Self-efficacy was excluded in the final model because it did not make a statistically significant addition to the current regression equation. The final model indicated that perceived effectiveness was mainly predicted by SRL strategies, and to a lesser extent by task value. Therefore, hypothesis 1 and 3 are supported, but hypothesis 2 is not supported.

Table 4. 2. Results of Stepwise Multiple Regression Analysis

| Variable | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|
| | B | *SE* | *β* | B | *SE* | *β* |
| SRL Strategies | .72 | .01 | .34** | .06 | .01 | .29** |
| Task Value | | | | .07 | .01 | .26** |
| Self-efficacy | | | | | | |
| $R^2$ | | | .11 | | | .18 |
| Adjusted $R^2$ | | | .11 | | | .17 |
| *F* | | | 36.48* | | | 31.03* |

*Note*. B = unstandardized beta; *SE* = standard error. * $p < .01$ and ** $p < .05$

**The Results of Stepwise Multiple Regression Analysis for Research Question Two**

Prior to carrying out stepwise multiple regression, 34 outliers were detected within each SRL strategy variable and removed from data analysis. Then, all assumptions were checked and met. The result of Koenker's test confirmed homoscedasticity ($p > .05$). VIF which was lower than 10 showing that there was no multicollinearity. In addition, the Durbin-Watson test result was 2.01 indicating that the residuals were uncorrelated. Stepwise multiple regression analysis was performed with an entrance level of 0.05 and an exclusion level of 0.10. Table 4. 3 presents the results of descriptive statistics and Pearson correlation analysis. As shown in Table 4. 3, there were positive correlations between sub-SRL strategies and perceived effectiveness except between persistence and perceived effectiveness, and between help-seeking and perceived effectiveness.

Table 4. 3. Means, Standard Deviations, and Pearson Correlations for Sub-SRL Strategies and Perceived Effectiveness

| | Variable | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MTBL | 4.59 | 1.85 | - | .74* | .68* | .42* | .41* | .27* | .17* | .20* |
| 2 | MTDL | 4.50 | 1.21 | .74* | - | .73* | .41* | .31* | .32* | .23* | .21* |
| 3 | MTAL | 4.65 | 1.06 | .68* | .73* | - | .33* | .30* | .22* | .16* | .25* |
| 4 | TM | 4.47 | 0.54 | .42* | .41* | .33* | - | .21* | .28* | .10 | .15** |
| 5 | ES | 5.36 | 1.19 | .41* | .31* | .30* | .21* | - | .12** | .06 | .21* |
| 6 | PER | 4.26 | 1.22 | .27* | .32* | .22* | .28* | .12** | - | .13* | .03 |
| 7 | HS | 1.95 | 1.08 | .17* | .23* | .16* | .10 | .06 | .13** | - | .00 |
| 8 | PEFF | 4.83 | 0.38 | .20* | .21* | .25* | .15** | .21* | .03 | .00 | - |

*Note.* MTBL = metacognitive activities before learning, MTDL = metacognitive activities during learning, MTAL = metacognitive activities after learning, TM = time management, ES = environmental structuring, PER = persistence, HS = help-seeking, PEFF = perceived effectiveness. * $p < .01$ and ** $p < .05$.

As shown in Table 4. 4, in the first step, meta-cognitive activity after learning was first added into the regression model. Model 1 was statistically significant ($F(1, 255) = 24.64$, $p < .01$). It accounted for approximately 9% of the variance of perceived effectiveness ($R2 = .09$, adjusted $R2 = .09$). On the second step, environmental structuring was added to the model. Model 2 was statistically significant ($F(2, 254) = 18.51$, $p < .01$) and accounted for approximately 12% of the variance of perceived effectiveness ($R2 = .13$, adjusted $R2 = .12$). On the third step, time management was entered into the model. The final model was identified as statistically significant ($F(3, 253) = 13.81$, $p < .01$) and accounted for approximately 13% of the

variance of perceived effectiveness (R2 = .14, adjusted R2 = .13). The final model showed that perceived effectiveness was primarily predicted by meta-cognitive activities after learning, and to a lesser extent by environmental structuring, followed by time management.

Table 4. 4. Results of Stepwise Multiple Regression Analysis

| Variable | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | B | *SE* | *β* | B | *SE* | *β* | B | *SE* | *β* |
| MTAL | .12 | .02 | .30** | .10 | .03 | .24** | .08 | .03 | .21** |
| ES | | | | .08 | .24 | .21** | .07 | .02 | .19** |
| TM | | | | | | | .11 | .06 | .12** |
| MTBL | | | | | | | | | |
| MTDL | | | | | | | | | |
| PER | | | | | | | | | |
| HS | | | | | | | | | |
| $R^2$ | | | .09 | | | .13 | | | .14 |
| Adjusted $R^2$ | | | .09 | | | .12 | | | .13 |
| *F* | | | 24.64* | | | 18.51* | | | 13.81* |

*Note*. B = unstandardized beta; *SE* = standard error. * $p < .01$ and ** $p < .05$

## Discussion

This study investigated the influences of successful MOOC learners' SRL strategies, self-efficacy, and task value on perceived effectiveness of a MOOC. Factors that affect perceived effectiveness have been examined in MOOCs mainly from the perspective of instructors, which has resulted in limited instructional design implications for MOOCs. In addition, the understanding of SRL strategies, self-efficacy, and task value of learners who successfully

completed MOOCs is scarce, which has limited our understanding of how to support other learners' SRL based on successful MOOC learners' self-regulation.

### RQ1. Do Successful MOOC Learners' SRL Strategies, Self-Efficacy, and Task Value Predict Their Perceived Effectiveness of a MOOC?

The results of stepwise multiple regression analysis indicated that successful MOOC learners' perceived effectiveness of the course was significantly predicted by both their use of SRL strategies and the task value of the Mountain 101 MOOC. In model 1 of stepwise multiple regression, SRL strategies were a significant and positive predictor of perceived effectiveness. In the final model where task value was added, SRL strategies significantly predicted perceived effectiveness. These study findings are consistent with previous studies on SRL in traditional online learning, showing that SRL strategies and task value significantly predict perceived effectiveness (e.g., Amoozegar et al., 2017; Puzziferro, 2008). In the final model of stepwise multiple regression, task value was also a significant predictor of perceived effectiveness, congruent with previous study findings (Artino, 2008; Miltiadou, 2001). These findings support an assertion that learners' SRL should be also considered in instructional design for effective online learning (Liaw & Huang, 2013). For example, MOOC instructors should provide an activity where learners set their own goals and make plans for effective time management at the beginning of courses, as suggested in MOOC design guidelines developed by Park, Cha, and Lee (2016). In addition, MOOC instructors should decrease monotony in designing and developing MOOCs as suggested for online learning environments by Chiu and Wang (2008).

On the other hand, successful MOOC learners' self-efficacy was not correlated with the perceived effectiveness of the Mountain 101 MOOC. Furthermore, it was excluded in the final

model of stepwise multiple regression, indicating that self-efficacy did not predict perceived effectiveness. This finding is in contrast to previous study findings showing that self-efficacy significantly predicted perceived effectiveness in traditional online learning environments (e.g., Artino, 2007; Liaw, 2008). One of the possible explanations is that the self-efficacy items used in this study might not fit with the context of Mountain 101 MOOC. Although self-efficacy is often domain-specific (Bandura, 1982), self-efficacy items used in this study were general. As the development of self-efficacy has been increasingly emphasized in MOOCs (Hodges, 2016), new self-efficacy items or other methods to correctly measure learners' self-efficacy in different MOOC contexts should be developed and used.

**RQ2. Which SRL Strategies Are Positively Related to Successful Learners' Perceived Effectiveness of a MOOC?**

The perceived effectiveness of the Mountain 101 MOOC was significantly predicted by successful MOOC learners' meta-cognitive activities after learning. Meta-cognition is positively correlated with academic outcomes as shown in a systematic review on SRL in online higher education learning environments (Broadbent & Poon, 2015). The effects of meta-cognition in MOOCs have recently been given attention by researchers (e.g., Tsai, Lin, Hong, & Tai, 2018). The findings of the present study contribute to the body of studies examining meta-cognition in MOOCs as well as shed new light on the role of meta-cognitive activities after learning in a MOOC. It was important for learners who successfully completed the Mountain 101 MOOC to use meta-cognitive strategies after learning. Therefore, MOOC instructors or instructional designers should provide meta-cognitive support for students as it has been emphasized in traditional online learning environments (An & Cao, 2014). For example, since evaluating

thinking process is one of the basic meta-cognitive strategies (Dirkes, 1985), students should be offered prompt questions to allow them to evaluate their learning process right after finishing each module or whole course.

Successful MOOC learners' environmental structuring significantly predicted their perceived effectiveness of the Mountain 101 MOOC. Environment structuring "involves selecting or creating effective settings for learning" (Zimmerman, 1998, p. 78). A few empirical study findings have shown the importance of environment structuring in traditional online learning environments. However, in general, students need to set a dedicated space for studying to succeed in online learning (Pappas, 2015). In addition, online learners are easily distracted because of their personal life activities such as taking care of family (Kerr, 2011). The findings of the present study showed that learners who successfully completed the Mountain 101 MOOC employed an environment structuring strategy, which significantly predicted their perceived effectiveness. Therefore, as García Espinosa, Tenorio Sepúlveda, and Ramírez Montoya (2015) suggested, MOOC instructors could offer activities where learners can identify the distractions they face while taking MOOCs, and then discuss ways to reduce them in an online forum.

The perceived effectiveness of the course by learners who successfully completed the Mountain 101 MOOC was significantly predicted by the learners' use of time management strategies. This result is supported by the importance of time management in MOOC environments. In fact, time management has been identified as one of the most important SRL strategies in MOOCs. For example, Nawrot and Doucet (2014) conducted a survey with 508 MOOC learners and found that poor time management was the main reason for withdrawing from a MOOC. In addition, in Kizilcec, Pérez-Sanagustín, and Maldonado's (2016) survey study, 17 learners who completed a MOOC responded that time management was one of the

most important SRL strategies for succeeding in MOOCs. While little has been identified about the effect of time management strategies in MOOC environments, the finding of this study provides empirical evidence of it. MOOC practitioners should support learners' use of time management strategies to help them succeed in MOOCs. For example, as Nawrot and Doucet (2014) proposed, based on learners' behavior and performance datasets from MOOC platforms, MOOC practitioners could predict the amount of time learners will need to complete a specific type of task, rather than a complete unit, and provide suggestions for learners who plan to complete this type of task.

## Conclusions

This study investigated the influence of SRL strategies, self-efficacy, and task value on perceived effectiveness of a course by learners who successfully completed the Mountain 101 MOOC. While SRL strategies and task value significantly predicted successful learners' perceived effectiveness of the MOOC, self-efficacy did not. These study findings provide new insights on instructional design considerations for MOOCs by revealing the importance of learners' use of SRL strategies and task value beliefs. They support Liaw and Huang's (2013) assertation that SRL should be considered in instructional design for effective online courses. In addition, learners' perceptions of interest, importance, and usefulness of the MOOC should be considered when designing MOOCs. In terms of sub-SRL strategies, meta-cognitive activities after learning, environmental structuring, and time management strategies significantly predicted successful MOOC learners' perceived effectiveness of the course. As it has been shown that successful MOOC learners' behaviors positively affected other learners' success (Davis et al., 2016), it is important for MOOC instructors to support their learners' use of these SRL strategies in MOOCs.

There are limitations to this study. First, the data used in the present study only represents the context of the Mountain 101 MOOC. For more generalizable results, future research should investigate other MOOCs addressing the same topic or different topics. In addition, this study relied on data drawn from self-reported questionnaires and used a quantitative method. Although self-reported questionnaires have been widely used in empirical studies to examine SRL in MOOC environments (e.g., Alario-Hoyos, Estévez-Ayres, Pérez-Sanagustín, Kloos, & Fernández-Panadero, 2017; Morales Chan, Hernandez Rizzardini, Barchino Plata, & Amelio Medina, 2015), future research could benefit from employing qualitative methods to explore more deeply individual learners' SRL strategies, self-efficacy, and task value and their effects on perceived effectiveness of MOOCs.

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# CHAPTER 5: DISCUSSION AND CONCLUSION

The purpose of this dissertation is to explore SRL in MOOC environments. This dissertation consists of three research studies that are related to each other. Although the topic of SRL has been increasingly emphasized in MOOCs, little has been known about the current status of empirical research on SRL in MOOCs, empirical evidence of the relationships between components of SRL in MOOCs, and effectiveness of SRL on learning outcomes in MOOCs. Therefore, this dissertation has conducted a systematic literature review and two quantitative research studies. This chapter provides a summary of each chapter as well as discusses the relationship amongst them. In addition, practical implications for MOOC instructions and instructional designers are included in this chapter. The last part of this chapter provides future research directions.

## Summary of Findings

Chapter Two presented a systematic literature review study on SRL in MOOCs. The content analysis results showed that the body of empirical research on SRL in MOOCs had been growing, particularly since 2014 until 2016, which supports the importance of SRL in MOOCs. Although reviews of literature on MOOCs had been actively conducted (e.g., Liyanagunawardena, et al., 2013; Veletsianos & Shepherdson, 2016), no review on empirical studies on the topic of SRL in MOOCs had been completed by the time when this study was conducted. This systematic literature review makes a significant contribution to the literature on MOOCs as well as SRL by being the first study to provide a valuable synthesis of empirical studies on SRL in MOOCs within a framework of Pintrich's (2000) SRL model. In addition, findings of the systematic literature review indicated that MOOC learners employed motivational

regulation strategies including self-efficacy and task value, behavioral and contextual regulation strategies including help seeking, time management, and effort regulation, and a goal setting as a metacognitive regulation strategy. New types of SRL behaviors, which have been not presented in existing SRL models (e.g., Pintrich, 2000, Zimmerman, 2000) but were drawn from diverse MOOC data including clickstream data, were also identified. These findings could help MOOC instructors, researchers, and educators better understand how students learn in MOOCs. In terms of the effectiveness of SRL, SRL positively affected MOOC learners' sense of academic achievement and goal achievement. Several interventions including platform and dashboard, design principles, and guidelines to promote SRL in MOOCs have been also identified in literature reviewed. These findings could provide MOOC practitioners with new insights on how to design and teach MOOCs to promote students' SRL. This chapter provided a foundation for the next two chapters by offering insights and directions for future research on the topic of SRL in MOOCs.

Chapter Three examined the relationships between self-efficacy, task value, and SRL strategies in MOOCs using a social cognitive model of SRL (Zimmerman, 1989). Through Chapter Two a research gap was identified that MOOC learners not only have self-efficacy and task value but also use diverse SRL strategies. However, little has been known about the relationships between them in MOOC environments. In fact, the relationships between self-efficacy, task value, and the use of SRL strategies provide new insights on how to support learners' SRL in traditional online learning environments (e.g., Artino, 2008). In Chapter Two, although several design principles or SRL interventions have been identified in literature, they have arguably underestimated self-efficacy and task value in designing MOOCs (e.g., Milligan & Griffin, 2016; Nawrot & Doucet, 2014). In might be attributed to the lack of understanding of

the relationships between self-efficacy, task value, and SRL strategies in MOOCs. The results of this study showed that there was a positive correlation between self-efficacy and SRL strategies as well as that between task value and SRL strategies in MOOCs. In addition, self-efficacy and task value were significant predictors of the use of SRL strategies in MOOCs. There was a statistically significant difference in the use of SRL strategies between learners with high self-efficacy and those with low self-efficacy as well as that between learners with high task value and those with low task value. These findings could provide MOOC practitioners with new insights on how to support learners' SRL in MOOCs.

Chapter Four investigated the influence of successful learners' self-efficacy, task value, and SRL strategies on their perceived effectiveness of a MOOC. Chapter Two discovered a research gap that there is still a lack of empirical evidence of the effectiveness of SRL in MOOC environments. In addition, Chapter Two identified that successful MOOC learners' behaviors positively affected other MOOC learners' success (Davis, Chen, Jivet, Hauff, & Houben, 2016), which indicated a necessity for exploring successful MOOC learners' SRL and its effectiveness. Chapter Four found that successful MOOC learners' perceived effectiveness was significantly predicted by both their use of SRL strategies and task value. On the other hand, self-efficacy did not significantly predict perceived effectiveness of a MOOC. In addition, successful learners' metacognitive activities after learning, environmental structuring, and time management significantly predicted their perceived effectiveness of a MOOC. These study findings provide new insights on instructional design considerations for MOOCs by revealing the importance of learners' use of SRL strategies and task value beliefs.

## Implications for Practice

The findings of three studies presented in this dissertation provided practical implications. MOOC instructors and instructional designers can consider the following when designing and teaching MOOCs.

### Helping MOOC learners develop their self-efficacy and task value

MOOC instructors and instructional designers should help students develop their self-efficacy and task value.

#### *Enhancing MOOC learners' self-efficacy*

Because self-perceptions of learning progress enhance learner's self-efficacy (Ertmer, Newby, MacDougall, 1996), MOOC instructors could regularly show learners their learning progress through system-generated e-mail notifications. In order to develop students' self-efficacy, four sources of self-efficacy (Bandura, 1997) should be also considered in designing MOOCs: Enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective factors. As Hodge (2016) suggested, quizzes could improve learners' self-efficacy through enactive mastery experiences or verbal persuasion. For example, MOOC instructors could provide students with quizzes that are challenging as well as achievable to promote enactive mastery experiences. In addition, they could offer persuasive feedback on quizzes rather than "correct" or "incorrect" feedback (Hodge, 2016).

#### *Enhancing MOOC learners' task value*

In order to develop learners' task value, MOOC instructors could decrease monotony as proposed for online learning settings (Chiu & Wang, 2008). Because videos showing an

instructors' face decreases the monotony of PowerPoint slides in MOOCs, instructors could make lecture videos showing their face at opportune times (Guo, Kim, & Rubin, 2014). Instructional designers and MOOC instructors should increase instructional design quality of MOOCs (Margaryan, Bianco, & Littlejohn, 2015) based on instructional design principles such as First Principles of Instruction (Merrill, 2002) to help learners place a value on high quality of MOOC contents, resources, and activities. Additionally, MOOC instructors should explain how the information presented in the lecture videos can be applied in everyday life or use real-life examples to demonstrate (Li & Moore, 2018).

## Supporting students' use of SRL strategies in MOOCs

MOOC instructors and instructional designers should support learners to effectively use SRL strategies in MOOCs. Based on the findings in this dissertation, MOOC instructors and instructional designers should support the following SRL strategies: metacognitive regulation strategy, time management, and environmental structuring.

### *Supporting MOOC learners' metacognitive regulation strategy*

Goal setting is one of the planning activities that make up metacognitive regulation strategies (Pintrich, Smith, Garcia, & McKeachie, 1991). In order to promote goal setting, as suggested by Park, Cha, and Lee (2016), MOOC instructors should provide an activity where learners set their own goals at the beginning of the courses in an online discussion forum or at the first page of MOOCs. In addition, self-monitoring is a vital metacognitive process of SRL and goal setting and self-monitoring complement each other (Zimmerman & Kitsantas, 1996). Therefore, MOOC instructors should encourage students to check progress indicators on the MOOC platform or show them through system-generated email because they facilitate students'

self-monitoring progress in MOOCs (Zhu & Bonk, 2019). As reflection plays an important role in developing learners' self-monitoring process (Schraw, 1998), MOOC instructors should provide reflection questions during lecture videos or in online discussion forums.

### *Supporting MOOC learners' time management strategy*

MOOC practitioners should help students effectively manage their time when taking MOOCs. In traditional online learning environments, efforts to develop a time management tool have been made by researchers. For example, de Raadt and Dekeyser (2009) developed a time management tool that could be integrated into a learning management system. The tool offered summaries of tasks that students had completed and needed to complete in a course through visualization (de Raadt & Dekeyser, 2009). Instructional designers and MOOC instructors could add scheduling features to MOOC platforms (Nawrot & Doucet, 2014) by collaborating with MOOC providers. In addition, based on learners' behavior and performance datasets from MOOC platforms, MOOC practitioners could predict the amount of time learners will need to complete a specific type of task rather than a unit and provide suggestions for learners who plan to complete this type of task on a MOOC page (Nawrot & Doucet, 2014).

### *Supporting MOOC learners' environmental structuring*

MOOC instructors should help learners create effective settings for MOOC learning. They could provide students with activities where students identify distractions that keep them from focusing on MOOC contents and how to remove them on a discussion forum as García Espinosa, Tenorio Sepúlveda, and Ramírez Montoya (2015) proposed. In addition, MOOC instructors could provide useful tools to help students remove distractions. For example, Patterson (2018) designed and offered three software tools to MOOC learners: a commitment

device, an alert tool, and a distraction blocking tool. A commitment device allows learners to set up a daily time limit on distracting websites. An alert tool provides student with an on-screen reminder if students spent on distracting websites during studying in a MOOC. A distraction blocking tool enables students to block distracting websites for 15, 30, or 60 minutes. In Patterson's (2018) study, a commitment device significantly improved students' completion rates and time spend on coursework.

## Limitations

There are limitations of the three studies presented in this dissertation. First, the systematic literature review study in Chapter Two analyzed empirical studies by using Pintrich's (2000) model as a theoretical framework. Therefore, SRL strategies such as task analysis that were grounded in other SRL models were excluded from this analysis. Secondly, the data used in Chapter Three and Chapter Four only represent the context of a single topic of MOOCs. The study featured in Chapter Three was conducted in Probability MOOCs. The study included in Chapter Four was performed in a single Mountain 101 MOOC. Finally, the aforementioned studies in Chapter Three and Chapter Four relied on data that was derived from self-reported questionnaires. Chapter Three's study used the Online Self-Regulated Learning Questionnaire (OSLQ) (Barnard, Lan, To, Paton, & Lai, 2009) and the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991). Chapter Four's study used the revised version of the Self-Regulated Online Learning Questionnaire (SOL-Q-R) (Jansen, Van Leeuwen, Janssen, & Kester, 2018), MSLQ, and survey items developed by Peltier, Drago, and Schibrowsky (2003).

## Directions for Future Research

Three studies included in this dissertation provide directions for future MOOC research.

### Reviewing empirical studies on SRL in MOOCs in an ongoing basis

As the systematic literature review in this dissertation was conducted by using Pintrich's (2000) SRL model as a theoretical framework, SRL components that are not included in the model were not analyzed. This implies that there is a need to conduct more systematic literature reviews on SRL in MOOCs within other SRL frameworks (Boekaerts, 1996; Zimmerman, 2000). In addition, as articles published after the search period were not identified in the review, future research should conduct a systematic review of empirical studies on SRL in MOOCs in an ongoing basis to better understand the topic. In addition to a systematic literature review, meta-analysis should also be performed in the future to synthesize empirical evidence on the effectiveness of SRL in MOOC environments and SRL interventions in MOOCs, and to support evidence-based practice.

### Exploring the relationships among other variables from a social cognitive perspective

Given that the second study revealed that a social cognitive model of SRL (Zimmerman, 1989) can be applied in MOOC environments, future research should further examine the relationships that might exist among other variables from a social cognitive perspective. The second study examined the relationships between self-efficacy and task value as personal variables and the use of SRL strategies as a behavioral variable. According to the social cognitive model of SRL (Zimmerman, 1989), SRL process is determined by personal factors, behavioral factors, as well as environmental factors. Researchers' reinterpretations of social cognitive models of SRL (Cho, Demei, & Laffey, 2010; Wang & Lin, 2007) showed self-

efficacy and task value as personal factors (Cho et al., 2010; Wang & Lin, 2007), the use of SRL strategies as a behavioral factor, and social presence and sense of community as environmental factors (Cho et al., 2010). Therefore, diverse relationships among self-efficacy, task value, the use of SRL strategies, social presence, and sense of community should be explored in future studies.

**Investigating Successful MOOC learners' self-efficacy**

Chapter Four study raised a question regarding the effects of successful MOOC learners' self-efficacy on their perceived effectiveness of a MOOC. In fact, previous studies on traditional online learning settings showed that online learners' self-efficacy significantly predicted perceived effectiveness (e.g., Artino, 2007; Liaw, 2008). Self-efficacy is task, context, and domain specific (Bandura, 1982). However, self-efficacy items used in Chapter Four study were more general. If survey items specifically addressed the knowledge of skills that a MOOC covered, they would have made more of an impact. Therefore, future research should develop a new self-efficacy questionnaire that better suits the context of MOOCs and investigate the effects of self-efficacy on perceived effectiveness. In addition, there is a need to examine the effects of successful MOOC learners' self-efficacy on perceived effectiveness in other MOOCs on different subjects.

**Employing diverse research methods and techniques**

Chapter Three study and Chapter Four study have limitations in that they only employed quantitative research methods including multiple linear regression. Although many researchers have used quantitative research methods to explore SRL in MOOCs (e.g., Alario-Hoyos, Estévez-Ayres, Pérez-Sanagustín, Kloos, & Fernández-Panadero, 2017; Lung-Guang, 2019),

other research methods could also be employed. For example, qualitative methods would allow researchers to closely analyze how MOOC learners specifically employ SRL strategies such as time management and what resources they need for their self-regulation processes in MOOCs. In addition, learning analytics or data mining technique could be used in future research to analyze student log data and identify MOOC learners' actual SRL behaviors. For example, the analysis of log files using the random forest algorithm (Breiman, 2001) can allow researchers to identify MOOC learners' study regularity and help seeking behaviors, as Kim, Yoon, Jo, and Branch (2018) have demonstrated in their study of traditional online courses. In addition, data mining approaches such as a K-means clustering method (MacQueen, 1967) and decision tree classifier (Quinlan, 1986) could be used to explore MOOC learners' SRL patterns as was done in studies on SRL in traditional online learning settings (Cho & Yoo, 2017).

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