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Instructional Strategies to Prepare Students for Success in Informal Learning Environments: Leveraging Metacognition and Critical Thinking to Develop Self-Regulated Learning Skills

Carolyn P. Commiso
University of Massachusetts Boston

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Instructional Strategies to Prepare Students for Success in Informal Learning Environments:

Leveraging Metacognition and Critical Thinking to Develop Self-Regulated Learning Skills

Submitted by

Carolyn P. Commiso

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Dr. Carol Ann Sharicz
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Approved by Dr. Carol Ann Sharicz, Faculty

Abstract

This paper looks at how learning is evolving in the 21st century and what skills learners need to be successful in that environment. Based on existing research into the topic, this paper focuses on how learning is increasingly taking place in informal settings, through the lens of the Social Cognitive Learning and Cognitive Constructivism theories. The hypothesis is that students can be successful in these settings by mastering self-regulated learning strategies which can be developed through critical thinking and meta-cognitive skills. It assesses what instructional strategies can be used to develop these skills and enable continued learner success. In addition, to the review of existing research, this paper leverages the first-hand feedback of five different K-12 teachers, administrators and school psychologists from varying districts and demographics to assess the importance of different cognitive skills and effectiveness of instructional strategies. Study participants were surveyed on their own observations of the evolution of learning and the role of self-regulated learning, critical thinking and meta-cognition.

Keywords: informal learning, self-regulated learning, critical thinking, metacognition, 21st century skills, instructional strategies

Introduction

Traditional classrooms follow a passive, transmittal model of teaching where the teacher holds all of the knowledge and pours it into the empty container that is the student. The teacher presents, explains and answers questions without active engagement, additional supports outside of the classroom or consideration for the prior knowledge or experiences of the learner (King, 1993, p. 30-35). Learning was not investigated as anything more than the transmission of knowledge until the late 19th century when scientists began to investigate the systematic behavioral changes that occurred throughout the process. From this research came modern learning theories (Bierema & Merriam, 2014). In the 21st century classroom, where learners have instant access to most, if not all, of the information their teacher has, educators have to be able to balance the traditional transmittal model, known as the "sage on the stage" with a "guide on the side," model. In this model, they support students' research, discovery and sharing of their own knowledge and experiences in order to create meaningful cognitive pathways for learning (King, 1993; Fadel & Trilling, 2012, p. 39). The context of learning, too, has changed as learners are giving more autonomy of their environments and have been provided more modes of delivery through the use of technology (Sitzmann & Ely, 2011, p. 422). This increase in what we will define as informal learning requires a specific set of skills and competencies for continued learner success.

Leveraging existing research on the topic from peer-reviewed and scholarly sources as well as research collected from five different K-12 professionals (3 teachers, a school psychologist and an administrator) was undertaken. A survey was delivered to educators and administrators to inform existing research from their own observations of the evolution of learning and the role of self-regulated learning, critical thinking and meta-cognition in the

classroom and school setting. This paper will look at how we can continue to make learning more effective and what learning practices or instructional strategies educators can implement in their schools and classrooms to best prepare students for learning that occurs away from a structured, formal classroom environment. Specifically, what instructional strategies can be employed to develop metacognitive and critical thinking skills that will help students master self-regulated learning (SRL) practices and be successful in informal learning environments and enable their success in the 21st century world?

Research Methodology

In order to answer the research question posed, existing research and literature was reviewed. This was used to provide background knowledge and context to the arguments and concepts. These peer-reviewed, academic articles created the basis for the theoretical frameworks discussed throughout the paper. They also informed the section on instructional strategies and their effectiveness.

To support this research with practical, real-world observations, a qualitative survey was administered to educators and administrators from five different districts and demographics (see Appendix). The survey was delivered via email directly to the individuals. It was completed over the course of 2-3 weeks before being returned by email to the researcher. Since survey responses were not monitored and there was not a required word count, responses varied in length and depth.

Participants were asked to respond to five open-ended qualitative questions and two dependent sub-questions. The questions asked for the educators to describe which instructional strategies they employed to develop self-regulated learning, critical thinking and metacognitive

skills in their students. It aimed to understand the importance and intentionality of these

strategies and was used to inform further research into their use and effectiveness. The questions

also asked for the educators' observations of informal learning in the school setting as well as

their opinions on the most important skills for student success. This feedback was used to verify

and strengthen the arguments made for 21st century skills and informal learning.

Participants were also asked to rank the significance of twelve different mechanisms on

learning outcomes using a 10-point Likert scale ranging from 1 (Most significant) to 10 (Least

significant). These responses were then aggregated and compared to the results of the research

conducted in the Sitzmann & Ely (2011) study on self-regulated learning which conducted a

Meta-analysis of Self-Regulated Learning in Work-Related Training and Educational Attainment

which assessed the impact of 12 core regulatory mechanisms that constitute self-regulated

learning. The results were used to help understand if practitioners shared the same understanding

of the role of these mechanisms in facilitating learning and thus found value in fostering them in

their learning environments.

Participants

Survey participants were selected through the researcher's personal and professional

network to provide a diverse set of perspectives within the school environment. They included

three K-12 Teachers, an elementary School Psychologist and a Director of Operations at a

charter school. All of the survey participants were college-educated females working within a K-

12 environment. Consideration was given for different perspectives within the school setting

since informal learning may not exclusively take place in the classroom, which was the rationale

for including a School Psychologist and Director of Operations.

Table 1

Participant Information

Participant	Years of Experience	Role	Grade	Location
Alyssa Connelly	5	Teacher	1st	Boston, Massachusetts
Katarina Zirkelbach	4	Teacher	3rd	Kissimmee, Florida
Karen Moore	16	Teacher	3rd	Phoenixville, Pennsylvania
Kim Kinsman	3	Director of Operations	K-12	Roxbury, Massachusetts
Rachel Johnston	2	School Psychologist	K-12	Medford, Massachusetts

Results

Of the skills the teachers, administrator and school psychologist reported as being most important to student success, they were: executive functioning (Number = 2), Self-confidence and persistence, reading skills and motivation. Critical thinking and metacognition were not mentioned, although both participants who responded with executive functioning provided explanations that share similarities to the definition of self-regulated learning implying a recognition of the importance of the underlying skills and competencies.

Survey participants reported a variety of instructional strategies all of which were in line with the recommendations derived from the literature review to develop critical thinking, metacognitive skills and self-regulated learning practices. None of the five respondents reported implementing instructional strategies for the explicit purpose of developing critical thinking or metacognitive skills. However, each one was able to recall examples of activities which implicitly did so. This suggests that there is not an intentional focus on developing these skills within the K-12 environment. This is in line with the reporting of examples of informal learning, which were minimal, with one respondent not being able to acknowledge any at all. While

respondents seemed to acknowledge the instructional value of informal learning, if informal learning is not widespread within their formal learning environments, it is not surprising that the development of tools to succeed in that setting would not be a priority.

21st Century Skills

The world is rapidly evolving and the rate at which its evolution occurs is also increasing. Global economic, social, communication and information systems have developed into vast, interwoven networks, increasing both connectivity and vulnerability. Information and communication technologies, specifically, are growing and evolving exponentially leading the world into what has been called the 'Knowledge Age' where economies are now focused on leveraging information, expertise and innovation instead of manufacturing and processing natural resources (Fadel & Trilling, 2012, pp. 3-7; Galanis, Mayol, Alier & Garcia-Penalvo, 2016). As society and technology develop, automation is increasing and computers have begun to replace humans for impersonal, routinized tasks. Since information is readily available at all times, memorization of large amounts of content is no longer needed. Instead, learners need to develop skills, character qualities and meta-learning strategies to learn useful and relevant knowledge and apply it in new and different ways. Education needs to prepare students with non-routine interpersonal and analytical skills that will enable them to complete complex, personal and creative tasks while using computers as assistive tools (Fadel, Bialik & Trilling, 2015, pp. 5-17).

As global trends and risks continue to interact and evolve, changes can be discontinuous and unpredictable. Past performance cannot be used to predict future outcomes and, therefore, educational solutions need to adapt and create students who are independently able to adapt (Fadel & Trilling, 2012, pp. 3-7; Fadel et al. 2015, pp. 5-17). Beginning with developing the

skills to acquire and absorb knowledge efficiently and effectively in the academic environment

will ensure learners can perform well later in other settings from the informal learning

environments to the workplace (Saadé et al., 2012, p. 1608). This will require not only assessing

the ways in which learning is evolving but also identifying what skills are required to enable

student success and what instructional strategies will develop them in a sustainable way.

Despite a rapidly changing world, education has been slow to mirror this transformation.

Overburdened curriculums, educators and school systems have a difficult time integrating new

learning goals and inserting new subjects and skills into deeply established systems (Fadel et al.,

2015, p. 40). The lag in the evolution of formal education can be attributed to ineffective/out-of-

date education policies, pressure from standardized testing systems, the momentum and

historical inertia behind current teaching practices, the influence of the education publishing

industry, fear of not achieving or undermining performance outcomes and the traditionalist

preferences of parents (Fadel & Trilling, 2012, p. 35). In order to work within these restrictions,

we need to create flexible guidelines for educators and help students develop skills that enable

them to succeed in any environment and with any subject matter, no matter how the world

evolves so that they can act mindfully, reflect and adapt.

Digital technologies have a big role in this and are increasingly influencing how students

learn. The global connectivity enables all kinds of communication forms (including

unidirectional or bidirectional, synchronous or asynchronous, symmetric or asymmetric) and

information networks provide access to unquantifiable amount of information, provided any

number of ways from specialized digital knowledge platforms to custom Internet searches

(Galanis et al., 2016). Increased connectivity means that people from all over the world are able

to share ideas, language and references. The internet has become the open source of all

information, available at all times and completely engrained in our everyday lives from how we move, communicate and, of course, learn. This uninhibited access to information has increased basic skills by making recall of terms, procedures and principles quicker and easier as they free up time for other, more interactive skill development (Saadé et al., 2012, 1610). While having information readily available in such abundance has great benefits, it also means there are far more choices available to each individual whether it be through television, internet or social media outlets and all at varying qualities. This means that it is up to the individual to choose content that has depth and to have the cognitive practices available to approach it intelligently. They must be able to navigate and discern information for themselves. Without the skills and ability to adapt to new innovations in technology, learners will be severely disadvantaged. The individual must be able to navigate and discern information for themselves (Fadel et al., 2015, pp. 29-39; Saadé et al., 2012, p.1608, 1610). The increased presence of alternative forms of information access and more student-focused learning environments as well as peer-generated content on platforms like YouTube and Wikipedia have expanded the accessibility and type of learning materials, allowing any individual more control over what, how and when they learn (Sitzmann & Ely, 2011, p. 422). Once they leave the classroom, learners must be able to make an informed choice and continue to refine their choices overtime.

Social Cognitive Theory

At the core of this paper is the belief that humans are agent beings, meaning that they are responsible for intentionally creating outcomes in their lives and are able to effect change in themselves and their situations through their own efforts (Bandura, 1989, p. 1175). The concepts of metacognition and critical thinking, along with their underlying qualities like motivation, self-efficacy, attention and mindset, assume the individual is playing an active role in their self-

development, adaptation, and self-renewal. It is important to recognize that this is a diversion

from traditional psychological theories that were founded on behaviorist principles, similar to the

traditional behaviorist pedagogies (Bandura, 2001). These now antiquated theories viewed

human behavior solely as a response to environmental stimuli. Similar to the 'empty vessel' in

behaviorist learning theories, humans were viewed as having no influence over their own

development, rather their behavior is reduced to an input-output model (Bandura, 2001, p. 2;

Bandura, 1989, p. 5). Social cognitive theory views humans as having intentionality, forethought,

self-reactiveness, and self-reflectiveness. This enables them to set goals, self-motivate, and plan.

It implies that they are able to employ self-efficacy, self-reactions, self-sanctions and self-

regulatory mechanisms that are all evaluative cognitive regulators (Bandura, 2001, pp. 6-10). All

of these functions are metacognitive in nature and enable learners to reflect on the effectiveness

of their learning and redirect their efforts.

This is not to say that external circumstances or occurrences have no affect on human

behavior and life outcomes, in a similar way that learning outcomes depend on more than

metacognitive and critical thinking skills (Bandura, 2001, p. 12). "Psychosocial functioning is,

therefore, regulated by an interplay of self-produced and external sources of influence"

(Bandura, 1989, p. 1179). While much of human behavior is dictated by internal cognitive

processes, environmental factors and events also interact to generate final outcomes.

As the world, and society evolves, individuals are given more opportunities to influence

the trajectories of their lives. Increasing availability of digital technologies and information

empower individuals with more access than ever before in human history while, at the same

time, the magnitude of global problems and growing transnational controls can lead to feelings

of powerlessness and a lost sense of control or efficacy (Bandura, 2001, p. 18). For this reason, it

is more important than ever to enable learners to navigate and control their own learning within

this system.

Cognitive Constructivism

As traditional behaviorist theories have evolved with research and practice over time,

new theories on how individuals learn have been developed which influence instructional

strategies already in place. Relying heavily on the underlying assumptions of human agency

described in the Social Cognitive Theory, Cognitive Constructivism states that learners must

actively construct new knowledge, rather than passively absorbing it. Based on the Cognitive

learning theory, primarily developed by the theorists, Piaget, Dewey, and Vygotsky, Cognitive

Constructivism believes that learners are actively seeking meaning from their experiences and

processing new information (Kalina & Powell, 2009, p. 242; Bierema et al, 2014, p. 38). It has

implications for our understanding of cognitive development and memory. Based on this

research, learners are not able to create true meaning by memorizing or reciting back information

via rote knowledge, nor are they able to store information acquired in that way for a significant

amount of time. Rather, they must engage in meaningful, contextual experiences or apply

substantial thought processes to acquire the knowledge, content or subject areas, and actually

understand the material and store the information in memory (Kalina & Powell, 2009, p. 242).

Teachers are able to help learners through this process by creating environments where

the learner is required to reformulate given information or generate new information. In this way,

the learner builds the cognitive structures needed to connect new ideas, link them to what is

already known and retain them over time (King, 1993, pp. 30-35). By understanding how the

human mind actually learns, and recognizing that it is not just accepting information, but actively

processing and storing it, instructional design can better address the realties of knowledge acquisition and retention.

The Constructivist view of Cognitivism looks specifically at the situational nature of learning, meaning it is greatly impacted by interactions and environments and is most effective when it takes place in context. Field trips, case studies, service learning, and problem-based learning are all examples of authentic learning that takes place in context under the learner's control (Bierema et al., 2014, p. 37). Teachers are, in this view, guides for their students, who model and support their individual learning. They do not simply provide information but mediate interactions, create connections, engage in discussions and modify environments that promote individual learning (Kalina & Powell, 2009, p. 242). The aim of their instruction should be to provide the students with the tools and skills to take responsibility for their own learning (Saadé et al., 2012, p. 1609). Because of its emphasis on the learner's role in constructing their own learning and the importance of developing the skills to do so, Cognitive Constructivism is central to the discussion on the importance of self-directed learning, reflective practice and critical thinking, particularly in informal settings.

Informal Learning

As our understanding of how learners learn has evolved over time, so has the ways that learning takes place. While formal learning activities tend to align with a curriculum and are focused on structured content and assessments, informal learning provides learners the opportunity to more freely explore concepts. This free exploration is often more intrinsically motivated, which has shown to produce greater learning outcomes (Hung et al., 2012, p. 1072). Almost any unstructured learning activity can be defined as informal learning. Informal learning is a broad term that can include any course-related activity that does not directly involve an

instructor or that occurs outside of a classroom setting, including course reading, class preparation, and even assignments and project activity (Jamison, 2009, p. 19).

Instant recall of information through mobile devices can also be considered one of the many forms of informal learning that learners have increasingly engaged in. Platforms like YouTube and Wikipedia have become more prevalent and enabled open-source, peer-production of training and learning materials, increasing the need for individuals and learners to assess both what they need to know and where they can find quality information (Sitzmann & Ely, 2011, p. 422). Almost every individual now has access to a home computer, personal smart phone and internet and cellphone service, facilities that were previously only available in an office or academic settings or to the elite (Straub, 2009, p. 642). The ability to learn from the internet, regardless of age or social or financial background, can be attributed to the growth of the concept of 'lifelong learning' which due to the restraints of working adults, tends to occur in an ad-hoc, unstructured way, driven by individuals needs or interests (Galanis et al., 2016, p. 2).

Modern work environments are also changing to be more knowledge centric and complex, requiring learners to adapt to changing demands (Fadel & Trilling, 2012, pp. 3-7). In a work environment, informal learning can be even less structured as it tends to be the means in which workers adapt to changing work responsibilities and complete new or complex tasks for which a formal training is not provided. One estimate attributes over half of work place learning to informal methods, suggesting that mastering effective informal learning is vital to workplace success (Yanchar & Hawkey, 2015, p. 425). This also implies that learners are not being prescribed over half the learning they are engaging in. Both academic and professional learners have more control over the courses and trainings they participate in as well as the content, sequence, and pace of material in the training environment (Sitzmann & Ely, 2011, p. 421-422).

This learner-driven approach requires learners to be prepared to select relevant learning experiences and then understand how to engage with them in a meaningful way.

The growth of informal learning is in line with the emerging acceptance of the Social Cognitive and Cognitive Constructivist learning theories but is also influenced by the changing nature of society and technology. As access to the internet grows, learning has begun to happen increasingly more online and outside of traditional school hours. It can now take place in any environment including public spaces and transit. Learning has become more woven into all the parts of everyday life. The impact of growing populations and urbanization is creating an increase in demand for space. This means that spaces, including physical learning environments, are being used for multiple purposes often as flexible and mixed use, and community centers (Fadel & Trilling, 2012, pp. 140-145) The student-entered pedagogy is being extended into the physical locations in which learning takes place. They are becoming decentralized and community based in order to enable exploration, curiosity and collaboration. By providing both the information technologies and the social contexts for experiential learning, learners are given more ownership of the learning process (Jamison, 2009, p. 21).

While the adoption of new technologies can be relatively slow and orderly, it is greatly influenced by social networks and peer groups, organizational pressure that may come from schools or employers as well as social norms (Straub, 2009, p. 641). As informal learning becomes an expected and necessary part of professional work, often serving as the only way to access information or develop a skill, and, therefore, ensure success within a field, its adoption has become essential. Generally, learners do not seem to view it as a negative thing. Rather, informal learning opportunities provide the chance to develop new skills and gain new perspectives in a purposive and selective way, maximizing the learner's s time and energy and

improving their perception (Yanchar & Hawkey, 2015, p. 428). As employers and educational

institutions recognize the value and importance of informal learning, there has been a push for

the development of tools and methodologies to help learners better navigate the experience,

promote the concept and, ultimately, improve outcomes (Galanis et al., 2016, p. 2).

Although informal learning is by nature unstructured, given that so much of workplace

learning is being done informally, that individuals are engaging in it in their daily lives and that it

has become more common within the school setting, it seems misguided that learning outcomes

are generally not clearly defined. Assessments, if any, may take the form of peer reviews and

critiques but are decidedly informal, making it difficult to verify what has been learned (Hung et

al., 2012, p. 1072). The Galanis (2016) study specifically looked at how to evaluate and validate

the learning acquired through informal learning activities and proposed a social-oriented

framework and a set of rules and predefined competences using social engineering and peer

interaction.

Of the educators surveyed for this paper, the most common form of observed informal

learning within the school setting was peer coaching. This took place in a both unstructured

'helping' scenarios and more structured time devoted to peer-feedback in the form of 'turn and

talk' activities. The educators recognized the value of this method of learning, but it appeared to

have the least amount of structure or defined outcomes. Research participants also recognized

informal learning occurring at an individual level when students were taking notes on fiction

books they were reading during 'D.E.A.R.' (Drop Everything and Read) time. While note taking

during all reading was encouraged by the teachers for the impact it has on knowledge

acquisition, this particular note taking was not structured or done with a definitive learning

outcome in mind.

Critical Thinking

In the knowledge age, the internet provides constant and instantaneous access to open source information. Individuals need to navigate this in order to identify false, incomplete or out of date information while forming opinions and considering a growing variety of perspectives (Saadé et al., 2012, p. 1608). A defining factor between critical thinking and other mental processes is the questioning and examination of claims (Fadel et al., 2015). As jobs are also becoming more complex in order for individuals to remain valuable assets in the workforce, educators, policymakers, and employers have all acknowledged critical thinking as an essential life skill (Huber & Kuncel, 2016).

Critical thinking is the ability to leverage cognitive processes to assess information and achieve a logical final goal (Saadé et al., 2012, p. 1608). In the book, *Four-Dimensional Education*, Charles Fadel (2015) cites The National Council for Excellence in Critical Thinking which, "defines critical thinking as the "intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning or communication as a guide to belief and action" (p. 115). Not to be confused with the concept of intelligence, critical thinking is not an innate ability but rather a skill that can be learned and improved over time.

Informal learning presents both a great need and challenge for critical thinking. While the self-regulation of learning relies heavily on critical thinking skills, informal learning settings do not provide the types of guidance and structure needed for higher levels of learning. Open-ended delivery and activity-based problem solving is limited in online environments and settings where there is not an instructor present (Saadé et al., 2012, p. 1608). While test tasking and other fact

and procedure-based skills are difficult to transfer outside of a formal learning environment,

critical thinking skills can be taught and habituated so they can be applied in contexts outside of

where they were learned. To prepare students for these settings, instructional strategies in formal

learning environments can develop critical thinking skills that can then be applied in new,

informal settings (Fadel et al., 2015, p. 115).

        While critical thinking can be taught explicitly, it can also be developed through activities

and projects with larger curricula goals that require learners to interpret information, analyze

parts and wholes, take different perspectives and evaluate evidence (Fadel et al., 2015). A meta-

analysis of critical thinking gains among college students suggests a deficiency in not only

critical thinking skills but also English, science, and mathematics skills to which critical thinking

is fundamental. This means, in order to fill these deficiencies as well as those in the labor market,

domain-specific attention to critical thinking, rather than generalized or explicit critical thinking

curriculums, will be most effective (Huber & Kuncel, 2016).

        Science and mathematics are examples of types of education that inherently teach

learners to think critically as they must prove outcomes and leverage data and provide evidence

to support their claims. They do this by creating cycles of decision making where learners are

presented with data which they must evaluate and use to determine how to modify their models

and experimental designs which then produce new outcomes that can be compared to the original

data. In line with Cognitive Constructivism, by giving learners control over the decision-making

process they develop a framework and habit of mind that creates the cognitive structures to test

and evaluate models in other settings. Learners also develop the belief that they are able to

control outcomes based on logic and strategy, an important transferable skill for regulating their

learning (Holmes, 2015; Shell, & Husman, 2008). Having an understanding of validity is

important for all individuals who need to question claims that are presented to them for sound

logical reasoning, but this is not an easy skill to master (Holmes, 2015). Additionally, findings

do suggest that critical thinking gains deteriorate over time if they are not fostered so continued

practice and application of the cognitive processes is essential to maintaining aptitude (Huber &

Kuncel, 2016).

Instructional strategies that develop domain-specific critical thinking skills require a high

level of interactivity. Pedagogy should create an interaction between content chunks, invite

collaboration between learners and align critical thinking activities along with domain specific

curriculum (Saadé et al., 2012, p. 1614). Examples of instructional strategies that contribute to

the development of critical thinking skills reported by survey participants were largely in line

with the effective strategies discussed here. Many responses included collaboration and

communication between learners. Small groups and student-led discussions were mentioned by

three of the five respondents. One response specified that this was particularly applicable in

science and social studies. Large group and discussions within the whole class were also

mentioned. These examples related to brainstorming ideas and answers to question prompts

given by the teacher.

Problem-based learning and abstract analysis was also a common theme in the responses.

Survey participants reported promoting the idea that there is not always a "right answer" and

teaching students about their process rather than the end result. One response specified that they

assisted students in creating a process of discovery that is logical to them by asking them to show

multiple ways to answer a question.

Metacognition

The development of critical thinking skills is closely linked to metacognitive skills; in fact, the two tend to support and strengthen each other (Fadel et al., 2015). John Flavell (1979) stated that, "Metacognitive experiences are any conscious cognitive or affective experiences that accompany and pertain to any intellectual enterprise" (p. 906). The concept of metacognition has had growing relevance to social learning theory, cognitive behavior modification, personality development, and education (Flavell, 1979). In the context of learning environments, metacognition is a learner's awareness of their own learning (Bonds, Bonds & Preach, 1996). It can be further divided into metacognitive knowledge, experiences, goals (or tasks), and actions (or strategies), all of which play an important role in the communication of information, comprehension, writing, language acquisition, attention, memory, problem solving, social cognition, and various types of self-control and self-instruction (Flavell, 1979).

Effective metacognition is essential to the learner's ability to control their own learning in order to achieve higher learning outcomes (Dunlosky & Rawson, 2012). The act of practicing metacognition improves overall cognitive functioning and learning processes. Metacognitive skills can enable minimally guided instruction by improving learner's ability to monitor the effectiveness of their own learning and, subsequently, alter their learning processes to achieve improved learning outcomes (Bonds et al., 1996). Research shows that younger students have less ability to understand cognitive phenomena, or how learning takes place, and are similarly less able to monitor their own memory and comprehension. This results in lower levels of knowledge acquisition, demonstrating the importance of metacognition in knowledge acquisition (Flavell, 1979).

Considering metacognition as an implicit awareness of the self, task, and context, it is a key regulatory mechanism in self-regulated learning. Metacognition encompasses a number of different self-regulatory processes, including planning and monitoring (Sitzmann & Ely, 2011, p. 426). Learning how to accurately monitor one's own learning and then regulate continued study based on that knowledge can have significant impacts on learning outcomes, retention and long-term academic achievement (Dunlosky & Rawson, 2012; Roebers et al., 2012). An inaccurate perception of one's competence can have negative effects on knowledge acquisition as overconfidence can lead to premature termination of study on particular subjects which ultimately results in lower retention (Dunlosky & Rawson, 2012). A learner's working memory is less engaged when they believe they are already competent in an area, creating negative impacts on learning outcomes and executive functioning (Roebers et al., 2012). To contribute to the development of metacognitive strategies by structuring self-study and guided reviews, one survey respondent reported an instructional practice of providing study guides and reviews set up in a similar format to the test or quiz. Learners are able to work on the study guides in class beforehand to help them understand what sections they "know" and what sections they need to spend more time studying at home before the test.

Survey participants, on average, rated the significance of metacognition as 4.5 on a scale of 1 (most significant) to 10 (least significant). However, based on the findings of the Sitzmann & Ely (2011) analysis, this may be due to its close inter-relation with other mechanisms as the difficulty in reporting valid measures (p. 433). For example, one survey participant responded that many educators utilize strategies such as meditation, yoga and movement breaks in between tasks to help their students live in the moment and learn how to decompress during stressful

situations. While these practices of developing self-awareness may contribute to improved cognitive functioning, the effects were not measured.

Self-Regulated Learning

The way in which one uses knowledge varies from the way in which that knowledge is acquired and for this reason: there is an acute need for guidance throughout instruction to help learners monitor their learning path. While direct, guided instruction is effective in providing guidance, examples and feedback, minimal instruction has also proven to be successful in situations where there is considerable structure, previous knowledge and learning support. Furthermore, external guidance is not needed altogether after learners have a high knowledge for internal guidance (Kirshner, 2006). This sense of internal guidance can be developed through self-regulated learning strategies. Student reports of utilizing 13 different categories of self-regulated learning strategies, including goal-setting, environmental structuring, self-consequences (self-rewarding and self-punishment), organizing and transforming, keeping records and monitoring, and self-evaluating are an extremely accurate indicator of achievement and predictor of standardized test scores (Zimmerman & Pons, 1986).

Consistent with Cognitive Constructivism, the nature of informal learning depends on the learner's ability to engage in dialogue and collaboration as a part of meaningful, contextual experiences which help to build the cognitive structures needed to create and retain new ideas and information. The ability to navigate this type of environment requires the learner to develop an ability to monitor their own learning (Hung et al., 2012, p. 1090). The concept of self-regulated learning relates to the cognitive, metacognitive, behavioral, motivational, and emotional/affective aspects of learning. It includes the practices that enable a learner to monitor and adjust their affective, cognitive, and behavioral processes throughout a learning experience

until they have achieved a desired learning outcome (Sitzmann & Ely, 2011, p. 42; Panadero, 2017). When asked about the most important skill learners need to develop in order to be successful, one of the survey participants for this paper reported "…students' ability to focus/concentrate, plan ahead, organize their thoughts and materials, self-monitor (e.g. check over their work for mistakes) and shift between tasks. If students were able to master these areas, they would have the skills to be successful in a variety of learning opportunities, both in and out of school." While she was referring to the concept of executive functioning, her assessment enforces the importance of the shared underlying competencies of self-regulated learning.

Self-regulated learning requires learners to not only be aware of and in control of their cognitive processes, behavior, emotions, environment and motivations but to also have agency over them. It speaks to both their ability and motivation (Nilson, 2013; Zimmerman & Pons, 1986). Informal learning presents learners with more autonomy over their learning experience. Through experience, they must be are able to identify what processes and approaches are most effective in producing learning outcomes. This includes their physical environment, mindset, and learning strategies. The learner then must be able to exercise control over those variables in order to maintain the optimal conditions for their learning (Nilson, 2013). This cyclical process of self-regulation will evolve over time and enable learners to refine their goals (self-efficacy), develop metacognitive strategies, and improve their learning outcomes (Sitzmann & Ely, 2011, p. 438).

The Zimmerman Cyclical Phases Model (1990) outlines the process of self-regulation into three phases: planning, performance, and self-evaluation. In the planning phase, learners set goals, assess their motivations and analyze the task. At this time, they also determine their initial learning strategies. Then, in the performance phase, they begin to execute the task and adapt to task demands as needed, while employing strategies to remain engaged and motivated.

The self-evaluation phase is when they reflect on what they learned and how well they did. They also reflect on why they were successful or not and how they can make improvements for next time (Ness & Middleton, 2012; Panadero, 2017) At the self-evaluation phase, the most successful self-regulators attribute failure to either low effort or ineffective learning strategies, factors which they are then able to modify (Sitzmann & Ely, 2011, p. 426). However, it is important that the learners are able to make accurate causal connections between the causes of their successes or failures to produce positive outcomes and that they believe they have the ability to control the outcomes of their learning. If either of these are not true, the learner will begin to lack the motivation to continue monitoring and modifying their effort and strategies (Shell, & Husman, 2008).

Behaviors including self-discipline, time management and effort, along with environmental factors like the use of technology, sensory inputs, physical orientation and task management, are all key facets of self-regulated learning. However, the process starts with self-observation and relies on mental processes including judgement, analysis and evaluation (Nilson, 2013). Therefore, in order for learners to be successful with using self-regulated learning strategies in the increasingly informal learning environments, they must develop critical thinking and metacognition skills.

During all three phases of the Zimmerman Cyclical Phases Model (1990), learners must think critically to determine the causes for their successes and failures and to construct methods for improving them in the future--a process which inherently requires metacognitive skills. Learners must be aware of their cognitive processes and abilities in order to recognize the effectiveness of their learning strategies and set appropriate goals for themselves. If the learner fails at doing this, they will fall into a negative feedback loop in which they implement

modifications which, not being based on sound logical causation, do not produce the desired results. In addition to failing to create more meaningful learning, it will cause them to adjust their goal level, effort and motivation (Sitzmann & Ely, 2011, p. 423). In the Sitzmann & Ely (2011) study, they found that goal level, persistence, effort, and self-efficacy were the self-regulation constructs with the strongest effects on learning p.). The learner's sense of agency over the learning process is also connected to their goal level and affective processes. (Shell, & Husman, 2008). Being able to think and identify whether conclusions are valid, based on data and evidence, and discriminate between causation and random variability is a skill developed through scientific modeling that can be applied to self-regulated learning models and authenticate the cyclical process (Holmes, 2015). By developing strong critical thinking skills and metacognitive skills, learners can avoid negative feedback loops or dysfunctional patterns by relying on their mental processes of discernment, analysis and evaluation to continually develop strong self-regulated learning strategies.

Survey participants reported ways in which they enabled self-regulated learning within their classrooms. Most of the reported strategies involved giving the students ownership either over their learning, their goals or their behaviors. In one example, students were asked to set goals for themselves and then discuss with the teacher if they did not meet them and why. Another example was of a school wide behavioral 'clip-up' or 'clip-down' system where student behavior is ranked based on the choices they make throughout the day.

There were also strategies reported that helped students to bring awareness to their strengths and weaknesses to help them be more successful in the classroom. One participant described specifically helping learners to understand their learning style while another reported educating learners on how to recognize their needs and advocate for accommodations they may

need in order to maximize their learning. This strategy, in particular ,demonstrates the importance of instilling a sense of both awareness and agency in learners in order to enable successful self-regulation.

Instructional Strategies

Research and survey participants confirm the importance of self-regulated learning on learning outcomes and as informal learning becomes more prevalent in the 21st century it is important to prepare learners for success in settings where they are provided more autonomy and control over the content and delivery of their learning (Sitzmann & Ely, 2011, p.422). Social Cognitive and Cognitive Constructivists argue for learner centered environments with a lot of dialogue and engagement support learner's discovery and sharing of experiences and the creation of meaningful cognitive pathways (King, 1993, p. 30-35). However, studies have shown that minimal instruction is only successful in situations where there is considerable structure, previous knowledge and learning support unless learners have a high knowledge for internal guidance (Kirshner, 2006). Self-regulated learning can compensate for this discrepancy but first learners need to master the underlying skills including metacognition and critical thinking, which are two of the core facets to effective self-regulation (Sitzmann & Ely, 2011).

In order to develop metacognition and self-regulated learning, a number of strategies were reported by survey participants. By comparing these first-hand reports to research and existing literature, four different instructional strategies were identified. Furthermore, it was determined that given the nature of both metacognition and critical thinking as transferable skills that the instructional strategies used to develop them, do not need to be explicit in doing so and should be domain-specific (Fadel, et al., 2015; Huber & Kuncel, 2016). The instructional strategies identified are: formative assessment, inactive activity-based work and mentoring.

Interactive/Activity-based

Instructional strategies that are activity-based and interactive allow learners to analyze, rationalize and evaluate information and then requires them to reflect on the outcomes of their application (Sitzmann & Ely, 2011). Critical thinking often results from pedagogy that requires learners to conceptualize different content and interact with outcomes (Saadé et al, 2012, p. 1614). Learning experiences that provide learners the agency to experiment and adjust their environments allow them the ability to see alternative applications of their understanding. Both critical thinking and metacognition are naturally engaged when learners are able to experience the consequences of their actions and decisions (Hung et al., 2012)

When learning is done in an authentic way, within the context that it will be applied, the amount of formal instruction can be minimized. In these authentic, contextual and activity-based scenarios, learners must be able to interact with and manipulate their environments. The ability to make mistakes and explore misconceptions helps to develop learner's metacognitive skills as they reflect on why the errors occurred. They then must activate critical thinking skills to problemsolve and create solutions (Hung et al., 2012; Sitzmann & Ely, 2011) in order for learning to be authentic and occur in rich context in order to result in transferable skills that can be applied across different context. Anchored, conceptually rich experiences then enable learners to practice metacognitive skills as they re-conceptualize them in another setting (Hung et al., 2012).

Four out of five survey participants provided examples of interactive and activity-based learning when asked what instructional strategies they implement that contribute to the development of critical thinking skills. These most notably included small group work, student-led discussions, collaboration, problem-based learning and assisting in discovery learning. In

regards to instructional strategies that develop metacognitive skills, only one respondent

provided an example of activity-based learning which was asking students to recall real-life

examples.

Formative Assessment

Testing practices can actually change and impact learning and retention through

formative feedback which helps to guide future learning (Roediger & Karpicke, 2006). The

mediated effects of feedback from testing, meaning that testing gives feedback on what the

learner does not know, promotes learning by correcting misconceptions and making future

learning more effective by enabling learners to more accurately control their efforts. Learners are

then able to focus their efforts on the areas of the content which they know the least. In this way,

they can make their study habits more effective and minimize the time spent covering

information they have already mastered (Karpicke, 2009; Roediger & Karpicke, 2006). The

processes that are engaged through the mediated effects of testing are those same processes that

are engaged during metacognition when a learner is made aware of how well they do or do not

know something. Learning is further improved as learners are then able to course correct to

account for their errors which requires critical thinking and, ultimately, the ability to self-

regulate their learning (Flavell, 1979; Sitzmann & Ely, 2011).

Formative assessment provides learners with an awareness of the effectiveness of

learning strategies they are employing and also helps them with an understanding of their own

understanding, both of which are key components of the Zimmerman Cyclical Phase Model

(Karpicke, 2009; Panadero, 2017). This can be described as metacognitive knowledge, which

informs a learner as to what variables create different outcomes through their cognitive

processes. A greater sense of metacognitive tasks will allow learners to better understand their

successes and failures and be able to implement solutions (Sitzmann & Ely, 2011; Flavell, 1979).

While there is significant literature supporting the effectiveness of formative assessments

on the development of critical thinking and metacognition, only two of the survey responses

described instructional strategies that implement formative assessment. In one example, the

classroom teacher allows students to take completed, graded tests home and make corrections to

the questions they got wrong and then resubmit them for half credit. Another example describes

providing study guides and practice tests that are structured similarly to the real test encouraging

students to understand which sections they 'know' and do not.

Mentoring

Social learning and the ability to learn from observing other's behaviors is one of the

foundational concepts of Social Cognitive theory (Straub, 2009, p. 629). When learners are given

opportunities to talk about their learning to peers and mentors, they develop the skills to

articulate their thinking. Over time, this practice becomes engrained in their own process and

understanding of how to leverage learning strategies and environments (Hung et al., 2012, p.

1087). Providing and receiving feedback and giving advice in a mentoring dialogue requires

active processing and when it is done in personally meaningful ways, learners are more likely to

retain it and apply it in different contexts. The reformulation of information in this way creates

the cognitive structures needed to produce meaningful learning (King, 1993).

Mentoring can occur between peers or with teachers or authority figures. This dialogue

encourages the learners to build on what they already know about a concept, receive feedback

and create their own ideas and theories (Bierema et al., 2014, p. 39). Mentoring and peer-to-peer

feedback allows learners to perform regulatory roles with peers. In these roles, they must think critically about their peers' experiences while reflecting on their own. Often these activities also involve goal-setting and reflection on how, why and if they have achieved their goals (Hung et al., 2012, p. 1087).

Mentoring was one of the most common instructional strategies described by the survey participants. They provided these as examples of instructional strategies that supported the development of both critical thinking and metacognition. One strategy that was reported by two different survey participants described the instructional strategy of "turn and talk." This is an informal form of mentoring where students turn and discuss course content or provide feedback on each other's work. Some respondents shared allowing both self and peer reviews and another example described allowing students who finish their work early to help other students with their work.

Conclusion

As the world continues to develop into the Knowledge Age and technology spurs greater connectivity and innovation, society evolves in unpredictable ways. It is imperative to prepare students for success in an ever-changing world. The ability to master self-regulated learning practices will ensure individual success with high automation, high-complexity jobs and informal learning settings (Fadel, Bialik & Trilling, 2015, pp. 5-17). By fostering metacognitive and critical thinking skills in a formal learning setting, learners will be prepared to better navigate minimally structured environments and make judgements about the information they interact with (Karpicke, 2009; Roediger & Karpicke, 2006). These skills will help them to acknowledge causation for their successes and failures, use logic to determine effective adaptations and improve their strategies over time through the process of self-regulated learning (Flavell, 1979;

Sitzmann & Ely, 2011). Teachers, administrators and school psychologists can reinforce this in K-12 environments by implementing interactive/activity-based instruction, formative assessment and mentoring in their instructional strategies. Based on the survey participants' feedback, it seems that this approach is not generally acknowledged or implemented in a systemic way. Further research, demonstrating outcomes and need, will be useful in building a case to create these structures going forward.

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Appendix

Informal Learning Survey

I am completing my capstone research for my Masters of Education in Instructional Design. Broadly speaking, I am looking at how learning is evolving and what skills learners need to be successful.

Through my research so far, I have focused on how learning is increasingly taking place in informal settings. My hypothesis is that students can be successful in these settings by mastering self-regulated learning strategies which can be developed through critical thinking and meta-cognitive skills. I am looking at what instructional strategies can be used to develop these skills and enable their success in the 21st century world.

The purpose of this survey is to inform my research from the point of view of educators and administrators based on their own observations of the evolution of learning and the role of self-regulated learning, critical thinking and meta-cognition.

To ensure we all are working from approximately the same understanding, I have defined four key terms, as they are applied in the context of my paper.

Definitions:

- Informal learning – learning that occurs away from a structured, formal classroom environment.
- Self-regulated learning (SRL) – the use of affective, cognitive, and behavioral processes throughout a learning experience to reach a desired level of achievement.
- Meta-cognition – awareness and understanding of one's own thought processes; cognitive self-regulation.
- Critical thinking – the mental processes of discernment, analysis and evaluation to achieve a logical understanding.

Please answer to the best of your ability. Thank you, in advance.

1. What do you believe to be the most important skill student need to develop to be successful?

2. Are there ways in which you enable self-regulated learning in your classroom/school?

   a. If so, what impacts do you see or hope for when implementing these strategies?

3. What, if any, instructional strategies do you implement that contribute to the development of **metacognitive skills** in your students?

4. What, if any, instructional strategies do you implement that contribute to the development of **critical thinking skills** in your students?

5. What are the most prominent examples of informal learning that you observe in your classroom and/or school (e.g. online social networking, peer-to-peer coaching, accessing "fingertip" knowledge, course reading etc.)?

    a. Which, if any, of those are systemically encouraged, or intentionally created?

Rate the following mechanisms from on a scale of 1-10 from most to least significant on learning outcomes:

	1	2	3	4	5	6	7	8	9	10
Planning										
Monitoring										
Metacognition										
Attention										
Learning strategies*										
Persistence										
Time management										
Environmental structuring										
Help seeking										
Motivation										
Emotion control										
Effort										

* Techniques employed to elaborate on the training material as well as integrate all the components of the material with each other and with one's existing knowledge

If you have any additional thoughts or comments on the topics covered in this survey, please share them below.