

Self-regulated Learning Theory in Metacognitive-Based Teaching and Learning of High-Order Thinking Skills (HOTS)

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Abstract – Along with the need for global competence, the aspect of high-level thinking skills that is widely emphasized nowadays has demanded students to be intelligent individuals who apply the ability of learning skills through their own determination by implementing effective learning methods through self-regulated learning. However, the study found that in the teaching and learning of high-level thinking skills, the approach in learning self-regulation is less applied. Thus, this concept paper aims to discuss the application of self-regulation learning theory in teaching and learning metacognitive-based high-level thinking skills. This study uses an analytical approach to the literature review in discussing the relationship between learning self-regulation, metacognition and high-level thinking skills, the definition and concept of self-regulation learning, self-learning theory and the importance of self-regulation learning in teaching and learning metacognitive-based high-level thinking skills. Self-regulated learning theory suggests that teachers can use metacognitive elements in self-regulated learning to improve students' cognitive abilities and improve pedagogical knowledge and teaching efficiency. Through the application of this theory, it gives implications to the teaching and learning practices of teachers and students in improving students' thinking skills based on metacognition.

Keywords – self-regulated learning, metacognitive, high-order thinking skills, teacher, students.

1. Introduction

Self-regulated learning is gaining attention among teachers as it facilitates active learning and improves students' academic performance [1], [2]. To adapt to the current changes for the sake of future survival, for sure students nowadays are ought to be equipped with the 21st century skills. Hence, it is imperative for pupils to cultivate and use self-regulated learning skills. Self-regulated learning is a way of learning that students control on their own. The approach described in the literature aims to support students in effectively regulating their cognitive processes, actions, and affective responses as they navigate their educational journey [3]. Therefore, students possess the ability to develop strategies in order to attain individual objectives, assess their advancement in relation to these objectives, and implement appropriate incentives or consequences based on their educational accomplishments. Students that engage in self-regulated learning exhibit self-direction by utilising a variety of learning techniques [1].

Self-regulated learning is a crucial learning technique that aids individuals in mastering their cognitive capacities and organizing their learning experiences. It requires metacognitive abilities for effective planning, monitoring, and assessment of higher-order thinking skills. By engaging in these self-regulatory practises, students can enhance their proficiency in thinking skills. The development of students' cognitive skills by teachers must be a key component of self-regulated learning implementation. Consequently, educators are now obligated to acquire proficiency in the instruction of high-order thinking skills (HOTS) [4] and the implementation of metacognitive skill methods.

On top of the significant role of the teachers in such situations, student involvement in the process of developing high-order thinking skills is also essential.

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The objectives of the Malaysian Education Development Plan (PPPM) 2013-2025 are in line with this, which emphasises the cultivation of students' thinking skills in the learning process, including their capacity to independently devise strategies and engage in critical thinking to acquire knowledge [5]. In order to achieve this goal, it is imperative for students to possess the intellectual capacity to strategize, execute, monitor, and assess their educational endeavours through the practice of self-regulated learning.

Self-regulated learning is a way for pupils to control their own learning, as supported by various sources [6], [7], [8], [9]. A cognitive process called "self-regulated learning" encourages students to identify and establish their own learning goals. It's true, self-regulated learning influences students to study and evaluate learning approaches and the outcome of their efforts in the pursuit of obtaining a deeper and more thorough understanding of something [10]. Therefore, to realize such kind of learning, teachers and students shall work hand in hand to ensure that the self-regulated learning process can be applied well to improve the students' mastery of thinking skills.

Past studies have found that HOTS learning is highly associated with metacognitive strategies [11]. Metacognitive strategy refers to the students' skills to increase awareness of their thought process during the learning session. However, metacognitive strategies are less implemented by teachers as an effective method of teaching HOTS in the classroom [12]. Considering the study's findings, it has been observed that educators demonstrate a reduced inclination to employ metacognitive methods as an efficacious approach to facilitate the teaching of HOTS within the classroom setting [12]. This is because teachers are less aware of the existence of metacognitive intelligence among students [13]. In fact, literature review of the past studies has demonstrated high-order thinking activities via metacognitive strategies can improve student performance in thinking skills. So, one of the measures that can be utilized by teachers in teaching and learning to improve students' thinking and metacognitive skills is through self-regulated learning. According to the metacognitive perspective model (MPM), self-regulated learning involves a metacognitive process, in which according to the principles of MPM, students are deemed to actively control their own learning via the practice of metacognitive monitoring [14].

This concept paper will examine the use of self-regulated learning theory in the instruction of metacognitive-based HOTS in light of the significance of this idea.

This concept paper will also discuss the definition, meaning, and significance of self-regulated learning as it relates to HOTS's metacognitive-based instruction. To design a study that will have a beneficial impact on self-regulated learning, metacognitive-based HOTS teaching, and ultimately generate students who are able to master thinking abilities and develop successful self-regulated learning, discussion of these issues is essential.

2. Relationship Among Self-regulated Learning Metacognition and Higher-Order Thinking Skill

In the past, researchers examined the connection between metacognitive elements and self-regulated learning. By adding metacognitive processes into self-regulated learning, cognitive abilities may be increased to a greater degree. According to [15], the findings of the present study demonstrated that self-efficacy exhibited a positive link with metacognitive strategy knowledge, notably in the cognition/metacognition domains. The study shows a substantial relationship between intrinsic motivation and metacognitive knowledge of strategies, notably competence-enhancing and avoidance strategies, which has a major impact on students' self-regulated learning. This underlines the need of metacognitive awareness and control for effective learning management and academic performance.

Additionally, a scholarly investigation posited that metacognition is a pivotal factor in the cultivation of critical thinking skills [16]. It entails an individual's conscious recognition and understanding of their own cognitive processes, with the aim of enhancing them for more effective knowledge acquisition. The effectiveness of critical thinking is contingent upon the proper functioning of metacognitive systems. This entails being aware of the cognitive processes, behaviours, and emotions involved, which in turn allows individuals to comprehend and rectify any deficiencies in their thinking. Despite the presence of data indicating a connection between metacognitive processes and critical thinking, there is a scarcity of projects aimed at elucidating the specific relationships between these processes. It remains unclear whether processes influence one another or if there exists a mutual dependency between them. The study proposes a self-regulated learning intervention that empowers students to set their own learning objectives, thereby enhancing their critical thinking and metacognitive skills.

Therefore, the researcher can conclude that in addition to self-regulation learning, metacognitive aspects can also increase high-level thinking skills among students.

Students who apply self-regulation learning will indirectly use metacognitive skills in managing their learning. This indirectly increases their mastery of thinking skills because the metacognitive aspects that are used have moved thinking in thinking.

This study's primary objective is to offer a suggested intervention targeted at promoting the cultivation of critical thinking abilities and meta-knowledge competencies. The exact correlation has the potential to facilitate the utilisation of technology-enhanced learning environments (TELEs) in order to effectively boost and assist learners' self-regulated learning (SRL) capabilities in an adaptive and measurable manner throughout their educational journey. In addition, the aforementioned link facilitates learners' comprehension of the extent to which cognition and metacognition contribute to their self-regulated learning (SRL) abilities, as well as how their cognitive and metacognitive methods are working. Therefore, learners have the ability to make necessary adaptations to their self-regulated learning (SRL) skills when engaging with upcoming intricate learning assignments. The empirical evidence supports the existence of a substantiated and verified correlation between cognition and metacognition within the context of technology-enhanced self-regulated learning (SRL), albeit to a limited degree. Given the aforementioned outcome, it is advisable to undertake additional quantitative study to explore the correlation between cognition and metacognition. The study reveals a strong link between metacognitive and cognitive elements in the learning process, enhancing students' self-regulated learning abilities. This concept is influenced by the incorporation of various metacognitive components, as previously demonstrated.

Similarly, the study conducted by [17] indicates that in a systematic review, there exists a substantial correlation between self-regulatory behaviour in musicians and the provision of self-regulation education. The present study additionally posits that students' proficiency in music is contingent upon their degree of self-regulated learning. Considering the findings of a study [18], it has been observed that the utilisation of metacognitive methods by young musicians engaged in the process of memorising piano compositions leads to an enhancement in their metacognitive awareness pertaining to the objectives and techniques involved in memorization. This aspect holds significant value in the cultivation of self-regulation within the domain of musical practice. This research demonstrates that the metacognitive component is influential not only in students' academic learning but also in their musical learning, hence impacting their development of self-regulation skills within the realm of music.

In self-regulated learning, metacognition and advanced cognitive capacities are interconnected. The metacognitive component indirectly influences learning development, including planning, observing, and evaluating cognitive processes essential to self-regulated learning. Through self-regulated learning, the metacognitive process can improve students' cognitive abilities, highlighting the interconnectedness of these traits.

3. Definition of Self-regulated Learning

Self-regulated learning encompasses a multitude of definitions and descriptions. This is because it has garnered a lot of attention among academic researchers with different psychological perspectives on such kind of learning. In other words, the definitions depend on the theoretical paradigms such as social cognitive theory, operant conditioning, phenomenology, and will theory. The general concept of self-regulated learning as a psychological construct that describes how students improve their learning and performance in metacognitive, motivation, and behavioral aspects is identified in [19].

This perception posits that students who exhibit self-control are consistently prepared to engage in learning by actively regulating their own motivational thoughts and beliefs, as well as properly managing their learning resources and environment. In addition, individuals assume responsibility for their own learning and refrain from depending solely on educators for the provision of knowledge and ongoing guidance. In order to facilitate proactive and independent learning, the acquisition of both willpower and learning abilities is necessary. Typically, students that engage in self-regulated learning possess a level of familiarity with the use of cognitive techniques. As a demonstration, individuals have the capacity to proficiently organise and evaluate information obtained from various written sources in a discerning fashion [6].

Furthermore, students possess the capacity to strategically manage and regulate their cognitive functions in order to maintain alignment with their scholarly objectives. Having strong, optimistic motivational beliefs, including a strong sense of self-efficacy, significantly influences individuals' perseverance in educational pursuits, even in challenging tasks, and their tendency to seek support when needed. Furthermore, should the learning environment prove to be less conducive, individuals may proactively seek a learning environment that is more advantageous or modify their learning practices to attain the most favourable results (9).

Indeed, these pupils take personal initiative and independently gain knowledge and abilities instead of depending on professors. Based on the reference provided (9), students who engage in self-regulated learning are observed to use conscious learning procedures to achieve their academic goals.

In conclusion, the research contends that self-regulated learning entails a person actively participating in the planning, observing, and assessing their own learning activities [20]. Self-regulated learning is a cognitive method that is influenced by metacognitive methods [21]. Metacognitive techniques encompass the cognitive processes of planning, monitoring, and managing learning activities [22]. Similarly, self-regulated learning is described as an active learning process in which pupils set goals or objectives and work to monitor, arrange, and manage their cognitive,

motivational, and behavioural objectives, as well as the contextual aspects of the learning environment [23]. Thus, students who are capable to self-regulate are deemed as accountable and active because they are in control of their self-learning pace by setting the learning goals, applying strategies to recall information, and using cognitive skills to promote self-learning [24].

Therefore, it may be inferred that the consensus among scholars is that self-regulated learning is a skill that enables students to understand and sort out their learning [24], [23], [21], [20]. This definition proves that self-learning includes cognitive, motivational, and even behavioral components. Not only that, students can adopt cognitive and metacognitive strategies in managing their ways of learning. Hence, the examination of the conceptualization of self-regulated learning can be presented in the format depicted in Table 1.

Table 1. Analysis of definition of self-regulated learning

References	Defination of self-regulated learning
[20]	<ul style="list-style-type: none"> • Self-regulated learning is an individual's capacity to actively plan, monitor, and evaluate their own learning processes.
[21]	<ul style="list-style-type: none"> • Self-regulated learning is a cognitive process that is regulated and controlled by the use of metacognitive methods.
[23]	<ul style="list-style-type: none"> • Self-regulated learning involves students setting objectives, managing cognitive, motivational, and behavioral processes, and considering contextual factors in their learning environment.
[24]	<ul style="list-style-type: none"> • Students who self-regulate are accountable and engaged, able to set learning objectives, use information retrieval strategies, and utilize cognitive skills for self-directed learning.

4. Self-Regulated Learning Concept

For the purpose of encouraging students to keep being inspired when it comes to education, they are ought to equip themselves with thinking skills to compete on the global level; however this is not an easy feat. Students need to be highly competitive and exceptional fighting spirit as well as having high-order thinking skills, especially those that involve problem solving. This implies that besides creative and critical thinking, students also need to generate ideas and make wise decisions. Therefore, they need to be aware of how their ways of thinking and thought processes influence their academic performance besides identifying the strategies that facilitate effective learning via the self-regulated learning practice [10].

Self-regulated learning is students' self-awareness to learn within their inner self. Past studies have proven to what extent self-regulated learning is effective and does play a role to improve mastery and understanding of learning concepts and even help students to address questions related to problem-solving that also involves the thinking skills process

[10]. The term "self-regulated learning" describes a student's capacity to regulate their own learning process [9]. In this context, students are no longer deemed as individuals who only receive information and knowledge from teachers, rather they are actively involved in organizing and reconstructing the existing information with the new one [25], [26].

Self-regulated learning is the learning activity that includes metacognitive, behavioural change, and motivation elements to determine the proper ways of learning according to the existing skills and knowledge the individual aims to accomplish their predetermined objectives [27]. Self-regulated learning focuses on students' ability to plan, monitor, control, carry out, and self-evaluate their learning. This approach is beneficial as it allows students to evaluate themselves based on their actions, enhancing their self-confidence and promoting a deeper understanding of a subject. Indirectly, self-regulated learning is able to improve student achievement in academics because students have set their learning strategies and objectives to come up with adequate preparation and knowledge in the learning process [5].

The effectiveness of self-regulated learning is determined by three distinct phases. The three stages of thinking are forethought, performance, and self-reflection. During the initial phase, students engage in the process of analysing, setting goals, and planning for achievement, and have the motivation to drive the process and navigate learning strategies. When it comes to the performance phase, this refers to the implementation of tasks devised by students, self-monitoring of their own progress, and the use of self-control strategies with cognitive thinking and motivation in completing the tasks. Meanwhile, the last phase is self-reflection where students shall assess their own performance toward the end goal. Students would evaluate the implementation, success or failure of their assignments. The assessments shall trigger response within themselves, be it positive or negative in the process of fulfilling the goals [29].

This means that the concept of self-regulated learning works would drive students to keep being successful in their learning because they themselves shall take the actions to achieve the outlined learning goals. According to [30], self-regulated learning should be implemented in three phases, starting with early learning, the second is overcoming problems

encountered in the learning process, and the third one is teaching others about the knowledge that has been studied [31]. In addition, students who implement self-regulated learning keep moving forward in their learning because they themselves utilize the elements in the self-regulated learning process. The factors encompassed in this context include the process of planning, the ability to manage one's focus, the use of effective learning strategies, the establishment of goals, the practice of self-monitoring, the appraisal of one's own progress, and the cultivation of self-motivation [28].

Therefore, with the presence of these elements, students can identify problems or monitor their own development in learning from time to time because they have done self-reflection. It is demonstrated that self-regulated learning can help students to study the learning approaches no matter where they are as well as improving their skills in navigating self-regulated learning and thus be able to control their actions toward the learning goals. The successful execution of the three phases is crucial for student learning, as students are primarily responsible for their own learning, while teachers act as facilitators. Table 2 provides an analysis of self-regulated learning.

Table 2. Analysis of self-regulated learning concept

References	self-regulated learning concept
[32]	<ul style="list-style-type: none"> • The concept of self-regulated learning involves a student's skills in self-regulating his or her own learning process
[25], [26]	<ul style="list-style-type: none"> • In this context, students are no longer deemed as individuals who only receive information and knowledge from teachers, rather they are actively involved in organizing and reconstructing the existing information with the new one
[27]	<ul style="list-style-type: none"> • self-regulated learning involves metacognitive, behavioural, and motivational elements to determine appropriate learning methods based on existing skills and knowledge. It prioritises students' ability to organise, supervise, control, implement, and self-evaluate their learning, aiming to achieve self-set goals
[28]	<ul style="list-style-type: none"> • the process involves pre-planning, execution, and introspection, where students critically examine, set objectives, develop strategies, and develop motivation to effectively use learning methodologies. When it comes to the performance phase, this refers to the implementation of tasks devised by students, self-monitoring of their own progress, and the use of self-control strategies with cognitive thinking and motivation in completing the tasks
[30]	<ul style="list-style-type: none"> • self-regulated learning is a pedagogical approach used in three phases of the learning process: early learning, problem-solving, and teaching others about the studied knowledge, characterized by the application of self-regulated learning strategies.

5. Self-Regulated Learning Theory

Social cognitive, operant, phenomenological, will, Vygotskian, and constructive cognitive present the six main viewpoints on self-regulated learning. The most extensively researched and commonly used theory in this area is social cognitive theory.

5.1. Social cognitive theory

Self-regulated learning can be explained by Bandura's Social Cognitive Theory [33]. Based on the theory, it is found that each individual functions to perform something based on the in a way that involves interaction between three factors, namely behavior, environment, and self in performing a task [5]. Behavioral factors in this theory refer to behaviors reflected during the observation. This is because the learning- process can be learned through observation [34].

Furthermore, according to this theory, a convenient and conducive environmental factor does help students to emulate good behavior in the classroom [29]. Meanwhile, the self-factor carries a lot of weight in determining students' abilities such as motivation, self-efficacy, cognitive and metacognitive skills, goal setting, and attitude. According to [8], self-factors include aspects related to students' self-confidence that encompasses effectiveness, time management skills, cognitive and metacognitive levels as well as their attitude toward the tasks and tests encountered.

Self-regulated learning significantly depends on the student's desire and ability to reflect on how they have learned based on previous achievements. Via the reflection process, students shall reset their goals in accordance with the next cognitive level using their metacognitive ability to regulate the learning environment by actively supervising, controlling, and organizing their own learning process. Reflection has a significant influence on confidence and self-belief, which shall result in more effective and efficient behaviors [33].

The author opts for this theory because it is relevant for the metacognitive element studied in this construct, which refers to cognitive control that involve three processes in initiating cognitive activity such as planning, monitoring, and controlling learning activities to improve thinking skills in teaching HOTS. Students with effective learning regulation utilize metacognition before, during, and after learning to understand tasks, planning, and goals [35]. Since they have already stated their goals, students who can apply self-regulated learning have the advantage of receiving something.

These self-regulated learning skills enable students to know how to focus on a task and identify learning strategies to be leveraged as well as organize the tasks carried out, especially in the classroom context. Thus, self-regulated learning theorists in general deduce that students are capable to improvise their learning skills by selecting and leveraging metacognitive and motivational strategies [22]. According to this theory, students who engage in self-regulated learning organise their learning process through self-control, self-supervision, and self-evaluation exercises. Indeed, all processes in learning do involve metacognitive skills.

The impact of these skills shall establish a systematic and controlled learning pathway. Therefore, metacognitive aspects shall be given attention and applied so that students can organize their own learning by adopting the high-order thinking skills. This is because the metacognitive aspect in self-regulated learning theory has a significant association with students' thinking skills [22].

A multitude of recent investigations have been undertaken in relation to social cognitive theory, embracing a wide array of views. The findings of a study conducted by researchers provide support for the Social Cognitive Theory, it implies that the setting of distant learning alters human characteristics like self-control, self-efficacy, and interest [36],[37]. The current research postulates that the degree of online instructional competence functions as a pivotal determinant of student involvement. This highlights how important it is to incorporate online activities as a tactic to increase student engagement. The notion in question is linked to the theory of social cognition, as expounded by the author [37]. The idea explains how psychological, behavioural, and environmental factors affect human learning. It implies that self-control, self-efficacy, and interest can affect the dynamics of distance education. Both the behaviour of the students and the collaborative learning environment have an impact on these variables. Students can communicate virtually throughout online exercises, which boosts motivation and engagement.

Meanwhile, the application of social cognitive theory can also be used in information science research [38]. This research investigates the contribution of the core principles of social cognitive theory to the field of information science research, specifically in relation to behaviour, information seeking, and knowledge sharing. The utilisation of social cognitive theory has indirectly expanded our comprehension of its significance as a beneficial instrument for the construction of theories in diverse fields that centre on the process of learning.

Furthermore, people who were given quizzes under self-regulated learning conditions performed better than people who were given them under social presence conditions [39]. Based on the findings, it can be inferred that educators demonstrate a reduced inclination to employ metacognitive methods as an efficacious approach to facilitate the teaching of HOTS within the classroom setting [12]. Therefore, the role of social cognitive theory in this study is very helpful to form self-regulation learning in online chemistry learning. Some previous studies also found teachers' experiences in learning self-regulation, metacognition and high-level thinking skills. In addition, students report mostly positive feelings (80%) when engaging in self- and co-regulated learning, with zeal being a key factor in goal-setting, task analysis, technique use, monitoring, and reflection [40]. In both self-regulated and co-regulated learning, a variety of joyful feelings are seen, highlighting their critical significance in learning processes. The results indicate that the combination of independent and controlled learning can initiate a mutually beneficial cycle of emotional engagement and effective learning between students and teachers.

The goal of this study was to examine how high school teachers' understanding and sense of self-efficacy changed after attending a professional development workshop [41]. It used pre- and post-tests, interviews, and qualitative studies to find out how teachers' thoughts, feelings, and experiences changed as SRL was put into place. Overall, the 19 teachers showed significant improvements across all categories throughout the posttest assessment. Teachers who showed proficient self-regulated learning (SRL) abilities subsequent to professional development (PD) demonstrated a greater propensity for adaptable, receptive, and optimistic approaches towards integrating SRL practices within the classroom, in comparison to teachers who possessed nascent SRL skills. Teachers are less likely to effectively teach HOTS skills in the classroom by utilising metacognitive strategies [12].

The study investigates how a professional development workshop affected the understanding, self-efficacy, and use of SRL in high school teachers. [41]. It uses an explanatory, sequential mixed methods approach, involving teacher interviews and qualitative analysis, to analyze changes before and after the workshop, assessing teachers' attitudes, perspectives, and experiences during SRL implementation. Overall, the 19 teachers shown significant improvements across all categories throughout the posttest assessment. Instructors who demonstrated proficient SRL abilities subsequent to professional development (PD) showcased greater adaptability, receptiveness, and favourable attitudes

towards the use of SRL within the educational setting, as comparison to instructors who revealed developing SRL skills. Therefore, the study of teachers' experiences in applying self-regulation learning illustrates that teachers are positive in implementing this self-regulation learning to students. The positive reception from this teacher shows that self-regulation learning is suitable and comfortable to be applied to students in an effort to form students who can manage their own learning.

Therefore, the author can conclude that the use of social cognitive theory is closely related to self-regulation learning. This theory can not only be seen as a contribution from the aspect of teaching and learning in schools, but this theory is also the main support and support for empirical studies in fields other than education such as information technology. Therefore, the contribution of this theory is very meaningful to see the strength of self-regulation learning in improving student performance.

5.2. Significance of Self-Regulated Learning in Metacognitive-Based Teaching and Learning of HOTS

Students create the learning roadmap by planning, monitoring, and actively managing their learning processes, according to the self-regulated learning theory's function in the metacognitive-based teaching and learning of HOTS [20]. Self-regulated learning can train students to organize cognitive strategies that are closely related to tasks, controlled behavior and also metacognition [35]. Teachers play the role of facilitators when it comes to the metacognitive-based teaching of HOTS, encouraging students to use self-regulated learning in a way that allows them to plan, monitor, and assess their own learning [22].

According to the self-learning hypothesis, students can use metacognitive techniques to control their learning processes, including self-monitoring, self-evaluation, and self-reaction. These techniques make it easier for students to manage their own learning processes by helping to organise learning, monitor self-learning, and evaluate learning outcomes. This means that while performing a task, students are to observe their performance, evaluate the progress of the task, and continue using the same or change their approach to the task [22].

The metacognitive-based teaching and learning of HOTS requires students' ability to understand, control, and organize their learning. Through the use of metacognitive activities in the classroom [42], metacognitive skills can improve critical and creative thinking abilities. These abilities make learners more efficient by assisting them in managing the learning process and maximising results.

The ability of a learner to use these skills effectively is referred to as "metacognitive" learning. Implicitly, their thinking skills can be improvised and in turn improve students' learning performance [43]. Self-regulated learning theory does not only transcend the boundary of cognitive skills emphasized by metacognitive experts, but also depicts self-directed intrinsic motivation as well as control of resources and environments to optimize the learning outputs [6]. Meanwhile, it has been highlighted that there are three basic categories into which self-regulated learning techniques can be divided: learning resource management techniques, metacognitive techniques, and cognitive techniques [8]. In fact, cognitive and metacognitive components encompass description, organizing, critical thinking, and metacognitive strategies. Meanwhile, resource management strategies include time management, environment, effort, and assistance from others [44]. To master self-regulated learning, students shall not only acquire the skills to organize their learning activities, but they also need to be highly motivated in the very process.

Therefore, the inculcation of metacognitive strategies in self-regulated learning theory is important to empower students in their planning via three processes guided by teachers, which involve identifying the best way to leverage the time available for their assignments. Self-regulated students plan their learning assignments and utilize the time effectively to achieve their goals. The second process is control of focus by prioritizing focus over the learning assignments. Self-regulated students attempt to focus their attention on the existing lesson contents and avoid their thoughts and emotions from losing focus or getting distracted. Next, is the self-monitoring process by which students evaluate the progress of their task from time to time to achieve the goal. Self-regulated students exhibit a continuous monitoring of their progress during their learning activities, and they possess the ability to adapt their learning tactics or modify their goals as needed [5].

In this regard, students who have better confidence in performing their academic assignments tend to be more effective in using cognitive and metacognitive strategies [22]. Metacognitive and self-motivational skills are important for self-regulated learning, according to Bandura's social cognitive learning theory [10]. Applying this idea to HOTS metacognitive-based instruction can help students become better thinkers and problem-solvers, which will benefit their learning process.

Students must develop self-control learning abilities that are compatible with the dynamic nature of the educational system, which undergoes continuous evolution throughout time.

In contemporary education, it is expected that students in the 21st century demonstrate active engagement and responsibility in the management of their own learning, while also recognising the inherent worth of the learning process [45]. Therefore, the ability to conduct self-learning since the school level can be a platform for individuals to boost their ability and quality to compete and adapt in the era of globalization [18].

6. Research Implications

This concept paper explores the implications of several stakeholders, including students, teachers, and educational institutions. Research conducted by the author shows that, the application of the self-regulated learning theory can improve students' abilities by applying metacognitive techniques to efficiently govern the development of thinking capacities.

Metacognitive methods are known to enhance students' ability to effectively regulate their learning process. These strategies encompass various activities, including the establishment of learning objectives, the development of comprehensive plans, the continuous monitoring of progress, and the evaluation of learning results. Furthermore, students who possess metacognitive abilities have the capacity to assimilate novel concepts into their preexisting knowledge, so facilitating a more profound comprehension and enhancing the meaningfulness of their learning experience.

These results imply that the self-regulated learning theory's application, which aims to improve student engagement and competency in critical thinking skills, has a significant impact on students' mastery and academic accomplishment. The student-centered self-learning method does somehow implicitly stimulates students' thinking to be more creative and critical. Students need to explore for themselves what they are planning to learn whereas the teacher only acts as a mentor so that the self-learning process does not deviate from the goals that have been set.

Additionally, this concept paper contributes to increasing awareness of the metacognitive methods described in the self-regulated learning theory as one of the most successful substitute teaching tactics that should be used by teachers. This is because the adoption of metacognitive strategies can help to improve teaching competency and pedagogical knowledge about such strategies among teachers. On top of empowering the teachers in terms of teaching performance, student performance can be improved as well. Hence, teachers shall always be ready and proactive to explore the best teaching practices to upgrade the students' metacognitive ability via self-regulated learning.

Furthermore, this concept paper also provides useful feedback and input to educational institutions in charge of developing self-regulated learning programs as well as thinking skills. Based on this information, this shall help the relevant parties in designing training and pedagogy programs to strengthen the mastery of teachers and students in the learning and teaching of thinking skills as well as self-regulated learning. Therefore, such programs would leave a positive impact in the effort to help teachers further improve their competency and skills in teaching and learning using metacognitive strategies.

7. Research Recommendations

Other elements from this concept paper will be taken into account as a way to enhance self-regulated learning in HOTS teaching and learning that is based on metacognition. Thus, for the purpose of improvement of the future studies, the author suggests to further look at and focus on self-regulated learning models. Among the recommended models are the Metacognitive Perspective Model (MPM) developed by [14] as well as the Cyclical Phases Model by [46]. Research on such models can help to further develop metacognitive elements in self-regulated learning.

Also, further studies with a broader scope on metacognitive elements in self-regulated learning are recommended to identify the contribution of these elements which are not only confined to the context of thinking skills but also cover all subjects and other competencies. To such a degree, this will create an environment of active self-regulated learning that gives students more opportunities to manage their own learning and develop metacognitive skills. To strengthen the use of metacognitive methods in self-regulated learning, it is also advised that future researchers produce a study in the form of training modules. This training module shall provide guidance and reference to the parties involved in organizing training programs and workshops for teachers in an effective way. In such a manner, this would improve teachers' skills, knowledge, and competency in the practice of metacognitive strategies.

8. Conclusion

In general, this concept paper focuses on the application of self-regulation learning theory in teaching and learning metacognitive-based higher order thinking skills. After this theory was analysed and discussed, it was shown that this theory is able to help and become the basis for self-regulated learning skills by students.

Where through this skill it can indirectly help students manage their thoughts in self-learning which can ultimately improve students' thinking skills.

This theory strongly emphasizes the concept of students determining goals in learning. Not only that, but self-regulation learning theory also involves metacognitive processes. The metacognitive process here refers to how students control their own learning through the implementation of metacognitive monitoring which consists of activities students need to plan, monitor, and evaluate the ongoing learning activities. In relation to that, through this process, it has indirectly trained students to be active and can encourage thinking skills.

Therefore, the application of self-learning theory in the teaching and learning of metacognitive-based high-level thinking skills can contribute to students' self-confidence in organizing their learning independently. In addition to this, this theory can also guide students to be more active, using metacognitive skills to ensure learning goals are achieved at the same time as it also contributes to an increase in thinking activities. Therefore, to ensure that the learning and teaching of metacognitive-based high-level thinking skills can be applied well by students, the process contained in the self-regulation learning theory needs to be followed so that it can give meaningful implications and contributions in students' self-learning.

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