**Incorporating Reflective Practice as a Means of Improving Student Self-Regulated Learning in a Digital Learning Environment**

by

Benjamin Storie

BSc, University of Manitoba, 1999
BEd, Brandon University, 2007
Post-Baccalaureate Diploma in Education, University of Manitoba, 2012

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Supervisory Committee

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## Abstract

Available research has shown that digital learning environments, in which students take active responsibility for controlling aspects of technology-infused learning, are often underutilized as many students lack the appropriate cognitive and metacognitive strategies - or *self-regulated learning* (SRL) skills. Providing SRL support in digital learning positively affects student learning (Johnson & Davies, 2014), with metacognition appearing to play the central role in SRL development (Winne, 2014). In addition, there seems to be agreement that reflection is a process by which one acts metacognitively (OECD, 2019), with use of reflective prompts being a common support to provoke metacognition in the literature. While the general research into reflection is mixed (Lew & Schmidt, 2011), more recent research on the use of reflective prompts as a support points to a positive influence on academic performance in digital learning (van Alten et al, 2020). This project details the research of reflection as a specific strategy to develop student SRL skill, culminating in a practical, research-backed book of the theory, strategies, and guidelines to help educators incorporate reflective training into digital learning environments to develop SRL skill in students.


**Keywords:** self-regulated learning, metacognition, reflection, digital learning, online learning

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**Acknowledgements**

Not only did the bulk of the work of this project occur during COVID-19 pandemic restrictions, but also during the protests and marches that took place all over the world to demand necessary action against racial inequality, police brutality, and social injustice. These profound events are at the forefront of my mind as I sit here and work at this project, and these events demand that I begin my acknowledgements by recognizing that I sit on Treaty One territory—traditional grounds of the Anishinaabe, Cree, Oji-Cree, Dakota, and Dene people, and on the homeland of the Métis Nation. My experiences and upbringing were privileged, and I recognize that this privilege led to opportunities that others cannot equitably access. I acknowledge that I must work to repair and strengthen our partnership with Indigenous Peoples to achieve the collaborative spirit necessary for reconciliation, and to address points of social injustice for marginalized peoples everywhere.

# Chapter 1: Introduction

*"Reflection can be done well or poorly, successfully or unsuccessfully, but it is always a productive experience"* (Trumpower & Sarwar, 2015, p.188).

My path to this program and this project, like many others I would assume, is neither exciting nor special: a casual conversation over coffee with a colleague in a master's program prompted a late-night search for opportunities that might pique my interest. That was it. A previously unconsidered professional path, that evening's search led me to this program offered by the University of Victoria, focusing on educational technology—an emerging interest of mine. With an application deadline only a week away, it was just serendipity colliding with an individual capable of making quick decisions.

While I can attest that even in my youth, I made decisions that would seem impulsive to some, I find it unlikely that I would have also been considered careless. I was fortunate to have two wonderful parents with slightly different worldviews: one taught me to consider practicality and prudence—a "plan for the worst but hope for the best" message, while the other stressed the importance of not hesitating out of fear of failure—a "the best laid plans of mice and men" mentality. Together they instilled a habit of thoughtful planning, along with the confidence to move forward with a less-than-perfect plan knowing that obstacles and errors were not only inevitable, but crucial for growth. Create a plan, evaluate the outcomes, and make improvements. That strategy has guided me in all aspects of life: plan, reflect, and adjust.

## What I've Noticed About Myself

As a result of this upbringing, I am endlessly consciously and subconsciously reflecting. These inner conversations always involve aspects of wondering, considering, comparing, contrasting, predicting, and questioning plans, events, and outcomes. Consequently, I have a

never-ending to-do list of new goals and necessary adjustments that I am working through in my constant quest for improvement. In my career, I likewise work to stay informed, challenge existing structures, and change approaches to best serve my students—the essential component of this work is reflection.

My reflective practice is best characterized by the work of Schön (1992) who, in evaluating how both professionals and "ordinary people" (p. 50) adapt and improve, distinguished between monitoring thought within a moment and after the fact, labeling the two situations *reflection-in-action* and *reflection-on-action*. Regardless of the point at which reflection takes place, overall, there is agreement among researchers that reflection involves monitoring and evaluating thoughts, feeling, and actions, which therefore connects it to the broader term metacognition (Butler, 2015; Reinholz, 2016; van Velzen, 2017; Parkes & Kajder, 2010). The term metacognition involves a self-awareness of the knowledge, experiences, and strategies of cognitive thought (Flavell, 1979; Zimmerman & Moylan, 2009), and the regulation of cognitive action or cognitive processes both during and after an event (Winne, 2017). The similarities are such that researchers have noted the two terms are often conflated (Toit & Kotze, 2009; Baten et al., 2017; Rose et al., 2016), with Cavilla (2017) clarifying that reflection is most accurately defined as a method of practice for improving metacognitive skills.

I credit metacognitive skill through reflective practice as foundational to improvements in all aspects of my personal and professional life (Flavell, 1979; Schön, 1992), and research has shown that honing this ability is positively connected both to school performance (Jansen et al., 2020; van Alten et al., 2020; van der Stel et al., 2010) and to life-long learning (Mevarech & Kramarski, 2014).

**What I've Noticed About Students**

Research suggests that although metacognitive ability likely emerges at around 8–10 years of age (Veenman et al., 2006), metacognitive skill requires training and does not necessarily develop on its own (Ambrose et al., 2010). Despite research showing that reflection may improve student outcomes in learning (Sarwar & Trumpower, 2015; Heemsoth & Heinze, 2016), metacognitive training is often undertaught (Zimmerman, 2002; van Velzen, 2017).

I had often wondered why so many of my students had difficulty progressing in their learning and identifying issues with necessary skill development or struggled to show even marginal growth after repeated assessment opportunities. Tanner (2012) explains that educators should not be surprised by a lack of reflection or metacognitive skill in students, as most educators do not make time for it in class. Once I recognized that students struggled to evaluate metacognitively or reflect on their learning, I attempted to incorporate reflection into my classroom with poor results. My early attempts to force reflection were based on trite question prompts like," Why were you unsuccessful?" or "How will you improve on this?" These prompts elicited short, equally trite responses like," Study harder," or "Read over the notes more."

These typically weak reflective responses are an indication that students may not have the metacognitive language to reflect with depth (Desautel, 2009), which Desoete and De Craene (2019) explain is a result of educators like myself, who often lack the knowledge to properly introduce metacognitive training into class. These failed attempts at reflection commonly involve only retrospective reflection (Reinholz, 2016), showing a limited understanding of the potential of metacognition, as it can also include reflection before and during an activity (Schön, 1992; Van Laer & Elen, 2017). In addition, the shallow responses of students are typical, as students are likely skeptical of the importance of reflection (Lew & Schmidt, 2011), leading to superficial

responses (O'Connell & Dyment, 2014) that are crafted to meet the expectation of the teacher (Rose et al., 2016).

**What I've Noticed About Education**

Within my relatively short 12-year career, my teaching strategies and resources have changed with alarming frequency. What began as lecture-style teaching with a standard whiteboard and paper handouts, quickly moved to a digital projector and then an interactive whiteboard with online applications and simulations. Where I once relied solely on lectures to deliver content, I found the courage to incorporate more personalized, project-based, or collaborative learning as a bank of reservable laptops with cloud computing became available. More recently, a 2017 division-wide "bring your own device" (BYOD) policy was launched along with an unspoken expectation to move towards a paperless teaching environment. Noticeably through all these changes, little to no training or professional development occurred on the new technology or the pedagogical shifts necessary to make full use of the technology.

This push to infuse technology into the classroom was not unique to my division, as the Government of Manitoba, through the Manitoba Education and Training department, stressed the importance of technology incorporation and its associated technological literacy skills in a provincial website called *Literacy with ICT Across the Curriculum: A Model for 21st Century Learning from K–12* (Manitoba Education and Training, n.d.). The acknowledgement of technological skill development as a means of preparing students for future learning needs is also found in the *Future of Education and Skills 2030* project of the Organisation for Economic Co-operation and Development (OECD). The OECD project, with its accompanying material, outlines the need to train students to use the technologies that are present and to prepare them for emerging technological advances (OECD, 2018).

In addition to arming students with the technological skill necessary for future success, these resources also recognize that metacognition through reflection is a vital skill for preparing for an unknown future. The Manitoba Education and Training website mentions reflection as a general requirement for understanding, and specifically connects reflective skill as necessary to the learning process in technology-infused inquiry learning (Manitoba Education and Training, n.d.). As well, the OECD lists "Reflection" as a key component of the *Learning Framework 2030* graphic, with mention of metacognition as a necessary skill for preparing for future jobs and technology (OECD, 2018).

**What I've Noticed About Technology**

Preparing students for the future by focusing on technology-based learning environments also provides educators with the chance to change learning strategies. Manitoba Education and Training (n.d.) reference inquiry learning as the learning model best suited for technology-based learning, while the OECD mentions the importance of personalized learning environments for future skills training (OECD, 2018). Current research supports the connection between existing and emerging technologies in the classroom and opportunities to provide personalized learning, collaborative learning (Blomgren, 2017; Dabbagh & Kitsantas, 2012), and problem-based learning (Bonk, 2009; van Alten et al., 2010).

For some students these new learning environments, which allow students to take a more active role in learning through problem-based learning, inquiry learning, or personalized learning, require a novel set of skills previously unnecessary in traditional lecture-style learning (Dignath & Büttner, 2018; Ewijk & Werf, 2012; Mykkanen et al., 2017). Identified as self-regulated learning (SRL), these skills can include identifying the task, setting goals, planning, self-control, evaluation, and self-reflection (Zimmerman, 2002). While there are many models

for SRL, generally, it is the cyclical process of preparing for, performing, and evaluating a task (Panadero, 2017).

Research has also shown that SRL is increasingly necessary and training is easily integrated into computer-based environments (Devolder et al., 2012; Deekens et al., 2018). Incorporating technology into these learning environments increases the need for students to remain active learners through self-regulation (Johnson & Davies, 2014; Deekens et al., 2018; Zheng, 2016), as students with weaker SRL often struggle with computer-based learning (Winters et al., 2008; Van Laer & Elen, 2017).

I had never considered the different skills that may be required of students actively learning in a personalized learning environment, and although I was aware that SRL components like goal setting and planning were crucial to independent learning, I did nothing to promote them. This oversight is common, as Ewijk and Werf (2012) explain, “although teachers consider SRL as important, most of them do not integrate strategy instruction into their teaching" (p. 8). Additionally, research also connects reflection to successful SRL (Zimmerman, 2008; Bannert, 2006; Dabbagh & Kitsantas, 2012), with some researchers arguing it is present in every aspect of learning (Mevarech & Kramarski, 2014; Butler, 2015; Reinholz, 2016; Sha et al., 2012).

Taken together, I recognize the role that reflection has played in my improvements, personally and professionally, and I have noticed that students struggle to reflect on their learning. Education has changed over my career, moving towards personalized learning environments and technology-infused learning, and these learning shifts require students to take a more active role in learning. Being an active learner requires SRL, and reflection is an important component of this process.

## Research Rationale

Technological advances and necessity are changing the method of educational instruction to more personalized, computer-based learning opportunities (Blomgren, 2017), and these environments require students to have additional skills to navigate the technology and take an active role in learning (Devolder et al., 2012; Deekens et al., 2018). Research into SRL makes mention of the necessity of reflection when students are within these computer-based learning environments (Kramarski & Gutman, 2006). It has been my general experience that students lack SRL, which is essential to actively learn in these environments (Zheng, 2016).

The following outlines my topic, research problem, purpose, and research questions to address in the literature review:

Topic: Digital learning

Problem: Many students lack the SRL that is necessary to participate actively in digital learning.

Purpose: Investigate strategies to support development of SRL in digital learning

Research Questions:

1. What does the literature say regarding SRL with digital learning?
2. How is reflection connected to SRL?
3. Can reflective opportunities support SRL within digital learning?

## Theoretical Framework

Both the main topic for this project and the following literature review were approached with the lens of constructivism (Dewey, 1910). This learning theory, which sits far across the theory spectrum from traditional educator-centered instruction methods, situates the student and their prior knowledge, experiences, and beliefs at the centre of the learning. In constructivism, the educator takes on a role of facilitation of learning opportunities to help students construct

knowledge in an active process that involves individual perspectives, as opposed to being the singular knowledge-holder with students as the passive receivers (Kalpana, 2014).

While constructivist learning theory has many interpretations (Karagiorgi & Symeou, 2005)—moving from Piaget's individual constructivism and Vygotsky's social constructivism to a blending of ideas—the common ground is that the student is to merge previous knowledge and beliefs to new experiences derived from social interactions, activities, and information to transform understanding (Kalpana, 2014; Yilmaz, 2008).

In discussing instructional design challenges, Karagiorgi and Symeou (2005) make mention of the recent dominance of constructivism, noting the adoption of this learning theory has led to an influx of instructional design changes into the classroom such as project-based learning and inquiry learning, discovery learning, experiential learning, and reflective practice (Yilmaz, 2008). To make the most of these new constructivist learning environments requires inclusion of current and emerging technologies (Karagiorgi & Symeou; Yilmaz), including social media, in providing opportunities for personalization and collaboration, allowing students to "participate in collective knowledge generation, and manage their own meaning making" (Dabbagh & Kitsantas, 2012, p. 4).

In 2002, under direction from the Government of Manitoba, Manitoba Education and Training developed the website *Literacy with ICT Across the Curriculum: A Model for 21st Century Learning from K–12,* and an associated education continuum for technology incorporation that connects technological incorporation to inquiry learning opportunities (Manitoba Education and Training, n.d.). Constructivist learning theory is specifically outlined as the foundation for this continuum, with the provided description hinting more to social

constructivism as it stresses that knowledge is actively constructed by the individual and grounded within social context (Manitoba Education and Training).

Consideration of technology incorporation in education is not unique to Manitoba Education and Training, as Blomgren (2017) has noted in analyzing the trends of increased technology in education for the purpose of providing equitable digital access across Canada. In addition to noting an increase in distance education models that provide blended or online learning opportunities across all provinces, Blomgren emphasizes that these digital environments give students control and responsibility for more personalized learning opportunities. Other authors have also noted that constructivist principles of collaboration, problem-based learning, and inquiry are often components of digital learning environments (Bonk, 2009; van Alten et al., 2010).

The topic of this project was selected as a response to my personal pedagogical shift towards constructivist learning environments. Giving students increased control of learning, whether in project-based learning scenarios, inquiry learning, or with increased technology usage, is aided by providing students with opportunities to practice and hone SRL components such as metacognition (OCED, 2019; Zimmerman & Moylan, 2009). These additional learning skills are valuable with or without a constructivist lens (Zimmerman, 2000; Butler, 2015; Dignath & Büttner, 2018), but gain increased importance in a digital learning environment (Jansen et al., 2020; Winters, Greene & Costich, 2008; Devolder et al., 2012).

Given the current restrictions placed on the education system by the COVID-19 pandemic over 2020, the trends seen by Blomgren (2017) will likely continue as digital learning environments are being made available across Canada to accommodate the various learning needs created by this event. The focus of my work—self-regulation skills, and specifically

metacognitive or reflective practice—is necessarily connected to the joint rise in digital learning environments and constructivism. A constructivist learning theory provides the framework for this literature review and project as it is the leading learning theory directing instructional design changes occurring within classrooms, as well as a strong learning theory from which to address our current educational environment during the COVID-19 pandemic.

**Definition of Terms**

While making sense of the confusion around terminology will be a component of the literature review, there are two broad ideas that will be addressed through simplified language moving forward: learning with technology and self-regulating learning. The provincial education departments in Canada use a range of terms to describe new, technology-infused educational environments—distance education, blended learning, online learning, e-learning, 21st Century learning, and web-based learning—all of them acknowledge the ubiquitous drive to incorporate Web 2.0 technology with new pedagogical opportunities (Blomgren, 2017; Van Laer & Elen, 2017). Additionally, both Van Laer and Elen and Irvine et al., (2013) observe the confusion around the use of the general term "blended learning" in covering a continuum from incorporating technology with face-to-face instruction to fully online courses.

In noting the same issues, Blomgren (2017) provides the use of an emerging term "digital learning" (p. 76), as suggested by the Alliance for Excellent Education, to cover any use of technology as an instructional enhancement for student learning. To avoid the continued management of multiple similar ideas, this broad term—*digital learning* (DL)—will be used to simplify writing throughout this project when discussing any technology-infused learning.

Additionally, the myriad definitions used in literature surrounding *self-regulated learning* (SRL) and its related skills has the potential to muddle the dissection of issues surrounding

metacognition and reflective practice. The differing models for SRL will be discussed further, as will the connection to metacognition and reflective practice; however, much like DL, a set definition for SRL will be helpful for understanding.

In evaluating SRL models, Panadero (2017) notes that there is agreement that all models are cyclical, comprised of three generally identifiable phases (preparatory, performance, appraisal) and many subphases. Over time, SRL research has put stress on different interrelated concepts like motivation (Zimmerman & Moylan, 2009), emotions (Winne, 2017), social interactions (Järvelä & Hadwin, 2013), and metacognition (Winne & Nesbit, 2009). For the purposes of this paper, SRL will be defined by one of the first authors to study and model SRL, Barry Zimmerman. This definition by Zimmerman (1989) is well suited for this paper as it is concise and purposefully acknowledges the relationship between SRL and metacognition: "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process" (p.329).

**Application of Knowledge: Design and Goals**

It has been my experience attending professional development sessions, that it is common to find little to no research support offered in discussion of the main topic. Often the speaker will develop the topic with humorous anecdotes and exemplars of their interventions, perhaps provide some statistical data of the success or failures of some pedagogical areas and may even offer up a name or two of a leading academic in that area; but rarely is the audience provided with details of supporting research evidence and time to digest said research findings.

This lack of research support also appears as a commonality through my experience in reading popular educational literature on various topics. The pattern of topic development mirrors a standard professional development session and, again, it is rare to find a detailed

overview of the supporting research. In some notable cases, literature may even be missing an end-of-book reference list.

Among other insights, my journey in this M.Ed. program has revealed to me the importance of a theoretical framework supporting classroom design and the need for strong research findings to guide the strategies and interventions within that design. Despite having read books on reflective practice in the past, it is only through my literature review of the topic that I was able to understand why providing reflective opportunities in my classroom would be relevant to other skills I expected to develop in my students, and how it connected to other fundamental learning processes. If educators can be made aware of the supporting research findings connecting new pedagogical approaches, it may provide them with increased drive to use class time to incorporate these new or unfamiliar strategies.

In acknowledging the continued incorporation of technology in classrooms, the trend towards DL environments, and the importance of SRL, the goal of my Application of Knowledge component will be to review and evaluate literature surrounding SRL—specifically the metacognitive component—to build a research-based guiding document for educators, outlining suggestions to improve learning outcomes by scaffolding and honing student reflective practice.

This Application of Knowledge component will be an open resource document of best practice, process, and strategies for implementing reflective skills into a classroom, with summaries and links to supporting research. It will also include suggestions for utilizing emerging technologies as a means of providing more robust opportunities for engaging students in reflective practice.

**Search Methodology**

Having some understanding of the term metacognition gave me a starting point for the type of search terms with which to begin. I was aware that the term “reflection” was contextually similar to “metacognition” from conversations with my educational circle of colleagues; however, I was not prepared for the theoretical uncertainty that lay ahead within the research. I began with a Boolean search using (metacognition AND reflect*) with and without ("high school" OR “secondary”), done through the University of Victoria Libraries Summons search engine. Lists were narrowed by adjusting search terms to highlight the following: adolescent, learning strategies, metacognition, science, students, strategies, teachers, teaching, teenagers, and young adults. Priority was given to peer-reviewed and scholarly articles published within the last 15 years, with an emphasis on articles with the largest Altmetric Attention Score (a measure of interest in that research output across multiple monitored sources).

A second Boolean search using (self-regulated learning AND reflect*), (self-reg* AND meta*), with and without ("high school" OR “secondary”), was also done through the University of Victoria Libraries Summons search engine. I reviewed a collection of articles found through these searches that provided a balance over the topics of interest—while articles within the high school setting were preferred, these proved difficult to find. Both reflection, metacognition, and SRL are mature themes (Cavilla, 2017; Panadero, 2017), however there were significantly fewer results when paired with technology using “techno*” in the search criteria. Efforts were taken to scroll through my previous search results for articles that seemed to include digital learning or similar possibilities.

Through review of some articles, it became clear that other hallmark research articles or important authors in the field of metacognition or SRL demanded my attention. I then searched

those authors or requested those articles. I also completed a separate Google Scholar search using the same collection of search terms listed, however few new or interesting hits were found beyond the plethora of research available via the University of Victoria Libraries. What was also specifically helpful was allowing myself to follow the links suggested by the various online repositories to additional research related to the article I had originally requested—I found this fruitful in uncovering more relevant articles on many occasions.

The following literature review will illustrate changes that DL is making to the role of the student in the classroom, the importance of explicit SRL training to make the most of these environments, and the central role that metacognition through reflection plays in honing SRL for student success in DL environments.

# Chapter 2: Literature Review

## Introduction

> *"Gone are the days when the lecture was the dominant mode of course delivery and deemed the essence of a successful course experience"* (Bonk, 2009, p. 32).

Any changes that have taken place in classrooms since the beginning of the 21st century have largely been informed by constructivist learning theory (Karagiorgi & Symeou, 2005). Originating with influential work by Dewey (1910), constructivist learning environments prioritize students in actively constructing new understanding through a process that involves individual perspectives and experiences merging with learning derived from social interactions, relevant activities, and new information (Kalpana, 2014; Villamizar & Mejía, 2019; Yilmaz, 2008). In discussing instructional design challenges, Karagiorgi and Symeou (2005) state, "constructivism is the last decade's dominant theory" (p. 18) and note that the adoption of this learning theory has led to an influx of instructional design changes in the classroom such as project-based learning and inquiry learning. Yilmaz expands this list to include discovery learning, experiential learning, and reflective practice.

As constructivism has influenced instructional design, there has been an associated rise in the digitalization of education (Blomgren, 2017; Bonk, 2009). The use of technology to enhance or augment learning can occur in multiple forms and to varying degrees, and researchers have noted the confusion of terminology (Irvine et al., 2013; Van Laer & Elen, 2017). In studying the trends of digitalization across Canada, Blomgren (2017) suggests the generalized term *digital learning (DL)* be used for discussing any learning with technology. These DL environments require students to take responsibility for controlling aspects of the content and resources for learning (Blomgren, 2017, Joksimović et al., 2015). Research has not only suggested that the

instructional design components of constructivist learning are often present in DL environments (Bonk, 2009; Skrypnyk et al., 2015; van Alten et al., 2010), but that some form of DL may be necessary to make the most of constructivist learning situations (Dabbagh & Kitsantas, 2012; Karagiorgi & Symeou, 2005; Yilmaz, 2008).

These constructivist-framed, DL environments require a student to take an active role in learning by utilizing additional skills beyond basic proficiencies to navigate the technology (Deekens et al., 2018; Van Laer & Elen, 2017). Kramarski and Gutman (2006) note that DL environments are often underutilized by students as they lack the appropriate cognitive and metacognitive strategies. Identified as SRL, Zimmerman (1989) defined it as, "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process" (p. 329). These skills can specifically include things like identifying the task, setting goals, planning, self-control, evaluation, and self-reflection (Zimmerman, 2002). SRL research is many decades old (Winne, 2017; Zimmerman, 2008), and SRL and its components have been shown to have value with or without a constructivist lens (Dignath & Büttner, 2018; Ewijk & Werf, 2012; Zimmerman, 2000; Zimmerman, 2008) and as necessary to lifelong learning (Butler, 2015; Schunk, 2005).

For a variety of reasons, educators rarely include SRL training opportunities for students (Ewijk & Werf, 2012; Dignath & Büttner, 2018; Nussbaumer et al., 2015;), yet some research has shown that providing SRL support in DL environments positively affects student learning (Johnson & Davies, 2014; Zheng, 2016). SRL is a complex topic (Winne, 2017; Zimmerman & Moylan, 2009) and identifying which component(s) to focus on as learning support to improve student outcomes is difficult (Butler, 2015; Medina & Pagán Maldonado, 2016; Winters et al., 2008). Self-reflection is a main component of some SRL theory (Zimmerman, 2000), and early

theory by Schön (1992) suggests that reflective practice is a foundational strategy for all skill improvement. There is little available research examining the support of student learning through reflective practice in DL environments, and available research into reflection shows a positive, although limited, affect on student performance (Cavilla, 2017; Lew & Schmidt, 2011) and knowledge structure (Heemsoth & Heinze, 2016; Sarwar & Trumpower, 2015).

The goal of this literature review is to examine research into both DL and SRL, to identify the connection between the two topics, and ultimately inform educators to better support students working within these learning environments.

**Digital Learning and Self-Regulated Learning**

The highest rate of K–12 student participation in distance education across Canada occurs in British Columbia at 12.2%, with the lowest rate occurring in Manitoba at 5% (Blomgren, 2017). Despite these seemingly low numbers, Blomgren notes these rates are increasing across Canada, with an increase of 15% in one reporting year. This trend is not confined to K–12, as higher education has also seen increases in DL environments, from MOOCs (Irvine et al., 2013; Rohs & Ganz, 2015; Siemens et al., 2015) to blended learning (Baepler et al., 2014; Skrypnyk et al., 2015). Further to this trend is an acknowledgement of the ongoing COVID-19 pandemic, which has brought about an abrupt shift towards emergency remote education as an obligation for learning in many countries (Bozkurt et al., 2020). Learners in these DL environments are often asked to take greater responsibility and autonomy in managing their own learning (Ewijk & Werf, 2012; Jansen et al., 2020; Johnson & Davies, 2014), as DL can involve components such as actively and adaptively managing content (Chaves-Barboza et al., 2015) and constructing personal meaning within a social context (Baepler et al., 2014; Dabbagh & Kitsantas, 2012; Skrypnyk et al., 2015). In discussing a previous study on technology skill in students, Blomgren

(2017) admits this role can present a challenge stating, “being young does not necessarily equate to adequate competency in the learning use of digital tools” (p. 85). The OECD, in the *Future of Education and Skills 2030* project, acknowledges the need for a broad range of skill development as a means of preparing students for future success. This project, with its accompanying material, outlines that students require the opportunity to become active learners, who apply an array of cognitive and metacognitive skills, including self-regulation, while preparing for emerging technological advances within a personalized learning environment (OECD, 2018).

Placing students in situations where they take a more active role in learning requires development of strong SRL that they may not have had a chance to hone during non-constructivist learning environments (Dignath & Büttner, 2018; Ewijk & Werf, 2012; Van Laer & Elen, 2017). Recognized as important for lifelong learning both in research (Butler, 2015; Nussbaumer et al., 2015; Zimmerman, 2002) and in national and international initiatives (Dignath & Büttner, 2018; OECD, 2018), there is a connection between SRL ability and student success in navigating DL environments (Johnson & Davies, 2014; Lehmann et al., 2014; Nussbaumer et al., 2015; Winne, 2014). Meta-analyses of research into SRL scaffolding in DL environments, completed by Devolder et al. (2012) and five years later by Zheng (2016), concluded that students must apply SRL to be effective learners in DL settings. The nature of SRL makes it is difficult to identify specific component(s) on which to focus as learning support to improve student outcomes (Butler, 2015; Medina & Pagán Maldonado, 2016; Winters et al., 2008), however, DL must be accompanied by affordances for the practice of SRL (Johnson & Davies, 2014; Winters et al., 2008). Common DL features such as complex tasks, choices in direction of content and strategy use, control of resources, individualized evaluation, chance to communicate and collaborate with educators and peers, and prompts to reflect, provide such

opportunity for student SRL development (Blomgren, 2017; Karagiorgi & Symeou, 2005; Mykkänen et al., 2017; Nussbaumer et al., 2015).

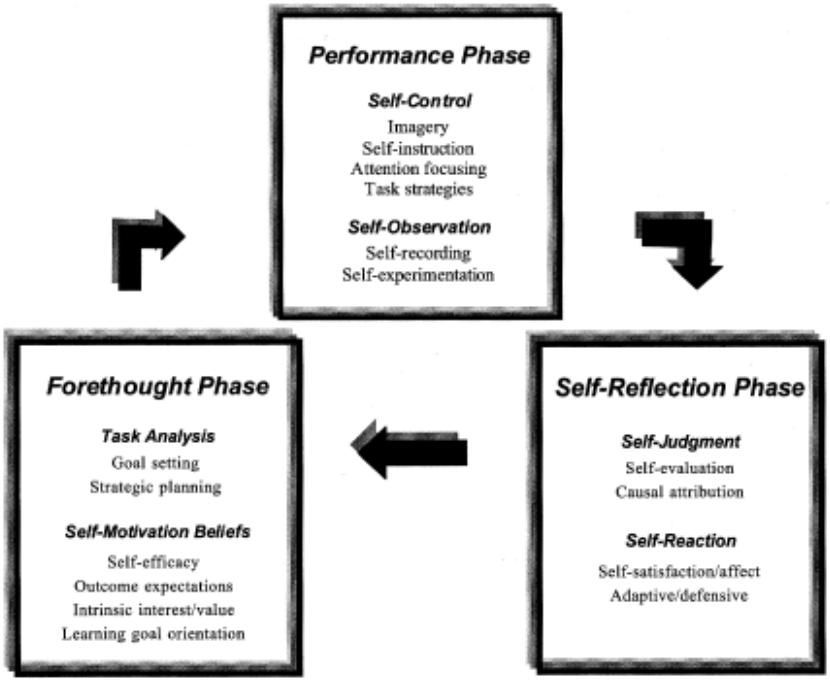
**SRL Models and the Central Role of Metacognition**

Of the several models of SRL put forth in the research, the two most cited by sources found in this literature review were the Zimmerman model (Dabbagh & Kitsantas, 2012; Johnson & Davies, 2014; Nussbaumer et al., 2015) and the Winne and Hadwin model (Devolder et al., 2012; Sha et al., 2012; Van Laer & Elen, 2017). This finding is supported by the research of Panadero (2017), which provides an overview of the most well-known, studied, and referenced SRL models (based on peer-review, empirical support, and number of citations) identifying the models of Zimmerman, Pintrich, and Winne and Hadwin as being the most referenced.

Although Zimmerman developed his first model in 1989 (Zimmerman, 1989), it is the cyclical phase model, first published in 2000, that is commonly referred to as Zimmerman's model (Panadero, 2017). Seen in Figure 1, this model is set apart by its clear distinction between phases and subprocesses, the inclusion of motivational and emotional aspects, and less consideration for metacognitive processing in comparison to other models (Panadero). Although it is noteworthy that Zimmerman (1989) defined SRL with an explicit association to metacognition, stating SRL is "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process" (p. 329). As per its popularity, Panadero posits that the relative simplicity of this model makes it easier for educators to explore and apply within classrooms.

**Figure 1**

*Zimmerman s Phases and Subprocesses of Self-Regulation (2003).*

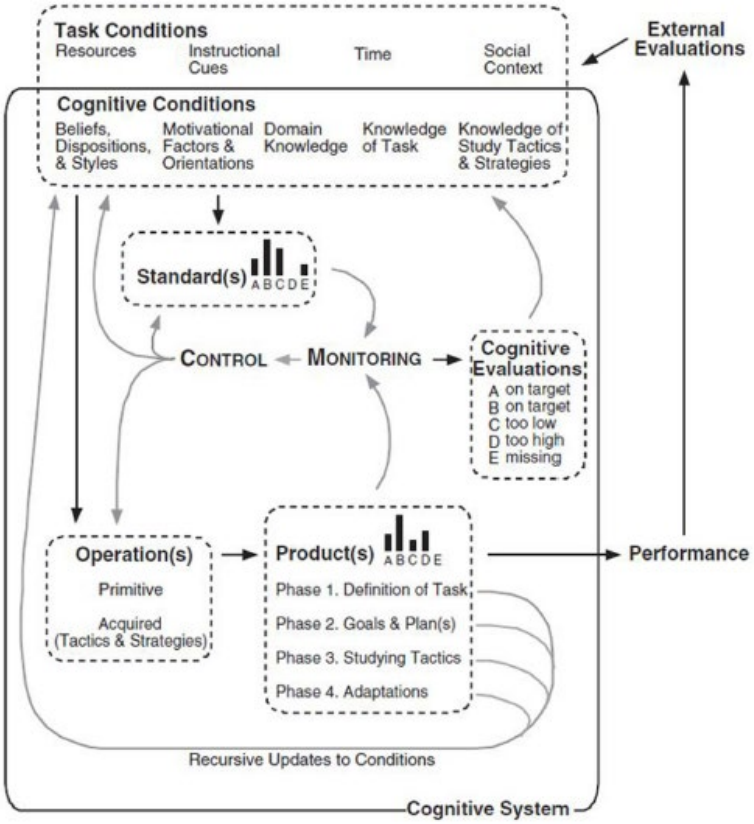



From Zimmerman, B. J. & Campillo, M. (2003) “Motivating Self-Regulated Problem Solvers.” In J.E. Davidson & R. Sternberg (Eds.), The Nature of Problem Solving. New York: Cambridge University Press.

Developed after Zimmerman’s original model, the Winne and Hadwin model (Figure 2), presented in 1998 (Winne & Hadwin, 1998), comprises four phases, linked in a recursive feedback loop. What sets this model apart from Zimmerman is that Winne and Hadwin placed greater emphasis on metacognitive processes, with students actively monitoring during each phase (Panadero, 2017). In comparison to Zimmerman, Panadero also states that, despite being less intuitive, the Winne and Hadwin model is favoured for use in research of computer-supported learning.

**Figure 2**

*Winne & Hadwin s COPES Model for Self-Regulated Learning (1998).*




From Winne, P.H. & Hadwin A.F. (1998) “Studying as Self-Regulated Learner.” In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), Metacognition in educational theory and practice. Hillsdale, NJ.

SRL research has included different interrelated variables like motivation (Zimmerman & Moylan, 2009), emotions (Winne, 2017), social interactions (Järvelä & Hadwin, 2013), and metacognition (Winne & Nesbit, 2009), with researchers noting this web of concepts often leads to difficulties in collecting and analyzing reliable data (Dinsmore & Zoellner, 2018; Winters et al., 2008). Specifically of SRL in DL environments, an analysis of research into SRL in computer-based learning, Winters et al. (2008) stated that isolating and studying specific variables of SRL presents a challenge. This was furthered in the systematic literature review of

Van Laer and Elen (2017) regarding attributes of DL environments that support SRL. Another roadblock to clarity in SRL research is the presence of many competing models, with Panadero (2017) requesting more empirical studies to support individual theories and Winne (2014) calling for efforts to trim the list of models through experimental support. Despite some confusion, Panadero (2017) notes that there is agreement that all SRL models are cyclical, comprised of generally identifiable phases (preparatory, performance, appraisal), and many subphases.

Metacognition is the interwoven component of SRL that is of specific note, with Winne and Nesbit (2009) calling metacognition the "hub" (p. 262) of SRL, and Van der Stel and Veenman (2014) noting that past meta-reviews concluded metacognition is "the most important predictor of learning performance" (p. 118). While the Winne and Hadwin model (Winne & Hadwin, 1998) emphasizes a larger role for metacognition over the Zimmerman model (Panadero, 2017; Zimmerman & Campillo, 2003), it is noticeable that Zimmerman altered his original model to explicitly include metacognition strategies in later work (Zimmerman & Moylan, 2009). Attributed to the research of John Flavell (Apaydin & Hossary, 2017; Flavell, 1979), metacognition once stood as a separate learning perspective distinct from SRL, however continued research has noted the entanglement of these two concepts (Butler, 2015; Kaplan, 2008). Sha et al. (2012) mentions the ubiquitous nature of metacognitive processes within SRL for students using mobile devices for learning, while Deekens et al. (2018) found a similar connection of metacognitive strategies present throughout the SRL processes of high school and college students within DL environments. The importance placed on metacognition in SRL is dependent on the researcher, with some noting connectivity (Zimmerman, 1989), others identifying metacognition as *the* essential component (Dabbagh & Kitsantas, 2012; Dignath & Büttner, 2018; Dinsmore et al., 2008; Winne, 2014), and some further stating that the two

concepts are interchangeable (Desoete & Crane, 2019; Toit & Kotze, 2009; Winters et al., 2008). Another learning model put forth by Butler (2015), not included in the review of Panadero (2017), suggests even more deliberate integration of metacognition with SRL, combining the overlapping terms into one framework.

While metacognition is recognized as fundamentally important to SRL (Winne, 2014), isolating and researching metacognition remains a difficult task (Veenman et al., 2006). In a three-year longitudinal study of metacognitive skills and intellectual ability in adolescents, Van der Stel and Veenman (2014) make note that research supporting metacognitive models are difficult to compare as there are no set assessment methods, and studies vary widely in participants and chosen tasks. Multiple research studies have also reported the difficulty in evaluating metacognitive strategies as an absolute, agreed-upon definition of metacognition remains elusive (Baten et al., 2017; Desoete & Crane, 2019; Tanner, 2012; Toit & Kotze, 2009).

**The Language of Metacognition**

Throughout the research, there seems to be at least moderate agreement on what constitutes metacognition. Flavell (1979), in his landmark paper on metacognition, explains, "cognitive strategies are invoked to make cognitive progress, metacognitive strategies to monitor it" (p. 909). Further work by Nelson and Narens (1990) outlines metacognition as the dual processes of control and monitoring, differentiated by the flow of information: an uptake of information gleaned by metacognitive monitoring of the current state results in downstream information delivery that may initiate a change in action through metacognitive control. While the term monitoring in connection with metacognition appears frequently in research (de Bruin & van Gog, 2012; Dinsmore et al., 2008; Winne, 2014), researchers note the use of many

overlapping terms for concepts that may be metacognitive (Baten et al. 2017; Mavarech & Kramarski, 2014).

In discussing his SRL model, Zimmerman (2002) uses the term *self-monitoring* to distinguish a skill of successful learners, but the term *metacognitive monitoring* appears in an updated version of his SRL model (Zimmerman, 2008) and is used by other researchers (Deekens et al., 2018). The other notable SRL model by Winne and Hadwin (Winne & Hadwin, 1998) use the terminology of Nelson and Narens—*monitoring* and *control*—without the term metacognition appearing at any point in the model. In probing educator use of SRL training in math classrooms, Dignath and Büttner (2018) use the term *metacognitive reflection* multiple times to describe a successful strategy used with secondary school students.

The term *reflection* is also defined in different ways in the research (Van Velzen, 2017), but is connected to metacognition (Rose et al., 2016). Cavilla (2017), in studying reflection and academic performance in high school, discusses "'stimulating students' metacognition through structured and meaningful reflective prompts" (p. 7), while O'Connell and Dyment (2016), studying reflective journal use in university students, used "metacognitive activities designed to promote reflection" (p. 394). While these researchers seem to put the opposite ideas as subordinate to the main, there is agreement that metacognition and reflection are interwoven. The OECD, in documents from its *Future of Education and Skills 2030* project, firmly superordinate metacognition by identifying reflection as a method of practice for developing metacognition (OECD, 2019), with this hierarchy seen within other research (Van der Stel & Veenman, 2014; Van Velzen, 2017).

The process of monitoring one's thinking has its origins with John Dewey (1910), frequently noted as the originator of educational thought on reflection (Villamizar & Mejía,

2019). In writing on the importance of reflection, Dewey (1910) states, "all reflection involves, at some point, stopping external observations and reactions so that an idea may mature" (p. 210). Further hallmark work by Schön (1992), who in evaluating how both professionals and “ordinary people” (p. 50) adapt and improve, distinguished between monitoring thought within a moment and after the fact, labeling the two situations *reflection-in-action* and *reflection-on-action*. Despite only using the term reflection to label the third stage of the SRL model, in discussions on SRL, Zimmerman and Moylan (2009) acknowledge the integration of metacognitive processes throughout SRL, as well use the term *metacognitive reflection* in reference to a specific SRL support strategy. Noted earlier, Winne and Hadwin (1998) outline the importance of active monitoring through the entirety of the SRL model and in studies on SRL in DL environments, both Johnson and Davies (2014) and Deekens et al. (2018) report that continuous monitoring is essential through all phases of SRL. Building off Schön’s understanding of reflection being both an active and retrospective occurrence, McAlpine and Weston (2000), in looking at the reflective practice of exemplary educators, notes that reflection also occurs asynchronously, prior to action—something the authors term *reflection-for-action*—in addition to being concurrent of action and retrospective of action. Using the Winne and Hadwin SRL model as guidance, Van Laer and Elen (2017) completed a systematic literature review focusing on reflection as supports of SRL in DL environments, identifying and labeling three types of reflection: *reflection before action*, *reflection during action*, *reflection about action*. Reinholz (2016), in research on reflection and learning in mathematics, also expands on Schön, but uses the term *prospective reflection* to mean reflections prior to and during an event, while Lehmann et al. (2014) call the same idea *preflection*. Also referencing Schön, the OCED (2019) states, "reflection is the thread that makes continuity of learning possible" (p. 6). However, research into reflection as a strategy

to improve SRL is muddled (Baten et al., 2017; Cavilla, 2017) due to the interaction of metacognition with other overlapping and developmentally similar topics beyond SRL (Apaydin & Hossary, 2017; Baten et al., 2017; Van der Kleij et al., 2017; Zimmerman & Moylan, 2009).

Specific research that does exist on reflection to engage metacognition or improve SRL often uses reflective prompt variations to those posed by Schön (1992), who in describing reflective questions during his dissection of reflection-in-action put forth, "What features do I notice when I recognize this thing?" and "What procedures am I enacting when I perform this skill?" Schunk (2005), in his review of the well-known Pintrich SRL model (Pintrich et al., 2000; Panadero, 2017), notes that Pintrich encouraged metacognition throughout the SRL process with similar reflective questions like:" What do I know about this?" "How is this going?" and "How did I do?" Bannert (2006), looking into metacognitive prompts to spur reflection in a DL environment, has prompts for every step of learning: primary prompts for identifying the goal and available resources ("What do I want to learn actually?"), which lead into planning and processing ("How do I proceed?"), and finally evaluation of the learning outcome ("Did I reach the learning goal?). These questions are like those used by Kramarski and Gutman (2006) in studying SRL support in DL of math: "What is the problem about?" and "What are the strategies that are appropriate here and why?" and "Did I understand it?" Toit and Kotze (2009) and Sabel et al. (2017) had a similar approach in research looking at metacognitive strategies and reflective questioning, respectively, with both indicating that reflecting continuously through the entire SRL process may be a strong instructional design strategy for educators to improve student metacognition and therefore SRL.

**Research on Reflection**

A positive correlation between developed SRL and academic outcomes was already noted as being well-established in the literature in 2002 (Zimmerman, 2002). The background portion of many recent articles investigating components of SRL have noted the established positive effect on academic performance (Sabel et al., 2017; Zheng, 2016), while more recent meta-analyzes investigating SRL supports in DL environments have noted that SRL skill improves academic performance and learning outcomes (Jansen et al., 2020; van Alten et al., 2020). More specifically, Deekens et al. (2018) studied metacognitive monitoring within DL for post-secondary and high school students, finding that more frequent monitoring led to selection of more complex metacognitive strategies, which led to better academic performance. Deekens et al. also acknowledged that this study built on prior research supporting positive connections between metacognition and academic performance (Chaves-Barboza et al., 2015; Mavarech & Kramarski, 2014; Van der Stel et al., 2010). While it was more difficult to locate studies specifically investigating reflection and academic outcome, uncovered studies involving reflection or reflective strategies varied widely both in the age of the study participants and the focus of study itself. Much of the research on reflection involved participants within a university setting (O'Connell & Dyment, 2016; Sabel et al., 2017; Villamizar & Mejía, 2019) or involved teacher or pre-service teacher participants (Hains-Wesson & Young, 2016; Kajder & Parkes, 2012; Parkes & Kajder, 2010).

In a large study of reflective journaling in 690 first-year university student participants, Lew and Schmidt (2011) had difficulty finding a significant measurable effect between journaling as reflective strategy for improving academic achievement of test grades alone, although the authors did acknowledge a small positive effect on general student learning and

improvement in reflective practice overall. Sarwar and Trumpower (2015), in studying reflection and its effects on student knowledge, analyzed the one-time reflections of high school physics students created from feedback given on a formative assessment task. Opportunities to reflect on assessment feedback appeared beneficial for all students and, in their analysis, the authors note that students who displayed a deeper conceptual reflection performed better on a subsequent assessment than students with shallow, declarative reflections. In a study using reflective prompts to engage students in learning through evaluating errors in middle-years mathematics, Heemsoth and Heinze (2016) noted the importance of reflection in the Zimmerman SRL model, and the potential of reflection as a means of improving student learning. The study found that reflection on self-made errors was an effective approach that resulted in procedural and conceptual knowledge gains in the participants. Also referencing the Zimmerman model, Sabel et al. (2017) studied the use of reflection prompts to improve metacognition and content understanding in undergraduate biology students. Their research showed that students utilizing the reflection prompts to engage metacognition performed better on assessment markers, with selected students who had received additional instruction on the use of the reflection prompts showing even higher learning gains. Cavilla (2017), in looking at reflection as a correlation to academic success and motivation in high school students, noted that while the study uncovered statistically insignificant results for academic performance and motivation across all participants, positive qualitative feedback was received from students indicating improvements in effort given on assignments and evidence of metacognitive development. Dignath and Büttner (2018), in researching how teachers promote SRL in primary and secondary schools, conclude that few secondary teachers use reflection as a strategy, despite discussing that their previous meta-

analysis on the most effective supports for SRL identified reflection as having a positive effect in secondary school specifically.

Although these reflective studies did not find overwhelming evidence of positive effect of reflection on academic achievement, authors were careful to outline the many limitations involved in studies on reflection (O'Connell & Dyment, 2016). In addition to the already acknowledged difficulties in interpreting research results for reflective practice due its association with metacognition and SRL (Cavilla, 2017; Lew & Schmidt, 2011; Sabel et al., 2017), Reinholz (2016) mentions that most research involves post-activity reflection support only, which limits potential as reflection may occur through the entirety of the SRL process (Van Laer & Elen, 2017). Lew and Schmidt (2011) note that their study on reflective journaling may not have been of long enough duration to ensure student success in reflective practice, while Sarwar and Trumpower (2015) only provided one opportunity for students to reflect in their study, with no prior training or preparation. It is recognized that metacognitive skills are often overlooked in the content area of most courses (Ambrose et al., 2010), with some mentioning time constraints (Hains-Wesson & Young, 2016; O'Connell & Dyment, 2016) and others mentioning a jam-packed curriculum that must be "pruned to make space" (Winne, 2017, p. 46) for proper metacognitive training. Hains-Wesson and Young (2016), in studying reflective practice in STEM teachers, stated that educators do not have a good understanding of reflection or the skills associated to teach and assess student reflections effectively. Direct instruction is deemed essential in developing metacognitive language and skills in students (Apaydin & Hossary, 2017; O'Connell & Dyment, 2016; Parkes & Kajder, 2010; Winne, 2017), and many of the studies mentioned involved little to no training for students on reflective practice prior to the study (Lew & Schmidt, 2011; Sarwar & Trumpower, 2015; Van Velzen, 2017). Without the

clarity of instruction, reflective practices are likely to be ineffectual and superficial (Cavilla, 2017; Kirk & Pitches, 2013; Van Velzen, 2017), or simply "what they think the professor wants to hear" (Parkes & Kajder, 2010, p. 221).

**Digital Learning and Reflective Practice**

In his overview of SRL, Winne (2017) identifies students as "learning scientists" (p. 36) and suggests that supporting students in enhancing SRL requires both opportunities to practice metacognitive monitoring and information about their learning on which to self-assess for areas of improvement. The importance of self-assessment information, or feedback, was highlighted by Van der Kleij et al. (2015) in a meta-analysis on the effects of feedback on student learning in DL environments. Van der Kleij et al. state," feedback is viewed as one of the most powerful means to increase student learning" (p. 476) and note that while many factors are involved in how feedback is created and used successfully, elaborate and timely feedback had a large affect size on learning. Van der Kleij et al. also noted that a significant amount of research existed on providing feedback facilitated through DL. Ostrow and Heffernan (2014), in researching the effect of text versus video feedback on 139 middle school students in a DL mathematics lesson, found larger performance improvements for students in the video feedback group over those in the text feedback group, an overall positive student perception of video feedback, and concluded video feedback is a beneficial tool for DL environments. An action-research study by Kirk and Pitches (2013) explored best practice in utilizing DL to enhance and embed reflective practice within their university courses. Working with colleagues and students across learning modules, students were tasked with capturing their work with video, using video production software to analyze and modify, and choosing from various DL modalities to document reflections fueled by this process. Kirk and Pitches found that the act of using DL technologies to further edit the

original video forced self-reflection, and that students found the video-enhanced reflection enabled recall and further review of their process. In referencing the work of Schön on reflection, Kirk and Pitches conclude, “learners need to reflect to document, and in the process of documenting, they reflect” (p. 215).

In further research, Van der Kleij et al. (2017) connected feedback to improved reflective practice as a means of strengthening SRL. In the study on the use of video technology in providing feedback for further reflection, feedback was given in the form of a video-recorded teacher-student conversation, which was then used to guide a follow-up student reflection. The authors concluded that video feedback enhanced both the reflective practice and the overall SRL process for students. The use of DL technologies for feedback and reflection was also researched by Kelly Parkes and Sara Kajder over multiple years with a cohort of pre-service teachers (Kajder & Parkes, 2012; Parkes & Kajder, 2010). Participants were asked to perform weekly reflections, alternating between DL text-based (blog) and DL video-based (vlog) modalities. In the 2010 article on reflections produced for an electronic portfolio, rubric-guided feedback on the previous reflection was found to promote deeper reflections in the subsequent weekly reflection. Also of note, Kajder and Parkes (2012) found that participants produced reflections of more depth in the video-based weeks speculating, similarly to Kirk and Pitches (2013), that video reflection provided opportunity to review and reflect in a manner of recursive reflection that was different than text-based reflection.

In researching the attributes of DL that support self-regulation, Van Laer and Elen (2017) performed a systemic literature review and identified reflection prompts as being one of the attributes of DL that could support SRL, with reflection prompts providing opportunity for self-initiated feedback that aided appropriate strategy selection. In research on preflective and

reflective prompts in DL, Lehmann et al. (2014) define prompts as "simple questions, incomplete sentences, execution instructions, or pictures, graphics and other forms of multimedia" (p. 315) and note that prompts can be used for reflection before, during, and after learning. Lehmann et al. conclude that preflective prompts worked best for novice learners, and that different prompt types have differing effects on a learner. A meta-analysis by Zheng (2016) on the effectiveness of SRL scaffolds on performance in DL, recognized prompts as a type of scaffold and noted prompts were most effective when used for two to four weeks through indirect engagement of all aspects of the SRL process. While no prompts were used for a study of metacognitive monitoring and strategy use in DL, Deekens et al. (2018) found that college and high school participants that initiated self-monitoring with more frequency tended to use deeper monitoring strategies—such as activating prior knowledge, drawing inferences, and summarizing—resulting in better academic performance. More recently, a university study on metacognitive scaffolding in a DL mathematics course by Valencia-Vallejo et al. (2019) found that use of reflective prompts, termed *metacognitive activators*, had a significant and positive effect on student learning achievement, metacognitive ability, and student sense of self-efficacy. These metacognitive activators were given both during and after learning and included prompts to engage student reflection on planning effectiveness, active understanding, resources use, and comprehension. Also investigating SRL prompts in DL, van Alten et al. (2020) introduced prompts over six weeks of course work for 154 high school participants. Using a Zimmerman model of SRL, prompts through all phases such as "What do you already know about…?" and "Is there any information so far that you did not understand?" and "Did your approach to learn...work for you?" (p. 10) had no effect on post-test achievement, despite the authors acknowledging previous research indicating positive results. Van Alten et al. suggest the results may be

compromised by a lack of metacognitive ability or motivation in high school students to use the prompts effectively.

While research specifically connecting academic performance and reflection may be mixed (Lew & Schmidt, 2011), there is literature that suggests incorporating reflective practice has perceived benefit outside of measurable academic performance. Chaves-Barboza et al. (2015) provided a questionnaire to a random sampling of 299 university students to discover the SRL strategies that students used in DL, and which strategies students perceived to account for their academic accomplishments. The study uncovered that, while students learn to self-regulate using various strategies, most students surveyed used reflection to enhance understanding, and one subset of students attributed metacognition as being the primary SRL strategy in their achievement. Verpoorten and Westera (2016), in research on the use of structured reflection breaks in DL coursework, found that while it did not help performance as based on pre- and post-testing, significant increases were seen in student time on task and perceived learning. Verpoorten and Westera conclude that while current literature supports incorporating reflection as a strategy to enhance learning, results to support reflective practice with improved academic performance are often mixed as using test performance to measure correlation may be limiting. Student data from a follow-up questionnaire in this same study (Verpoorten & Westera) mirrors that of another study on the use of video reflection in ninth grade participants (Rose et al., 2016), in that participants of both studies indicated a generally positive impression of incorporating reflective practice.

Studies of reflective practice also indicate the importance of incorporating different modalities for reflection. The reflection studies of Kirk and Pitches (2013) and Parkes and Kajder (2010) both acknowledge that students reflect differently across modalities, with Kajder

and Parkes (2012) speculating that digital-text reflection encourages editing and revising in a way that hinders the deeper, stream-of-consciousness reflecting that occurs in video reflections. Rose et al. (2016) note that written reflections are the tradition modality, which can impede underdeveloped writers and be limiting in scope. In examining the use of video reflections, Rose et al. discuss how the recursive nature of video resonated with students, allowing for a third person view that aided future reflections—something not captured in writing. While the action-research of Villamizar and Mejía (2019) described how the use of video for reflection provided students who may not typically participate in class a mode for giving voice and considerations. O'Connell and Dyment (2016) noted that when given a choice in modalities, students will often choose what they perceive to be less work. However, it was theorized that this choice could also be due to insufficient technological proficiency, despite the assumed comfort level of the current student age-group (O'Connell & Dyment, 2016; Villamizar & Mejía, 2019). Additionally, it is postulated that distrust of technology, self-consciousness, and apathy may contribute to a choice of traditional methods of reflection (Kirk & Pitches, 2013; Villamizar & Mejía, 2019).

Among the common limitations throughout these studies are the acknowledgement of small sample size that makes it difficult to generalize findings (Kajder & Parkes, 2012; Valencia-Vallejo et al., 2019; Villamizar & Mejía, 2019), a short duration of study that limits the potential for observing growth over reflections (van Alten et al., 2020; Verpoorten & Westera, 2016), and little to no pre-study metacognitive training that limits participant understanding of the purpose and potential of reflection (Bannert, 2006; Lehmann et al., 2014; Parkes & Kajder, 2010). Technology skills were also noted to be lacking in participants in some studies of reflection in DL, which limits findings (Kirk & Pitches, 2013; O'Connell & Dyment, 2016; Villamizar & Mejía, 2019).

Across studies into reflection—with or without DL—as a means of improving either metacognition specifically, or SRL generally, the following are the overlapping suggestions from the authors to improve future reflective practice in students based on the results of their research: teacher modelling (Kirk & Pitches, 2013); explicit instruction (Parkes & Kajder, 2010; Sarwar & Trumpower, 2015); feedback on which to build reflective depth (Chaves-Barboza et al., 2015; Van der Kleij et al., 2017; Villamizar & Mejía, 2019); use of reflection exemplars to build understanding (O'Connell & Dyment, 2016; Villamizar & Mejía, 2019); and numerous practice opportunities (O'Connell & Dyment, 2016; Sarwar & Trumpower, 2015). Taken together, incorporating these features into direct instruction on reflection would provide students with the best chance of developing strong metacognitive skills that may not only improve performance in content areas, but also positively affect other areas of learning and provide transferable skills that can be applied to novel situations as lifelong learners (Sarwar & Trumpower, 2015; Villamizar & Mejía, 2019).

**Summary of Main Findings**

> *"Reflection can be done well or poorly, successfully or unsuccessfully, but it is always a productive experience"* (Trumpower & Sarwar, 2015, p. 188).

Returning to the research questions leading this review, the literature outlines the increasing use of DL environments for learning (Blomgren, 2017) and the importance of having students develop strong SRL (Dignath & Büttner, 2018; OECD, 2018; Van Laer & Elen, 2017) to take the controlling role in learning that is often expected in DL (Ewijk & Werf, 2012; Jansen et al., 2020; Johnson & Davies, 2014). Two meta-analyses performed on SRL scaffolding in DL environments concluded that students must apply SRL to be effective learners in DL settings (Devolder et al., 2012; Zheng, 2016), and various SRL research studies have concluded that

providing SRL supports in DL positively affects student learning (Johnson & Davies, 2014; Lehmann et al., 2014; Nussbaumer et al., 2015; Winne, 2014). Difficulty lies both in determining which SRL component(s) to best focus attention as means to support student outcomes (Butler, 2015; Medina & Pagán Maldonado, 2016; Winters et al., 2008), and in isolating research on SRL, as studies have acknowledged SRL includes other complex variables such as motivation (Zimmerman & Moylan, 2009), emotions (Winne, 2017), social interactions (Järvelä & Hadwin, 2013), and metacognition (Winne & Nesbit, 2009). Despite the support in favour of supporting SRL development in students within DL, many students currently lack the SRL necessary to participate in DL actively and successfully (Kramarski & Gutman, 2006), and educators rarely include SRL training opportunities during course work (Dignath & Büttner, 2018; Ewijk & Werf, 2012; Nussbaumer et al., 2015).

Most SRL models identify metacognition as a central component of the SRL process (Panadero, 2017), with one popular model—the Winne and Hadwin model (Winne & Hadwin, 1998)—placing metacognition at the center of all SRL (Panadero, 2017; Winne & Nesbit, 2009). The Winne and Hadwin model (Winne & Hadwin, 1998) is the preferred model for framing research studies into DL (Panadero, 2017), and research supports this model's assertion that metacognition plays the central role in SRL development (Dabbagh & Kitsantas, 2012; Deekens et al., 2018; Dignath & Büttner, 2018; Winne, 2014). There continues to be discrepancy around the language of metacognition and metacognitive strategies (Baten et al., 2017; Desoete & Crane, 2019; Toit & Kotze, 2009), with variations on the terms monitoring (Dinsmore et al., 2008; Winne, 2014; Zimmerman, 2002; Zimmerman, 2008), metacognitive reflection (Dignath & Büttner, 2018), or reflection (Rose et al., 2016) being used to describe a similar metacognitive process. However, in the research there also seems to be some agreement in acknowledging

reflection as a process by which one acts metacognitively (Cavilla, 2017; OECD, 2019; Van der Stel & Veenman, 2014; Van Velzen, 2017). Self-reflection is a main component of some SRL theory (Zimmerman, 2000), and work by Schön (1992)—delineating reflection as something that occurs both during and after action—identifies reflective practice as a foundational strategy for all skill improvement. Some researchers, building on Schön, have attempted to expand the common understanding of reflection as retrospective only (Lehmann et al., 2014; McAlpine & Weston, 2000; Reinholz, 2016), while a systematic literature review by Van Laer and Elen (2017), focusing on reflection as support in DL, identified and labeled the three types of reflection used within the literature as r*eflection before action*, *reflection during action*, and *reflection about action.* Additionally, there is further research supporting metacognition as occurring throughout the entire SRL process (Deekens et al., 2018; Johnson & Davies, 2014; Zimmerman & Moylan, 2009). The use of reflective prompts to engage metacognition is considered a main attribute of DL in support of SRL (Van Laer & Elen, 2017), with reflective prompts also appearing as a common support to provoke metacognition in studies in the literature (Bannert, 2006; Kramarski & Gutman, 2006; Sabel et al., 2017; Toit & Kotze, 2009).

While there is prior research supporting positive connections between metacognition and academic performance (Chaves-Barboza et al., 2015; Mavarech & Kramarski, 2014; Van der Stel et al., 2010), more recent meta-analyses investigating SRL supports in DL environments have also noted that skill in SRL improves academic performance and learning outcomes (Jansen et al., 2020; van Alten et al., 2020). Research into reflection is mixed, with a limited positive effect on student performance (Cavilla, 2017; Deekens et al., 2018; Lew & Schmidt, 2011; Sabel et al., 2017) and generalized learning gains (Heemsoth & Heinze, 2016; Sarwar & Trumpower, 2015), along with other ancillary learning benefits (Chaves-Barboza et al., 2015; Kirk & Pitches,

2013; Verpoorten & Westera, 2016; Villamizar & Mejía, 2019). More specific research on the use of prompts as a support to engage reflection suggest prompts may positively influence academic performance in DL (van Alten et al, 2020; Valencia-Vallejo et al., 2019).

One of the limitations around investigating reflection as a support for SRL in DL is the difficulty researchers have identifying and attributing study effects to an isolated variable from the mix that influences SRL (Cavilla, 2017; Lew & Schmidt, 2011; Sabel et al., 2017). Additionally, some studies acknowledge a short study duration that may not allow for emerging student success with prolonged reflective practice (Lew & Schmidt, 2011; Sarwar & Trumpower, 2015). Others identify that a lack of pre-study training for participants in the process and potential of reflection creates poor conditions for documenting potential effects on SRL (Bannert, 2006; Lehmann et al., 2014; Parkes & Kajder, 2010; Van Velzen, 2017). Further still, others identify the importance of feedback in promoting and developing reflective skill and note a lack of feedback use as a possible limiting factor in studies (Kirk & Pitches, 2013; Ostrow & Heffernan, 2014; Van der Kleij et al., 2015). Still missing from the literature is significant research into how different modalities within DL affect reflection and reflective practice for students. Rose et al. (2016) mention that text-based reflection is common, and other studies have noted that participants not only preferred specific modalities for reflection (O'Connell & Dyment, 2016), but reflected differently in these modalities (Kajder & Parkes, 2012; Kirk & Pitches, 2013; Villamizar & Mejía, 2019). Additionally, more research is needed to investigate the impact of reflection throughout the SRL process in DL, as opposed to reflection as a retroactive activity alone (Reinholz, 2016). While researchers have noted the potential of reflection throughout the SRL process (Lehmann et al., 2014; McAlpine & Weston, 2000), there are few studies investigating the differences between reflection done before, during, and after an

event with DL environments (Van Laer & Elen, 2017) and how to best maximize the potential of these supports. Taken together, there is enough promise through this limited research into reflection to encourage the continued investigation into the potential of embedding explicit SRL instruction through reflective practice within the DL environments that have become standard practice in education to improving student outcomes.

## Chapter 3: Application of Knowledge

For this portion of the work, I have chosen to create a digital book, *Reflecting with Purpose: A Research-Backed, Educator's Guide to Fostering Student Reflection*. It is difficult enough to find time outside of the basic demands of educating students to read educational literature, let alone dig into academic research (I acknowledge that not everyone is clamoring to read research). I argue that if educators can be made aware of the supporting research connecting new pedagogical approaches, it will make them more likely to invest some of their precious class time to incorporating new or unfamiliar strategies. The book was created with the BCcampus Pressbooks site, while the images were created at Canva.com. The book is split into two sections—Theory and Practice: The Theory section provides detail into the background, theoretical frameworks, terminology disputes, and research in support of reflection in the classroom. The Practice section outlines strategies, activities, and considerations for classroom incorporation of reflection. Reflecting with Purpose is available for download in multiple formats from the Pressbooks site (https://pressbooks.bccampus.ca/reflectingwithpurpose/) and a PDF copy of the book can be found archived to UVicSpace—under the title *Storie_Benjamin_MEdProject_2021_pressbook_002*. However, the BCcampus Pressbooks location will be the current iteration if revisions are necessary. The book is under an Attribution-NonCommercial 4.0 International licence (CC BY-NC 4.0). Individuals may share, copy, adapt, and redistribute this material for non-commercial purposes; but must include proper attribution and credit to the author (without suggestion of endorsement). An example attribution would be, "This work was created by Benjamin Storie [@prairie_teacher] and is licensed for use under an Attribution-NonCommercial 4.0 International licence."

## Chapter 4: Conclusion

The final component of this project was completed as digital video media. The 12:38 minute video—Med Ch4 Conclusion—can be located on a private YouTube channel, as well as archived as a video file to UVicSpace—under the title *Storie_Benjamin_MEdProject_2021_conclusion_003*. The video discusses these points: summary of learning, reflections on growth, and recommendations for future research and practice. All research referenced in the video can be found in a listing in the description section under the video title.

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