Cognition and Instruction/Metacognition and Self-Regulated Learning

This chapter explores how learners take an active role in their own learning through self-regulation. We examine the stages of self-regulated learning (SRL) and how the ability to reflect on our own thinking, known as metacognition, facilitates these stages. We discuss the theory of metacognition and self-regulated learning and show how these fundamental cognitive processes drive learning in academic settings.

1 The Concept of Metacognition

Metacognition is one of the key components of self-regulated learning which involves knowledge about our cognitive thinking and regulation of thinking.

1.1 Definition of Metacognition

Metacognition is the knowledge and regulation of your own thinking. Someone who is able to monitor and control his learning is thought to have metacognitive ability. [1] This notion has a huge implication in the field of education because studying often involves these skills. In this section, we will look at how the definition of metacognition has evolved.

In 1979, Flavell introduced the concept of metacognition. [2] From his and other's study, Flavell found out that "young children are quite limited in their knowledge and cognition about cognitive phenomena, or in their metacognition" in other words, "cognition about cognition" [3]. This was the beginning of research in metacognition and the field has been growing since then. The notion of metacognition also led educational psychologists to study self-regulated learning, which will be discussed later in this chapter. Metacognition not only holds importance in educational psychology but also in developmental psychology, along with theory of mind, and cognitive psychology. This is why researchers always come back to the notion of metacognition.

Metacognition is related to various aspects of life including reading, writing, planning, and evaluation. Flavell initially states that metacognition serves two basic functions, which are the monitoring and control of cognition [4]. Similarly, Ann Brown in 1980, provides a definition including the knowledge and regulation of cognition [5]. This is when the word "regulation" comes in. In recent research, metacognition is usually divided into three forms. They are metacognitive knowledge, metacognitive experiences, and metacognitive skills or strategies [6][7].

Metacognitive knowledge is declarative knowledge such as language and memory [8]. It also involves information about tasks, strategies, goals and persons. That includes how people process tasks.

Metacognitive experiences are "what the person is aware of and what she or he feels when coming across a task and processing information related to it" [9]. Metacognitive experience is especially important in self-regulated learning because it allows people to make attributions about their feelings. For example, a student might feel that the task is too difficult. This leads the student to adjust his goals.

Metacognitive skills are the "deliberate use of strategies (i.e. Procedural knowledge) in order to control cognition. [10] Metacognitive skills include "orientation strategies, planning strategies, strategies for regulation of cognitive processing, strategies for monitoring the execution of planned action, and strategies for the evaluation of the outcome of task processing" [11].

Efklides also adds that "metacognition is a representation of cognition, and that metacognition and cognition are connected through the monitoring and control functions" [12]. This is the concept Flavell and Brown were missing and it is called the meta-level thinking. Metacognitive experiences and metacognitive knowledge are related to the monitoring of cognition, and metacognitive strategies are related controlling of metacognition [13]. These definitions and assumptions of metacognition led Efklides to conceptualize metacognition as first, "metacognition is multifaceted. Specifically, there are metacognitive experiences and metacognitive knowledge, which are related to the monitoring of cognition, and the control processes that are distinct from the monitoring of cognition". [14] Second, metacognition is a conscious process. Third, metacognitive monitoring and metacognitive control are strictly limited to the self-regulation of cognition without any interaction with affect or broader self-regulation of behaviour".[15] Fourth, "metacognition is purely individual phenomenon".[16] Usually, metacognition is measured using self-report questionnaires. However, Efklides suggests that behavioural measures such as verbal and non-verbal behaviour, and physiological measures also needed[17]. In order to study metacogni-

tion in the self-regulation processes, we need to combine "experimental methodology that implicate the self (e.g., feedback, social comparison) along with measures of metacognitive experiences and affect" [18]. A number of interventions have been developed in education because metacognitive experience is important for the control of cognition and learning. [19] The Emphasis of interventions is often on the metacognitive knowledge of strategies and the procedures involved in metacognitive experience because they can be improved over time. Specifically, metacognitive interventions should be able to identify reasons why metacognitive regulation is failing. "That is, if it is metacognitive knowledge, metacognitive skills or metacognitive experience. Then, they can target that particular facet of metacognition and support regulation"[20].

[21]

1.2 Judgments of Learning

A topic related to metacognition is Judgements of learning. **Judgments of learning (JOLs)** are "assessments that people make about how well they have learned particular information".[22] Nelson and Dunlosky (1991) [23]first introduced this concept and it is frequently discussed since then. They suggest that judgements of learning "help to guide self-paced study during acquisition".[24] Although judgements of learning can be inaccurate a lot of the times, Nelson & Dunlosky argue that judgments of learning made shortly after study is more accurate than judgements of learning made immediately after study. This implies that students should evaluate their progression of study after waiting for a short time. Nelson & Dunlosky call this "delayed-JOL effect". Knowing what one knows has a huge effect on later recall because they can go back and re-study the items they do not know. This leads to better study outcome because they can allocate their study time more efficiently on later study sessions. Nelson and Dunlosky use the word "self-monitoring during learning" to represent judgements of learning. Thus, metacognition is once again a crucial component of judgements of learning, and self-regulated learning. **Feeling-of-knowing judgment** is another concept related to judgements of learning. Feeling-of-knowing refers to "the judgment about the degree of accuracy for recognizing or knowing a task or answer and predicting one's knowledge"[25] It is similar to the concept of judgments of learning except the accuracy is considered. Feeling-of-knowing and self-regulation of learning are related because it is related to metacognitive accuracy. Metacognitive accuracy will be discussed later in this chapter. Nelson and Leonesio (1988) suggest that feeling-of-knowing judgment is part of metacognition. Feeling-of-knowing judgment is part of monitoring components of metamemory which is a similar concept of metacognition. Another important concept of knowledge and monitoring of one's cognition is metamemory. Metamemory is "a high level of cognitive functioning involving decisions of when to deploy a strategy and knowledge of one's memory abilities".[26] During Bembenutty's study on undergraduate students, all students allocated their study time according to their feeling-of-knowing. The study also revealed labor-in-vain effect which means that the longer self-paced study time did not predict better recall. This might be because feeling-of-knowing is often inaccurate. Then, the question would be how can we improve our understanding of knowledge? In other words, how can we improve metacognitive knowledge? Implication in educational settings will be discussed later.

1.3 Metacognition in Writing

Metacognitive abilities are essential in writing, especially in university level courses. Although instructors often urge students to reflect on their writing and revise it several times, it is rare for students to actually evaluate and re-work their writing in a detailed fashion. Parrott and Cherry brings up this concern and suggest a new teaching tool to make students think about their writing more actively. The strategy is called process memos. **Process memos** are guided reflections submitted from students and teachers. [27]Students submit process memos after writing the first drafts and the final versions of their papers. For the first draft, students are asked to reflect on their paper, helpfulness of the rubrics, questions regarding the assignment, strengths and weaknesses of their paper, and what they think they need to improve in the final version of the paper. After this, teachers mark the paper and provide feedback. In the second process memo, students are asked to reflect on the feedback they received from the teacher. Questions include "which comments were most helpful, and why?". [28] Parrot and Cherry started testing out process memos in 2005 and fully implemented it in a study in 2015. The study included 242 university students in various sociology courses, including introductory courses and more advanced courses. The results suggest that process memos help both students and teachers to actively engage in the process of writing. Teachers get feedback on their instructional qualities so that they can improve their teaching in the future and make sure the rubrics are clear. Although some students did not take process memos seriously and provided insufficient comments, most students found this method useful in improving their writing skills. Most students were honest about their comments. Process memos also promoted communication between students and teachers which allowed teachers to directly respond to students' reflections. Another advantage of using process memos is that they engage every student in the class so students who feel too shy to raise their hands and ask questions in class can benefit.[29] It is an efficient way to enhance students' metacognitive awareness, and guide students' writing step by step.

1.4 Metacognition in Reading

Recent research on metacognition and the effect on reading comprehension includes studies on individuals with language disorders and adolescents. These studies show the relationship of metacognition with reading and writing, as well as the applicability of metacognitive interventions. Furnes and Norman (2015) [30]compared three forms of metacognition (that is metacognitive knowledge, metacognitive skills, and metacognitive experiences) in normally developing readers and readers with dyslexia. Participants read two factual texts, and their learning outcomes were measured by a memory task. Metacognitive knowledge and skills were assessed by self-report and metacognitive experiences were measured by predictions of performance and judgements of learning.[31] The results show that reading and spelling problems of individuals with dyslexia are not generally associated with lower levels of metacognitive knowledge, metacognitive strategies or sensitivity to metacognitive experiences in reading situations.[32] A longitudinal study on normally developing children indicate that girls have better metacognitive knowledge between age 10 −14.[33] The study also revealed that text comprehension is positively correlated with individual differences in metacognitive knowledge of strategy use. These two studies suggest that text comprehension in dyslexia is not related to their metacognitive skills, metacognitive knowledge or metacognitive experiences, however for normally developing children, their text comprehension is related to their level of metacognition. **Question generation** often help students understand the texts better. "An ideal learner – self-regulated to active – is a person who asks deep questions and searches for answers to thought -provoking questions".[34] A number of research are done regards to question generation on reading. This suggests that question generation is an important aspect of reading. Question generation also benefits learning in science. García et al. (2014) [35]examined 72 ninth-grade students in science class. The results indicate that "question-generation training influenced how students learned and studied, specifically their metacognition".[36] Participants in group 1, who received question-training by providing prompts had the highest score on metacognitive knowledge and self-regulation. This suggests that effectiveness of question generation depends on the person's metacognitive knowledge. It is important for teachers to recognize students' knowledge before letting students generate questions.

1.5 Metacognition in Science Education

As mentioned before, metacognition is important in the field of science education because higher levels of science require students to reconstruct perceptual knowledge and procedural strategies on their own. It is also important for students and teachers to be aware of the beliefs they have about science as they affect their learning and for teachers it affects how they teach science in classrooms. [37] However, a number of teachers take these beliefs for granted. A study where researchers interviewed preservice teachers and students reveals that not many teachers teach beliefs about science or nature of science. Some teachers in this study believe that teaching the nature of science is not as important as teaching other concepts in science. [38] This becomes a problem when students proceed to university and learn higher levels of science. It also affects students' motivation to study science because it hinders their understanding of science. Schraw, Crippen & Hartley agrees to this and state that "effective instruction should help students and teachers aware of the beliefs they hold about science". [39]Then, how do we promote metacognition in science learning? Schraw, Crippen and Hartley suggest that "authentic inquiry promotes metacognition and self-regulated learning because students are better able to monitor their learning and evaluate errors in their thinking or gaps in their conceptual understanding." [40]This is part of the **inquiry based learning** that many researchers believe it is effective for science teaching. In inquiry based learning, students pose questions and construct solutions. [41]Another way to enhance metacognition in classroom is by collaboration among students and teachers. This will promote feedback, modeling and social interaction, which will benefit in students' motivation and epistemological beliefs. [42] Similarly, metacognition and self-regulated learning is highly discussed in math learning and instruction research. Please refer to [43] for more information.

1.6 Individual Differences in Metacognition

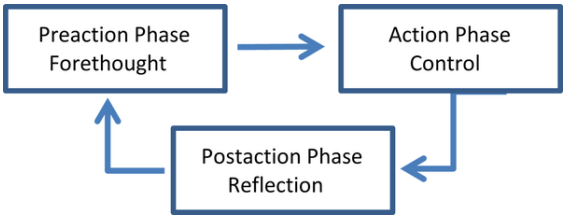
Different minds

Another popular topic in the studies of metacognition is individual differences in metacognition. Research in individual differences in metacognitive ability shows that it is very difficult to measure metacognition. Winne (1996) proposed that there are 5 sources of individual differences affecting metacognitive monitoring and control in self-regulated learning. They are "domain knowledge,

knowledge of tactics and strategies, performance of tactics and strategies, regulation of tactics and strategies, and global dispositions" [44] Global dispositions refer to dispositions about learning. In other words learning styles. Winnie emphasized that his proposals are tentative and requires further investigation. However, his research encouraged other researchers to dive into this topic. A number of researchers suggest that individual differences in metacognitive accuracy reflect differences in metacognitive ability, however Kelemen, Frost, & Weaver, (2000) suggest that this is not the case. **Metacognitive accuracy** refers to "the relationship between metacognition and future memory performance". [45] The study measured 4 common metacognitive tasks. They are ease of learning judgements, feeling of knowing judgements, judgements of learning, and text comprehension monitoring. In the study including pre-test and post-test, memory and confidence levels were stable however, individual differences in metacognitive accuracy were not. [46]This suggests that metacognitive accuracy is not reliable when it comes to measuring individual differences in metacognitive ability. However, the validity of research is unknown as a lot of researchers acknowledge the difficulty of measuring metacognition. Further research are required in this field. The notion of individual differences in metacognitive ability also suggest that there is no one-size-fits-all solution for metacognitive instruction. Lin, Schwartz and Hatano (2005) suggest that application of metacognition need to be proceeded with careful attention to differences in individual learning and classroom environment.[47] Lin, Schwartz and Hatano (2005) suggest teachers to use **adaptive metacognition** which involves "both the adaptation of oneself and one's environment in response to a wide range of classroom variability." [48] Classroom variability includes social and instructional variability. In order to implement adaptive metacognition, Lin, Schwartz and Hatano suggest an approach called Critical Event Instruction which "help teachers appreciate the need for metacognitive adaptation, particularly in situations that appear routine on the surface level". [49] This approach helps prepare preservice teachers deal with commonly occurred problems in the classroom. It provides information on how to deal with different values, goals and experiences. [50]

2 The Concept of Self-Regulated Learning

Self-regulated learning is the ability to control learning [51]. People who are self-regulated are metacognitively, motivationally and behaviourally active participants in their own learning, they are self-motivating and make learning easier for themselves [52]. Another aspect of self-regulation is the focus on why and how students initiate control of their own learning [53]. It is believed that people who self-regulate are capable of influencing their own learning. By changing ones own learning strategies, one is better able to understand the knowledge they are learning and the process by which they are achieving it. Active planning before learning takes place, monitoring during learning, and evaluation after learning are simple strategies that can help one self-regulate [54]. Being a self-regulated learner prompts the ability to change and alter learning strategies based on the growth of self understanding [55].



Self-regulated learning

For example: Emily is trying to learn the process of evolution. She reads three chapters and realizes that she can not remember what she just read. As she reads the next chapter she summarizes each paragraph in one sentence into her notebook. Writing notes helped her understand the overall concept of what she was learning. The process she went through was self regulating because she understands that she was not learning by simply reading and she change her learning strategy so that she could learn more information.

Self-regulated learning is beneficial because with better metacognitive awareness one is better able to judge their learning strengths and weaknesses and can alter their learning patterns from what they know about themselves [56].

Self-regulated learning can be better understood through viewing specific strategies which people use to engage in their own learning. The large scale structure of self-regulated learning is as follows:

This model of self-regulated learning is broken down into three phases. The **forethought phase** (self-assesment, goal setting, strategic planning) which is what takes place before learning occurs, the **performance phase** (Strategy implementation, strategy monitoring) which takes place during learning and **self-regulation phase** (outcome evaluation) [57].

By adopting this method an individual is showing engagement with their learning and by assessing it they can better their understanding.

2.1 Self-Assessment:

Self-assessment is about understanding yourself and the way you learn. Questions you can ask yourself are: What are my skills? What are my Interests? Do I learn by watching videos? Do I learn better taking notes? Do I learn by writing or typing out notes? Do I learn best my

memorizing and explaining? Self-assessment makes people reflect on their abilities and their strategies. It requires choosing techniques that are most appropriate for the information needed to learn [58]. This first stage in self-regulated learning is not always easy because one must be motivated, one must have the will and effort to test new learning techniques [59]. Self-assesment requires a specific attitude [60]. Negative attitudes towards studying will not promote self-assesment. It will promote the idea that studying and changing techniques of learning will not enhance understanding. However a positive attitude and having an open mind in changing learning techniques can enhance the process of self-assesment. With optimal motivation, persistency and emotion one is better able to asses themselves and find techniques that work and don't work. These traits are also important in total self-regulation.

2.2 Goal Setting:

Goal setting is looking at what you need to achieve and how to get there in a specific time frame [61]. Goal setting requires a basic understanding of the information you will be learning, because in order to set a goal you must have some knowledge in what the outcome should look like. Goal setting is important because it helps create motivation and can motivate a person to accomplish a specific goal. It is essential to create attainable goal. Attainable goals are goals which one is capable of reaching. Therefore the goal one sets is not too high and not too low, it is in the persons realm of attaining and succeeding. By creating attainable goals and many goals, a person is more likely accomplish them. Attainable goals promotes desire and will power because it is not so far out of reach. Some questions that one could ask themselves to goal set are as follows:

What do I want to achieve? What steps will take me to my goal?

2.3 Strategic Planning:

Strategic Planning is similar to goal setting in that you need to have a basic understanding of the information you will be learning. This is important because after setting a goal there are specific strategies which you will set to achieve that goal. [62].

For example if you had seven days to study for an exam covering 14 chapters you might separate your learning into studying two chapters per day. By strategically planning how much you need to study everyday, the end goal of learning 14 chapters in 7 days will be achieved.

People goal set and strategically plan for athletic goals too.

A person may have one month to train for a marathon. To properly plan their training they can create a timeline of how much they should improve each week, how long they will run each day and each week and how much to add or take out of their workouts each day and each week.

Strategic Planning is a more detailed way to reach your goal. It is composed of smaller goals within the bigger goal. To have a good plan one must understand their goal, one must know the direction they want to pursue. Some questions one could ask themselves to help promote strategic planning are as follows:

How will I reach my final goal? What do I normally do? Will I be able to achieve this? How do I study/learn best? How can I implement my learning strategies into my goals? Do I have enough time to accomplish each goal? Are my goals realistic in this specific time frame? How should I study/learn for this specific goal? What are my values? How does my personality affect my learning and goals? What distracts me? When do I get tired of study? What things in learning do I not like?

These are several questions which can help strategic planning. Some questions such as “how does my personality affect my learning goals” can inhibit or enhance learning and the ability to reach goals. If a person has a chatty personality and wants to talk when in a group of people, that person might want to set goals to study alone. If someone has a hyperactive attitude and cannot focus on their studying due to excess energy, they might try setting goals to workout or go for a run before studying. These questions can look at many different aspects which effect the outcome.

2.4 Strategy Implementation:

Strategy implementation is an even more detailed organization system of goals and strategic planning. This is the process of which one will implement strategic plans and actually enforcing them into practice [63]. Strategy implementation requires motivation and self-determination. You must have a solid strategic plan to prevent environmental distractions and understand what will motivate you and demotivate you in achieving the goal. Strategy implementation is important in the success of learning because it addresses and implements when you will study or learn. It enforces how you will learn and where you will learn and is the physical act of reaching your goals.

2.5 Strategy Monitoring:

Strategy Monitoring is the process of monitoring how effective your strategic planning is for your learning. This is an important stage for effective learning because as you learn you can asses if the practice you are doing is effective. Strategy Monitoring occurs during learning and during the act of reaching your goal, similarly to strategy implementation [64]. You may monitor how much you are accomplishing, if you are reaching your goals, if you are

actually learning, if you are being distracted and how your environment is effecting your learning process. Monitoring is evaluating your strategies and how effective they are. You must accurately adjust your strategies so that your best learning can take place.

2.6 Outcome Evaluation:

Outcome evaluation takes place after learning has occurred. It is reviewing your goals and planning and figuring out how effective it was [65]. Outcome evaluation is important because it allows one to improve on their learning practices and creates a better plan for the future learning processes. Questions you may ask could be as follows:

How effective were my goals? Were they attainable? How accurate was my strategy planning? Should I have included any strategy's which I did not? What should I change about my learning next time? Was my environment distracting?

2.7 Other Self-regulated Terms

Self-regulated Action is the means of how regulation is conducted [66]. Self-regulated action takes into consideration the object and the action. To better explain this, the object is the end goal such as writing an essay. The action is how that goal will be achieved. Actions can include changes in cognition, emotion, motivation, behaviour, personality attributes and physical environment [67]. The action of motivation will effect if, how and when a student will write their essay. A poor behaviour will negatively effect the learning of an individual. In this case the action is the behaviour and the action is effecting the persons learning ability, which is the object.

Purpose of Engagement is a combination of self-process, purpose, and possible actions that are relevant in a specific situation [68]. For example all people have different reasons for engagement of their learning. Some people learn because it is interesting, some learn because it will make others happy. They have different motivating factors which will benefit or hinder their learning process. The reasons people have towards why they are engaged or not engaged in their learning, can and will effect the purpose of engagement. The reasons one has towards learning will change self-regulated action and the process by which one will plan, monitor and evaluate their learning.

A more detailed table of the self regulated process and how students regulate their personal functioning, academic performance and learning environments is as follows:

(20)

Self-Motivation Beliefs

Another important component of self-regulated learning that we have not mentioned is self-motivation beliefs. Zimmerman introduced this concept in the forethought phase and it includes self-efficacy, outcome expectations, intrinsic interest/value, and learning goal orientation.[69] **Self-efficacy** in this case is your belief about the ability to learn a task. For example, when you are learning a difficult concept in class you feel like you are going to understand it right away or you fear that you are going to get lost. "Self-efficacy is extremely important for self-regulated learning because it affects the extent to which learners engage and persist at challenging tasks." [70]Teachers can enhance self-efficacy by providing tasks with appropriate level of difficulty, which is related to the concept of scaffolding. Schraw, Crippen and Hartley suggest that there are two ways to enhance students' self-efficacy. "One is to use both expert (e.g., teacher) and non-expert (e.g., student peers) models", "The second is to provide as much informational feedback to students as possible"[71] **Outcome expectations** is expectations about your consequences of learning. Students who believe that they can learn a difficult concept in economics class and believes that he is going to use this knowledge in the future. [72] Teachers can promote outcome expectation by reminding students that the information is going to be useful in the future. Students with high **intrinsic interest** learn because they want to acquire the task skill. A student might study education really hard because he wants to become a teacher. [73]Teachers can enhance this intrinsic interest by introducing the application of knowledge. Students who have **learning goal orientation** value the process of learning. They simply enjoy learning the material. Teachers can enhance learning goal orientation by making the class entertaining or intrigue students' attention using different modality (video clips, graphs). Another component of self-regulated learning in the category of motivation is epistemological beliefs. **Epistemological beliefs** are "those beliefs about the origin and nature of knowledge". [74]These beliefs affect problem solving and critical thinking, which are important component of self-regulated learning. [75]Please refer to chapter 4 [76] for further information about motivation and beliefs about self. Another component of self-regulated learning in the category of motivation is epistemological beliefs. Epistemological beliefs are "those beliefs about the origin and nature of knowledge".[77] These beliefs affect problem solving and critical thinking, which are important component of self-regulated learning. [78]

3 Critical Review of Metacognition and Self-Regulated Learning

3.1 Conceptual Confusion

While self-regulated learning has blown up to be the topic of discussion in contemporary educational psychology, there are a number of criticisms being set forth. In an extensive critical analysis done by Martin & McLel-

lan (2008) conceptual confusions, especially with respect to the definitions surrounding self-regulation, have been noted to lead to misunderstandings in knowing what is really being measured. Multiple terms are being used to pinpoint the focus of self-regulation such as "self-management", "metacognitive strategies", "behavior management" and "self-regulated learning"[79]. Some researchers use these interchangeably [80] which can be misleading. Yet still some tend to emphasize and categorize defining features based on internal mental activity (i.e. Winne and Hadwin, 1998 as cited in [81]) while others define it by reference to action and activity (i.e. Bandura, 1986 and Zimmerman, 1989 as cited in [82]). The former group view self-regulation as metacognitive capabilities that can develop over time with respect to individual variation while the latter more-so consider beliefs and behavior that are context dependent. [83] According to Martin & Mclellan (2008), it is important to consider that the lack of conceptual boundaries in some cases and that over-integration of terms in other can account for problems in empirical research. Without knowing what it is exactly that is being studied, or having too wide of a range in inclusive criteria, it will be difficult to reach the purpose of bettering the models of SRL [84].

3.2 Cultural Differences

Culture may play an impact on self regulated learning but there is still not a significant amount of research to understand how much it impacts self-regulation. Every individual is different and therefore stereotypes of how one culture learns is not a complete replication of how all people from that culture learn. To add to this point, self-regulation can change as one ages and can change when emerged into a new or different culture [85]. One study found that American students placed a high value on education but the academic achievement of african Americans and Hispanic Americans were considerably less than European and Asian Americans [86]. Japanese and Chinese students were found to have high levels of academic achievement [87]. The difference in achievement may be due to cultural influence on self-regulated learning. This same study measures strategies used by Australians, Japanese and Japanese students in Australia in self-regulation. The study evaluates these students on their self-evaluation, organizing and transforming, environmental structuring (for example: turning off the radio), rehearsing and memorizing, and the nonstrategic category of "other" which analyzes if their learning behaviour was an outcome initiated by another person.

Japanese students in Australia:

The study found that Japanese student's studying in Australia had lower environmental structuring strategies, little seeking assistance strategies and little strategy use of outcomes initiated by others [88]. However these students were high in memorization and rehearsing strategy use [89]. These Japanese students used a great deal of checking, outlining, drafting, recording, reviewing notes, reviewing tests and using willpower [90]. The high achievement and their self-regulation results correlate to the traditional ways Japanese students are raised at home and in school. Traditional Japanese culture emphasizes effort because effort is a large contributing factor in success. They emphasize group cooperation and persistence, and also believe that achievement is met with individual diligence and self-discipline [91].

Japanese Students:

Memorization was found to be the most important self-regulated learning strategy used by Japanese students [92]. Repetition was another strategy widely used by Japanese students [93]. In Japanese culture it is believed that spontaneous understanding will occur when a person has read the information they are learning 100 times [94]. Values are different in Japan than they are in the western world. They value "compliance with authority", "obedience in good grace," and "cooperation with the teacher" [95]. Japanese students are likely to use a high will power to achieve and self-regulate successful learning [96].

Australian Students:

Memorization was not encouraged in an Australian classroom [97]. They were aiming for understanding rather than memorizing. Although Australian students did use memorization, they did not use it to the extent that Japanese students did [98]. Australian culture, alike to American culture, values self-confidence, tolerance of differences, creativity and assertiveness [99].

Culture may impact self-regulated learning. However when an individual is learning in a new culture some of their learning strategies may change and some of their learning strategies may stay the same. For example, one study found that Japanese students maintained their memorizing strategy as a learning behaviour in the Australian learning system even though the Australian classroom did not recommend it. Because memorization is a large part of learning in Japanese culture it effected their learning strategy use when they moved to Australia to learn. This is one example of how culture effects self-regulated learning. Learning strategies are approached differently in ever country, every town, every school and every classroom. Therefore the learning strategies of every individual is different, and culture is not necessarily the driving force of how we implement self-regulation although it can be a big influencer. Another point is that the strategies used by Australian students, Japanese students and Japanese students studying in Australia are not necessarily right or wrong.

3.3 Concept of Learning

The concept of learning can be looked at in six steps:

1. Increasing one's knowledge

2. Memorizing and reproducing
3. Applying
4. Understanding
5. Seeing something in a different way
6. Changing as a person. [100]

Their are many different views of learning such as what is learning and what strategies are used in learning. According to Purdie learning is viewed in several ways: It is a way to increase knowledge, it requires memorization, it requires reproducing and studying [101]. Learning is seen to help generate a career and learning is viewed as understanding [102]. Learning is also a way to see things in a different or new way, it is a means of personal fulfillment and can be considered a 'duty' to some individuals [103]. Learning may be seen "as a process not bound by time or context" and also as a way to "develop social competence" [104]. These different views of learning generate a concept of learning which help to understand self-regulated learning. Understanding the different views of learning is self-regulating itself and it can also help one to understand the learning strategies people use when self-regulating.

3.4 Concept of Learning in Relation to Cultural Differences

The concept of learning relates to cultural differences and self-regulation because most information on 'self-regulation', and the 'concept of learning' are Western views. This makes understanding the cultural effect of self-regulation one sided. Being exposed to different cultures, exposes people to different ways of thinking. When the Japanese students studied in Australia they learnt different learning strategies and found new ways to understand knowledge than what they were used to. This process may have been unconscious but because they were put into a new system with a different language and a different structure, they would be forced to change some of their learning strategies. When viewing learning from different perspectives people may start to see that knowledge is not necessarily dualistic [105]. This means that knowledge is not right and wrong, or good and bad. Learning may become viewed as relativist where one can "recognize the flexibility of knowledge and understand that knowledge can be questioned. The stereotypical view of Asian culture on learning is that knowledge is something learnt by an authority figure who knows right and wrong [106]. Knowledge is to be learnt and memorized [107]. This results in the assumption that students from Asia are passive learners who are compliant, obedient, and absorb knowledge rather than understand it [108]. The stereotypical view of Australian students are that they are active learners. This results in the assumption that they are "assertive, independent, self-confident, accepting of diversity and willing to question and explore alternative ways of thinking and acting" [109].

4 Metacognition Through a Developmental Lens

Research shows that metacognitive abilities are related to factors such as age and biology (citation 4). It is therefore important to understand the developmental progression in order to apply the theory.

4.1 Maturation Bases

- Age as a factor
  - Young children
    - Theory of Mind
- Adolescents
- Adults

4.2 Biological Bases

- Deficits in Learning

5 From Theory to Application

A review of how theories around self-regulated learning and metacognition are put into practice in educational settings.

5.1 Commonly Used Strategies

Self-regulated learning is a vastly growing topic of interest, especially within the field of educational psychology [110]. The aim lies in seeking to integrate theories into a cohesive framework that can be used to guide educators and learners. In a review of the literature regarding self-regulated learning, Paris & Paris (2001) summarize several principles outlined by Paris & Winograd (1999) as being practical applications of SRL in the classroom environment[111]. They categorized them within the confines of four ideas that integrate the research in this field. Firstly, students are capable of better understanding what learning entails when they can make self-appraisals [112]. This means that by analyzing their ways of learning and comparing it to others, evaluating what they have and don't have knowledge about, and assessing their efforts students can enhance their awareness of the process of learning [113]. Secondly, self-management of thought and affect allows for greater flexibility in the ability to problem solve adaptively [114]. By setting realistic goals that focus on improving their competence, effectively managing their time through continual monitoring, and reviewing/revising learning strategies students can commit to higher performance standards for themselves [115]. Thirdly, with respect to instruction self-regulated

learning can be taught in a variety of ways that allows for accommodation [116]. SRL may be taught to students explicitly (directed reflection, discussions around metacognition, practice with experts); it can be taught indirectly (modeling, and reflective practices); and it can be prompted with individualized mapping of growth [117]. Lastly, it is believed that self-regulation is intertwined with the narrative experiences related to identity for each student [118]. The way in which students choose to assess and monitor their behavior is consistent with the identity they desire and by being a part of a reflective community of learners/instructors, one can enhance the level of depth by which they look at their self-regulated learning [119].

While there may be variation in the ways in which students self-regulate, the importance lies in understanding how children come to self-regulate in the first place. According to Paris & Paris (2001), SRL can be enhanced in three ways: (1) Indirectly through experience: repeated exposure to experiences in school can elicit learning of what is expected by the teacher and what is most beneficial to the student [120]. An example of this is the learning that double-checking work, although initially time-consuming, can be beneficial in the long-run and will therefore be advantageous to do the next time around also. (2) SRL can be taught directly: students can learn from the explicit instruction of educators who highlight effective strategy use, and increase awareness of the importance of goal-setting [121]. As an example, an instructor may emphasize the strategic steps of how to analyze a word problem from start to finish. (3) Self-regulation can be elicited when integrated with active practices that embody SRL within them [122]. An effective practice that encompasses SRL into it is collaborative learning projects where each student takes on responsibility for a portion of an overall project [123]. Self-regulated learning appears throughout such projects as students are bound to learn from the feedback of others, and from analysis of what they have done to contribute to the whole. These three outlined ways of enhancing SRL are often found in combination as students get exposed to experiences with their peers and instructors in their educational environment [124].

Throughout education, students are taught various learning strategies to incorporate into their studies; yet as research shows, it is not always enough to know such learning strategies but to be able to regulate the use of the strategy effectively [125]. In a computer-based training experiment by Leutner, Leopold, and Elzen-Rump (2007), researchers were able to show the benefit of not only teaching students a useful cognitive learning strategy (highlighting) but of additionally providing training on how to monitor and regulate the use of this tool with metacognitive learning strategies [126]. The study involved 45 college students randomly assigned to either a treatment group that received no training at all, one in which they were trained only in the cognitive strategy of highlighting, and the other in which training on highlighting was combined with training on self-regulation in learning about new-born babies [127]. The combined self-regulation training group had a version of the computer-program that included steps on how to obtain metacognitive control with time to practice the control strategy and apply it in the next section of their text learning [128]. The results of the study indicate that students trained in both strategy-use and metacognitive control of this strategy use were more successful in applying their learnings in a goal-oriented way when tested after the training [129]. The cognitive-strategy use only group performed better than the control group that received no training at all; however the combined training group outperformed both indicating that while strategy use can improve outcome performance, learning can be enhanced even further when students are taught to regulate such strategies [130].

5.1.1 The Use of Speech

Psychologist Lev Vygotsky believed that all speech, beginning as early as childhood, serves adaptive communication and socialization purposes[131]. Interacting with others as a child allows them to eventually function as self-regulated problem solvers [132]. In other words in an interaction between an adult and child, the adult at first holds responsibility for helping to perform strategies like planning and monitoring to reach a desired goal [133]; however as they work together to accomplish what can be done with assistance from a capable other as opposed to on their own, the adult helps to transfer self-regulatory performance over to the child [134]. In this sense, metacognition can be seen as being rooted in social interaction [135] as the child learns to think about the actions they take.

The literature in this field discusses the important role that speech, and in particular inner-speech, plays in facilitating self-regulation [136]. Vygotsky suggested that private speech serves the self-regulatory aspect of planning, and related cognitive functions of "orienting, organizing, and structuring behavior" [137] . This aids in understanding how to deal with various difficult situations. Even early forms of speech (i.e.egocentric speech) that become a part of a child's activities aid in "accidentally capturing or regulating behavior" (Zivin, 1979 as cited in [138]). In this sense, he advocated that language is essential to the development of self-regulation [139]. Vygotsky's student outlined verbal self-regulation occurs in a sequential process where initially others' speech controls the child, then the child's overt speech starts to regulate their own behavior, and finally the meaning of their own overt/covert speech regulates behavior in an efficient manner [140].

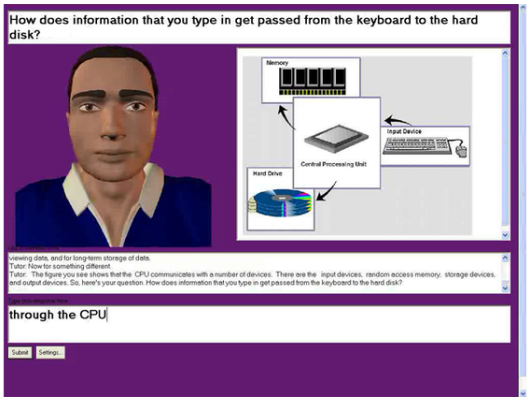
Behavioral perspectives of self-regulated learning also give us insight into the important role played by self-speech, especially with regards to self-control [141]. They look at the role of induced self-speech where one self-instructs themselves in facilitating such self-regulatory processes as self-monitoring and self-evaluation [142] .

These self-instructions can act as cues that guide behavior [143] and can therefore be helpful in encouraging self-regulated behavior on the part of the speaker. This sort of self-speech is described as being a "part of a complex cognitive-symbolic process that mediates and maintains behaviors when consequences are either delayed or not evident" (Mahoney & Thoresen, 1974 as cited in [144] . In other words, if we imagine an individual performing some sort of problem-solving task that requires regulatory behaviors, self-speech and talking it through with themselves can initiate progression in the task as they try to attain understanding. A study of third-grade students who were taught to self-instruct and self-monitor the use of a comprehension strategy yielded more use of the strategy in comparison to the teacher only explicitly teaching it to them (Elliott-Faust & Pressley, 1986, as cited in [145]). Continuation in empirical evidence is needed to further understand the specifics of when and how this sort of speech allows for self-regulation [146] as limitations do exist in the assessment and methodology of researching private speech.

5.2 Incorporating Technology

With the undeniable growth in technological use, it is important to consider ways in which this can be used to improve self-regulated learning for students in today's educational system. Graesser et al. (2005) notes that there is a need for "inquiry and explanation-centered learning", and a good starting point for this would be incorporating computer programs into schools that are capable of fostering this. Certain computer programs have the ability to produce positive learning outcomes by allowing for deep learning, scaffolding, elaboration, and self-monitoring [147] while creating a reflective environment that employs collaboration [148]. Students have the opportunity to interact with these computer programs which allow them to learn not only the topic of study but of how to approach that topic in an effective manner that enhances them as learners. In a study based on interactive software, White & Frederiksen (2005) were able to assess metacognitive changes. This Inquiry Island software allowed for learners to interact with different characters on an "island" that incorporated various knowledge, advice, and tools that supported metacognitive growth [149]. It gave students the opportunity to internalize forms of expertise (e.g. questioning) as they carried out their projects [150]. The results of pre and post assessments show that the program allowed for significant gains on metacognition and inquiry assessments while simultaneously decreasing the performance gap between low and high achieving students as they engaged in these reflective activities [151].

Based on prior research, The Learning Kit Project [152] became an extensive study looking at self-regulated learning through the development of a software program known as gStudy. This software could be used in a variety of subjects and allowed for learners to study through interacting with a shell of knowledge that used cognitive tools such as note-making, glossaries, mind-map construction, and collaborative chat [153]. A particularly important design of this software that aided research was the fact that it contained a non-invasive log analyzer that traced the work of learners through a time-referenced, real-time account of how students interacted with the material/tools [154]. This allowed for researchers to see that, for example, data for students who reported higher mastery goals aligned with them engaging in more elaborate and frequent note taking [155].



AutoTutor

Many computer programs aim to stimulate professional human tutoring which has shown to be advantageous [156]. Such programs include Autotutor in which animated agents converse with students to guide metacognition, Istart which teaches comprehensive reading strategies, and Betty's Brain where students are able to teach computer agents their knowledge [157]. These types of programs provide concrete ways of getting metacognitive and self-regulating practices into play in a visually and mentally engaging manner that tailors to the demographic targeted. As metacognitive expertise is needed to gain knowledge and transfer this knowledge from one context to another [158], giving students the opportunity to enhance this domain will serve to be beneficial in creating more self-regulated learners.

The question is can these tutoring systems completely replace human tutoring? Research by Azevedo (2010) shows that when it comes to approaching difficult scientific topics, hypermedia use accompanied by human-tutor scaffolding regarding course content and self-regulated learning processes can facilitate learning for students [159]. Yet given the current restrictions on technology in this field, Azevedo (2010) notes that it is impossible for tutoring systems to completely mimic human tutors. One of the biggest challenges these types of systems face is the inability to fully monitor a student's understanding in the same sense that a human tutor would be able to given the verbal feedback and requests for help that a human can receive throughout and the timely manner in which they can respond [160]. In this respect, there are limitations with providing adaptive scaffolding[161] to the situ-

ation at hand. Scaffolds embedded within these systems pose technical challenges in, for example, judgments of learnings (JOL) described earlier in this chapter [162]: the hypermedia does not "know" that a student cannot tell if they are reading too fast [163], yet a human tutor would most likely be able to pick up on this through the interaction and conversational exchange [164].

5.3 Facilitating & Encouraging Self-Regulated Learning

The educational environment, the home environment, and the family of a student can play an important role in supporting and facilitating self-regulated learning. Martinez-Pons (2002) outlines practical steps that educators can take in aiming to support self-regulation both at school and home. One of these is to emphasize encouragement: this can be done by teaching students how to encourage their peers and by keeping parents informed of what challenges students are facing in what areas and therefore needing the most encouragement in to get through [165]. Another is to model self-regulation: an educator can be open to sharing their own goals and processes with students or encouraging parents to share theirs with their children to actively model what it means to have self-regulation be incorporated into their life [166]. Families can be made a source of good strategy ideas: educators can provide a monthly strategy to take home and share, or families can be encouraged to help their children with their work systematically rather than referring to textbook answers[167]. As well, providing self-evaluation guidelines can be efficient in prompting SRL[168]: Rubrics for self-evaluation can collaboratively be created with students; educators can gradually encourage students to develop their own record-keeping sheets for keeping track of their work throughout the semester; and examples of material that has been useful for some parents can be openly shared with others at parent-teacher meetings to stimulate ideas of how families can track the progress of their child in an effective manner [169].

Another way to promote self-regulated learning is to start implementing it at a young age, as research shows that self-regulation can effectively be fostered as early as preschool [170]. The improvement of self-regulatory competence of children in preschool was studied in Germany through providing self-regulation training to the kindergarten teachers directly involved with teaching them [171]. This short-term intervention involved 35 kindergarten teachers who underwent self-regulatory strategy training and 97 children who were interviewed before and after intervention was carried out. Teachers were taught strategies for their own learning process and for supporting the learning of these children through a model of self-regulated learning [172]. Within this model they included the notion of meta-cognitive dialogues where conversations take place between children and their teachers as they reflect on various aspects of learning [173]. Through a structured interview, changes in self-regulatory skills were measured and coded as children explained to a puppet how they could learn to ride a bike [174]. Results indicated that it is possible to improve self-regulation of preschoolers with significant differences shown throughout all phases of self-regulation [175]. The researchers discussed that kindergarten teachers ought to be adequately prepared to "help children to learn how to learn, to organize their knowledge and to solve problems" [176].

This important interaction that takes place between an instructor and a student that facilitates self-regulated learning is emphasized in other literature as well [177]. In particular, dialogue and guided discovery are important tools that can aid the learner to grow through "graduated difficulty, prompts, feedback, and social reinforcement" [178]. The student plays an active role, as well, as they work collaboratively with the teacher in determining purpose, strategy, and the most effective way in carrying out the discussed strategy to facilitate performance (K.R.Harris, 1985; K.R. Harris & Pressley, in press, as cited in [179].)

While many factors may ultimately influence a child's educational environment which can in turn influence their self-regulated learning (e.g. being tired), there are instructional practices that can be beneficial in promoting self-regulated learning [180] . Paris and Newman (1990) suggest a number of instructional conditions that encourage the development of self-regulated learning. The first of these is that "effective instruction provokes students to change their theories" [181]: although it may be a difficult task, students must make personal commitments to a new strategy otherwise it may seem more like obedience [182]. Modeling correct strategy use and how to revise plans is one method instructors can use but they must incorporate persuasion to an extent because simply observing the success of another is not always enough [183]. Another condition is "effective instruction makes thinking public": it is suggested that good instructional environments allow students to listen to the problems and solutions of their peers, with such discussions that arise facilitating the understanding and awareness of alternative ways to approach issues, and this ultimately allowing the instructor to address misconceptions [184]. A third practice is "effective instruction promotes active participation and collaboration": when students are encouraged to peer tutor and take an active role they are able to face their own theories and to become aware of what they do and do not sufficiently know which simultaneously aids their own learning as they teach others [185] . Paris and Newman (1990) encourage the use of these practices alongside other aspects such as motivating students to measure success or failure by their own standards and not in comparison to others while assisting them along the way.

6 Suggested Readings

Kaplan, A. (2008). Clarifying metacognition, self-Regulation, and self-regulated learning. *Educational Psychology Review, 20*(4), 477-484.

A helpful reading that aims to clarify conceptual boundaries.

Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. *Educational Psychologist, 36* (2), 89-101.

Reviews self-regulated learning research and its practical applications in educational settings.

Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. *European Psychologist, 13*(4), 277-287.

A Review of metacognition and its components.

7 Glossary

Dualistic: Knowledge viewed as right or wrong; good or bad.

Forethought Phase: Strategies taking place before learning. Self assessment, goal setting and strategic planning.

Metacognition: Thinking about thinking

Metacognitive Knowledge: Declarative knowledge such as language and memory.

Metacognitive experiences What the person is aware of and what she or he feels when coming across a task and processing information related to it.

Metacognitive skills: Deliberate use of strategies (i.e. Procedural knowledge) in order to control cognition.

Performance Phase: Strategies taking place during learning. Strategy implementation, and strategy monitoring.

Purpose of Engagement: The self-process, the purpose, and the possible actions that are relevant in a specific situation.

Relativist: Knowledge is flexible and changeable. It can be questioned.

Self-Regulated Action: The means by which regulation is conducted.

Self Regulated Learning: The ability to control learning.

Self-Regulated Phase: Strategies after learning has taken place. Evaluation.

8 References

Abd-El-Khalick, F., Bell, R. L. & Lederman, N. G. (1998). The nature of science and instructional practice: Making the unnatural natural. *Sci. Ed., 82*: 417–436.

Azevedo, R.(2005). Using hypermedia as a metacognitive tool for enhancing student learning? The role of self-regulated learning. *Educational Psychologist, 40*(4), 199-209.

Bembenutty, H. (2009). Feeling-of-knowing judgement and self-regulation of learning. *Education, 129*(4), 589-598.

Bruning, R.H., Schraw, G.J., & Norby, M.M. (2011).*Cognitive psychology and instruction* (5th ed.). Boston, MA: Pearson

Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. *European Psychologist, 13*(4), 277-287.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist*, 34(10), 906-911.

Furnes, B., & Norman, E. (2015). Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. Dyslexia: *An International Journal Of Research And Practice, 21*(3), 273-284.

García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. *Psicothema*, 26(3), 385-390.

Harris, K.R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

Kaplan, A. (2008). Clarifying metacognition, self-regulation, and self-regulated learning. *Educational Psychology Review*, *Vol 20*(4), 477-484.

Kelemen, W. L., Frost, P. J., & Weaver, C. A. (2000). Individual differences in metacognition: Evidence against a general metacognitive ability. *Memory & Cognition, 28*(1), 92-107.

Kolić-Vehovec, S., Zubković, B. R., & Pahljina-Reinić, R. (2014). Development of metacognitive knowledge of reading strategies and attitudes toward reading in early adolescence: The effect on reading comprehension. *Psychological Topics, 23*(1), 77–98.

Leutner,D., Leopald, C., & Elzen-Rump, V.D. (2007). Self-regulated learning with a text-highlighting strategy:A training experiment. *Journal of Psychology, 215* (3), 174-182.

Lin, X., Schwartz, D. L., & Hatano, G. (2005). Toward Teachers' Adaptive Metacognition. *Educational Psychol-*

ogist, 40(4), 245-255.

Martin, J., & McLellan, A. (2008). The educational psychology of self-regulation: A conceptual and critical analysis. *Stud Philos Educ, 27,*433-448.

Nelson, T. O., & Dunlosky, J.. (1991). When People's Judgments of Learning (JOLs) Are Extremely Accurate at Predicting Subsequent Recall: The "Delayed-JOL Effect". *Psychological Science, 2*(4), 267–270.

Nelson, T. O., & Leonesio, R. J. (1988). Allocation of self-paced study time and the "labor-in-vain effect". *Journal Of Experimental Psychology. Learning, Memory & Cognition*, 14, 676-686.

Nesbit, J.C., Winne, P.H., Jamieson-Noel, D., Code, J., Zhou, M., Macallister, K., Bratt, S., Wang, W., & Hadwin, A. (2006). Using cognitive tools in gStudy to investigate how study activities covary with achievement goals. *J Educational Computing Research, 35* (4), 339-358.

Paris, S.G., & Newman, R.S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25*(1), 87-102.

Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. *Educational Psychologist, 36* (2), 89-101.

Parrott, H. M., & Cherry, E. (2015). Process memos: facilitating dialogues about writing between students and instructors. *Teaching Sociology, 43*(2), 146-153.

Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

Purdie, N., & Hattie, J. (1996). Cultural differences in the use of strategies for self-regulated learning. *American Educational Research Journal, 33* (4), 845–871.

Purdie, N., Hattie, J., & Douglas, G. (1996. Student conceptions of learning and their use of self-regulated learning strategies: A cross-cultural comparison.*Journal Of Educational Psychology, 88* (1),87-100.

Rosman, T., Mayer, A.K., & Krampen, G. (2015). Combing self-assessments and achievement tests in information literacy assessment: Empirical results and recommendations for practice. *Assessment & Evaluation in Higher Education, Vol 40*(5), 740-754.

Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a croader perspective on learning. *Research In Science Education, 36*(1-2), 111-139.

Son, L.K., & Metcalfe, J. (2005). Judgments of learning: Evidence for a two-stage process. *Memory & Cognition, 33*(6), 1116-1129.

Stoeger, H., Fleischmann, S., & Obergriesser,S. Self-regulated learning (SRL) and the gifted learner in primary school:the theoretical basis and empirical findings on a research program dedicated to ensuring that all students learn to regulate their own learning. *Asia Pacific Education Review, Vol 16*(2), 257-267.

Winne, P. H. (1996). A metacognitive view of individual differences in self-regulated learning. *Learning and Individual Differences, 8*(4), 327-353.

White, B., & Frederiksen, J. (2005). A theoretical framework and approach for fostering metacognitive development. *Educational Psychologist, 40* (4), 211-223.

Winne, P.H., Nesbit, J.C., Kumar, V., Hadwin, A.F., Lajoie, S.P., Azevedo, R., & Perry, N.E. (2006). Supporting self-regulated learning with gStudy software: The learning kit project. Tech, Inst., *Cognitive and Learning, 3,* 105-113.

Woolfolk, A.E., Winne, P.H., & Perry, N.E. (2012). *Educational psychology*(5th ed.). Toronto, ON: Pearson.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice, 41*(2), 64-72.

[1] Bruning, R.H., Schraw, G.J., & Norby, M.M. (2011).*Cognitive psychology and instruction* (5th ed.). Boston, MA: Pearson

[2] Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American Psychologist, 34(10), 906-911.

[3] Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American Psychologist, 34(10), 906-911.

[4] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[5] Bruning, R. H., Schraw, G. J., & Norby, M. M. (2011). Cognitive psychology and instruction (5th ed.). Boston, MA: Allyn & Bacon/Pearson.

[6] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation.

[7] Furnes, B., & Norman, E. (2015). Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. Dyslexia: An International Journal Of Research And Practice, 21(3), 273-284.

[8] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[9] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[10] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[11] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[12] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[13] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[14] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[15] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[16] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[17] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[18] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[19] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[20] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[21] Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. European Psychologist, 13(4), 277-287.

[22] Son, L.K., & Metcalfe, J. (2005). Judgments of learning: Evidence for a two-stage process. Memory & Cognition, 33(6), 1116-1129.

[23] Nelson, T. O., & Dunlosky, J.. (1991). When People's Judgments of Learning (JOLs) Are Extremely Accurate at Predicting Subsequent Recall: The "Delayed-JOL Effect". Psychological Science, 2(4), 267–270.

[24] Nelson, T. O., & Dunlosky, J.. (1991). When People's Judgments of Learning (JOLs) Are Extremely Accurate at Predicting Subsequent Recall: The "Delayed-JOL Effect". Psychological Science, 2(4), 267–270.

[25] Bembenutty, H. (2009). Feeling-of-Knowing Judgment and Self-Regulation of Learning. Education, 129(4), 589-598.

[26] Bembenutty, H. (2009). Feeling-of-Knowing Judgment and Self-Regulation of Learning. Education, 129(4), 589-598.

[27] Parrott, H. M., & Cherry, E. (2015). Process Memos: Facilitating Dialogues about Writing between Students and Instructors. Teaching Sociology, 43(2), 146-153.

[28] Parrott, H. M., & Cherry, E. (2015). Process Memos: Facilitating Dialogues about Writing between Students and Instructors. Teaching Sociology, 43(2), 146-153.

[29] Parrott, H. M., & Cherry, E. (2015). Process Memos: Facilitating Dialogues about Writing between Students and Instructors. Teaching Sociology, 43(2), 146-153.

[30] Furnes, B., & Norman, E. (2015). Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. Dyslexia: An International Journal Of Research And Practice, 21(3), 273-284.

[31] Furnes, B., & Norman, E. (2015). Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. Dyslexia: An International Journal Of Research And Practice, 21(3), 273-284.

[32] Furnes, B., & Norman, E. (2015). Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. Dyslexia: An International Journal Of Research And Practice, 21(3), 273-284.

[33] Kolić-Vehovec, S., Zubković, B. R., & Pahljina-Reinić, R. (2014). Development of metacognitive knowledge of reading strategies and attitudes toward reading in early adolescence: The effect on reading comprehension. Psychological Topics, 23(1), 77–98.

[34] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self-regulation and learning approaches in Science. Psicothema, 26(3), 385-390.

[35] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390.

[36] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self-regulation and learning approaches in Science. Psicothema, 26(3), 385-390.

[37] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[38] Abd-El-Khalick, F., Bell, R. L. and Lederman, N. G. (1998), The nature of science and instructional practice: Making the unnatural natural. Sci. Ed., 82: 417–436.

[39] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[40] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[41] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[42] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[43] https://en.wikibooks.org/wiki/Cognition_and_Instruction/Learning_Mathematics

[44] Winne, P. H. (1996). A metacognitive view of individual differences in self-regulated learning. Learning and Individual Differences, 8(4), 327-353.

[45] Kelemen, W. L., Frost, P. J., & Weaver, C. A. (2000). Individual differences in metacognition: Evidence against a general metacognitive ability. Memory & Cognition, 28(1), 92-107.

[46] Kelemen, W. L., Frost, P. J., & Weaver, C. A. (2000). Individual differences in metacognition: Evidence against a general metacognitive ability. Memory & Cognition, 28(1), 92-107.

[47] Lin, X., Schwartz, D. L., & Hatano, G. (2005). Toward Teachers' Adaptive Metacognition. Educational Psychologist, 40(4), 245-255.

[48] Lin, X., Schwartz, D. L., & Hatano, G. (2005). Toward Teachers' Adaptive Metacognition. Educational Psychologist, 40(4), 245-255.

[49] Lin, X., Schwartz, D. L., & Hatano, G. (2005). Toward Teachers' Adaptive Metacognition. Educational Psychologist, 40(4), 245-255.

[50] Lin, X., Schwartz, D. L., & Hatano, G. (2005). Toward Teachers' Adaptive Metacognition. Educational Psychologist, 40(4), 245-255.

[51] Bruning, R.H., Schraw, G.J., & Norby, M.M. (2011).Cognitive psychology and instruction (5th ed.). Boston, MA: Pearson

[52] Purdie, Nola, and John Hattie. "Cultural Differences in the Use of Strategies for Self-regulated Learning". American Educational Research Journal 33.4 (1996): 845–871.

[53] Purdie, Nola, and John Hattie. "Cultural Differences in the Use of Strategies for Self-regulated Learning". American Educational Research Journal 33.4 (1996): 845–871.

[54] Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American Psychologist, 34(10), 906-911

[55] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390.

[56] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[57] Furnes, B., & Norman, E. (2015). Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. Dyslexia: An International Journal Of Research And Practice, 21(3), 273-284

[58] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[59] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[60] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[61] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[62] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[63] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[64] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[65] García, F. C., García, Á., Berbén, A. G., Pichardo, M. C., & Justicia, F. (2014). The effects of question-generation training on metacognitive knowledge, self regulation and learning approaches in Science. Psicothema, 26(3), 385-390

[66] Kolić-Vehovec, S., Zubković, B. R., & Pahljina-Reinić, R. (2014). Development of metacognitive knowledge of reading strategies and attitudes toward reading in early adolescence: The effect on reading comprehension. Psychological Topics, 23(1), 77–98

[67] Kolić-Vehovec, S., Zubković, B. R., & Pahljina-Reinić, R. (2014). Development of metacognitive knowledge of reading strategies and attitudes toward reading in early adolescence: The effect on reading comprehension. Psychological Topics, 23(1), 77–98

[68] Kolić-Vehovec, S., Zubković, B. R., & Pahljina-Reinić, R. (2014). Development of metacognitive knowledge of reading strategies and attitudes toward reading in early adolescence: The effect on reading comprehension. Psychological Topics, 23(1), 77–98

[69] Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. Theory Into Practice, 41(2), 64-72.

[70] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[71] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[72] Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. Theory Into Practice, 41(2), 64-72.

[73] Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. Theory Into Practice, 41(2), 64-72.

[74] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[75] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[76] https://en.wikibooks.org/wiki/Cognition_and_Instruction/Motivation_and_Beliefs_About_Self

[77] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[78] Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research In Science Education, 36(1-2), 111-139.

[79] Martin, J., & McLellan, A. (2008). The educational psychology of self-regulation: A conceptual and critical analysis. Stud Philos Educ, 27,433-448.

[80] Martin, J., & McLellan, A. (2008). The educational psychology of self-regulation: A conceptual and critical analysis. Stud Philos Educ, 27,433-448.

[81] Martin, J., & McLellan, A. (2008). The educational psychology of self-regulation: A conceptual and critical analysis. Stud Philos Educ, 27,433-448.

[82] Martin, J., & McLellan, A. (2008). The educational psychology of self-regulation: A conceptual and critical analysis. Stud Philos Educ, 27,433-448.

[83] Martin, J., & McLellan, A. (2008). The educational psychology of self-regulation: A conceptual and critical analysis. Stud Philos Educ, 27,433-448.

[84] Martin, J., & McLellan, A. (2008). The educational psychology of self-regulation: A conceptual and critical analysis. Stud Philos Educ, 27,433-448.

[85] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[86] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[87] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[88] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[89] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[90] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[91] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[92] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[93] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[94] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[95] Purdie, Nola, John Hattie, and Graham Douglas. “Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison.” Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[96] Purdie, Nola, John Hattie, and Graham Douglas. “Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison.” Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[97] Purdie, Nola, and John Hattie. “Cultural Differences in the Use of Strategies for Self-regulated Learning”. American Educational Research Journal 33.4 (1996): 845–871.

[98] Purdie, Nola, and John Hattie. "Cultural Differences in the Use of Strategies for Self-regulated Learning". American Educational Research Journal 33.4 (1996): 845–871.

[99] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[100] Purdie Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[101] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[102] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[103] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[104] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[105] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[106] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[107] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[108] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[109] Purdie, Nola, John Hattie, and Graham Douglas. "Student Conceptions Of Learning And Their Use Of Self-Regulated Learning Strategies: A Cross-Cultural Comparison." Journal Of Educational Psychology 88.1 (1996): 87-100. PsycARTICLES. Web. 30 Nov. 2015.

[110] Rosman, Tom; Mayer, Anne-Kathrin; Krampen, Günter. (2015). Combing Self-Assesments and Achievment Tests In Information Literacy Assesment: Empirical Results And Recommendations For Practice. Assessment & Evaluation in Higher Education, Vol 40(5), pp. 740-754.

[111] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[112] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[113] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[114] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[115] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[116] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[117] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[118] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[119] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[120] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[121] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[122] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[123] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[124] Paris, S.G. & Paris, A.H. (2001). Classroom applications of research on self-regulated learning. Educational Psychologist, 36 (2), 89-101.

[125] Leutner,D., Leopald, C., & Elzen-Rump, V.D. (2007). Self-regulated learning with a text-highlighting strategy:A training experiment. *Journal of Psychology, 215* (3), 174-182.

[126] Leutner,D., Leopald, C., & Elzen-Rump, V.D. (2007). Self-regulated learning with a text-highlighting strategy:A training experiment. *Journal of Psychology, 215* (3), 174-182.

[127] Leutner,D., Leopald, C., & Elzen-Rump, V.D. (2007). Self-regulated learning with a text-highlighting strategy:A training experiment. *Journal of Psychology, 215* (3), 174-182.

[128] Leutner,D., Leopald, C., & Elzen-Rump, V.D. (2007). Self-regulated learning with a text-highlighting strategy:A training experiment. *Journal of Psychology, 215* (3), 174-182.

[129] Leutner,D., Leopald, C., & Elzen-Rump, V.D. (2007). Self-regulated learning with a text-highlighting strategy:A training experiment. *Journal of Psychology, 215* (3), 174-182

[130] Leutner,D., Leopald, C., & Elzen-Rump, V.D. (2007). Self-regulated learning with a text-highlighting strategy:A training experiment. *Journal of Psychology, 215* (3), 174-182.

[131] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[132] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[133] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[134] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[135] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[136] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[137] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[138] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[139] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[140] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[141] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[142] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[143] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[144] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[145] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[146] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. *Educational Psychologist, 25*(1), 35-49.

[147] Bruning, R.H., Schraw, G.J., & Norby, M.M. (2011).Cognitive psychology and instruction (5th ed.). Boston, MA: Pearson

[148] White, B., & Frederiksen, J. (2005). A theorietical framework and approach for fostering metacognitive development. Educational Psychologist, 40 (4), 211-223.

[149] White, B., & Frederiksen, J. (2005). A theorietical framework and approach for fostering metacognitive development. Educational Psychologist, 40 (4), 211-223.

[150] White, B., & Frederiksen, J. (2005). A theorietical framework and approach for fostering metacognitive development. Educational Psychologist, 40 (4), 211-223.

[151] White, B., & Frederiksen, J. (2005). A theorietical framework and approach for fostering metacognitive development. Educational Psychologist, 40 (4), 211-223.

[152] Winne, P.H., Nesbit, J.C., Kumar, V., Hadwin, A.F., Lajoie, S.P., Azevedo, R., & Perry, N.E. (2006). Supporting self-regulated learning with gStudy software: The learning kit project. Tech, Inst., Cognitive and Learning, 3, 105-113.

[153] Winne, P.H., Nesbit, J.C., Kumar, V., Hadwin, A.F., Lajoie, S.P., Azevedo, R., & Perry, N.E. (2006). Supporting self-regulated learning with gStudy software: The learning kit project. Tech, Inst., Cognitive and Learning, 3, 105-113.

[154] Winne, P.H., Nesbit, J.C., Kumar, V., Hadwin, A.F., Lajoie, S.P., Azevedo, R., & Perry, N.E. (2006). Supporting self-regulated learning with gStudy software: The learning kit project. Tech, Inst., Cognitive and Learning, 3, 105-113.

[155] Nesbit, J.C., Winne, P.H., Jamieson-Noel, D., Code, J., Zhou, M., Macallister, K., Bratt, S., Wang, W., & Hadwin, A. (2006) Using cognitive tools in gStudy to investigate how study activities covary with achievement goals. J Educational Computing Research, 35 (4), 339-358.

[156] Bruning, R.H., Schraw, G.J., & Norby, M.M. (2011).Cognitive psychology and instruction (5th ed.). Boston, MA: Pearson

[157] Bruning, R.H., Schraw, G.J., & Norby, M.M. (2011).Cognitive psychology and instruction (5th ed.). Boston, MA: Pearson

[158] Winne, P.H., Nesbit, J.C., Kumar, V., Hadwin, A.F., Lajoie, S.P., Azevedo, R., & Perry, N.E. (2006). Supporting self-regulated learning with gStudy software: The learning kit project. Tech, Inst., Cognitive and Learning, 3, 105-113.

[159] Azevedo Roger. (2005). Using Hypermedia as a Metacognitive tool for Enhancing Student Learning? The role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209.

[160] Azevedo Roger. (2005). Using Hypermedia as a Metacognitive tool for Enhancing Student Learning? The role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209.

[161] Azevedo Roger. (2005). Using Hypermedia as a Metacognitive tool for Enhancing Student Learning? The role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209.

[162] Azevedo Roger. (2005). Using Hypermedia as a Metacognitive tool for Enhancing Student Learning? The role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209.

[163] Azevedo Roger. (2005). Using Hypermedia as a Metacognitive tool for Enhancing Student Learning? The role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209.

[164] Azevedo Roger. (2005). Using Hypermedia as a Metacognitive tool for Enhancing Student Learning? The role of Self-Regulated Learning. *Educational Psychologist, 40*(4), 199-209.

[165] Woolfolk, A.E., Winne, P.H., & Perry, N.E. (2012). Educational psychology(5th ed.). Toronto, ON: Pearson.

[166] Woolfolk, A.E., Winne, P.H., & Perry, N.E. (2012). Educational psychology(5th ed.). Toronto, ON: Pearson.

[167] Woolfolk, A.E., Winne, P.H., & Perry, N.E. (2012). Educational psychology(5th ed.). Toronto, ON: Pearson.

[168] Woolfolk, A.E., Winne, P.H., & Perry, N.E. (2012). Educational psychology(5th ed.). Toronto, ON: Pearson.

[169] Woolfolk, A.E., Winne, P.H., & Perry, N.E. (2012). Educational psychology(5th ed.). Toronto, ON: Pearson.

[170] Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

[171] Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

[172] Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

[173] Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

[174] Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

[175] Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

[176] Perels, F., Merget-Kullman, M., Wende, M., Schmitz, B., & Buchbinder, C.(2009). Improving self-regulated learning of preschool children: Evaluation of training for kindergarten teachers. *British Journal of Educational Psychology, 79*, 311-327.

[177] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[178] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49.

[179] Harris, Karen R. (1990). Developing Self-Regulated Learners: The role of private speech and self-instructions. Educational Psychologist, 25(1), 35-49

[180] Paris, S.G., Newman, R.S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25(1)*, 87-102.

[181] Paris, S.G., Newman, R.S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25(1)*, 87-102.

[182] Paris, S.G., Newman, R.S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25(1)*, 87-102.

[183] Paris, S.G., Newman, R.S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25(1)*, 87-102.

[184] Paris, S.G., Newman, R.S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25(1)*, 87-102.

[185] Paris, S.G., Newman, R.S. (1990). Developmental aspects of self-regulated learning. *Educational Psychologist, 25(1)*, 87-102.

9 Text and image sources, contributors, and licenses

9.1 Text

- **Cognition and Instruction/Metacognition and Self-Regulated Learning** *Source:* https://en.wikibooks.org/wiki/Cognition_and_Instruction/Metacognition_and_Self-Regulated_Learning?oldid=3025683 *Contributors:* QuiteUnusual, Nesbit, SFU-301229581-KNF, EDUC320-AB-1948, Rumi Hasegawa, Educ320bf, Educ320bf2015 and Anonymous: 5

9.2 Images

- **File:AutoTutor.png** *Source:* https://upload.wikimedia.org/wikipedia/commons/c/cd/AutoTutor.png *License:* CC BY-SA 3.0 *Contributors:* Own work *Original artist:* Sidney.dmello
- **File:Mr_Pipo_different_minds.svg** *Source:* https://upload.wikimedia.org/wikipedia/commons/2/2c/Mr_Pipo_different_minds.svg *License:* CC BY-SA 3.0 *Contributors:* This file was derived from Silhouette Mr Pipo.svg:
Original artist: Silhouette_Mr_Pipo.svg: Nevit Dilmen (talk)
- **File:Self-regulated_learning.png** *Source:* https://upload.wikimedia.org/wikipedia/commons/5/58/Self-regulated_learning.png *License:* CC0 *Contributors:* Own work *Original artist:* Brews ohare

9.3 Content license

- Creative Commons Attribution-Share Alike 3.0