

# Learning Style Based Teaching to Enhance Student Metacognition Skills (Review of Neuroscience Learning Theory)

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*Abstract. Optimal development in all aspects will determine the child's future success. Parenting and education patterns carried out by parents, teachers and the environment will affect the quality of children. Without neglecting other aspects, cognitive development becomes an important focus in addition to physical development in childhood. If in learning, learning styles and how the delivery of material by the teacher is adjusted to what is desired by the students it will have a good impact on student learning outcomes. When the teacher has adjusted to the learning styles of each student, learning will be more easily absorbed and learning outcomes will be maximized. The success of students in capturing information or knowledge delivered by the teacher is determined by the readiness of the brain to capture the information or knowledge, if the brain is not ready, the learning process will never occur. Learning that uses a neuroscience perspective involves the formation and strengthening of connections and neural networks, which strengthens the relationship between the characteristics of learning styles with the improvement of students' metacognition skills.*

*Keywords: Learning style, metacognition, neuroscience learning*

## Introduction

Learning activities for each individual do not always last naturally. In the learning process students sometimes find it difficult to concentrate, thus making the student unable to understand the lessons that are going on. Students need strong and complex thinking skills, namely higher cognitive abilities. But there are also students who can capture what is learned during the learning process. This fact is what we often encounter with students in everyday life where it relates to student activities and learning styles. Every individual has nothing in common, this individual difference causes differences in behavior in students.

Metacognition is basically the ability to learn how learning should be carried out in which the following activities are considered and carried out (Francesca, 2014; Van Velzen, 2016) develop a plan of learning activities, identify strengths and weaknesses regarding learning activities, develop a learning program for new concepts, skills and ideas, identifying and using their daily experiences as learning resources, utilizing modern technology as a source of learning, leading and participating in group discussions and problem solving, learning from and benefiting from people's experiences certain who have succeeded in a particular field, learn from and take advantage of the experience of certain

people who have succeeded in a particular field, and understand the supporting factors for the success of their learning.

One factor that influences student learning outcomes is student learning styles. Learning Styles are considered to have an important role in the process of teaching and learning activities (Margaret & Roberta, 2006). Students who are often forced to learn in ways that are not suitable and pleasing to them do not rule out the possibility of inhibiting the learning process, especially in terms of concentrating when absorbing the information provided. In the end it also affects learning outcomes that have not been as optimal as expected.

Student learning outcomes are influenced by how students understand the learning style they have, and make learning styles as a means to absorb information obtained through learning (Behar-Horenstein et al., 2011; Behar-Horenstein & Dix, 2009). Students who use learning styles according to themselves will help achieve satisfying learning outcomes. Learning style is the way students absorb and remember lessons and ways of thinking in solving a problem based on the student's personality. The determination of learning strategies that are suitable for learning styles is certainly done with an empirical approach that must be continuously tested for accuracy (Tóth, 2012).

The suitability between learning strategies and learning styles is certainly expected to lead to maximum learning outcomes, which are appropriate for the learning objectives. If students already understand their respective learning styles, students can learn well and will more easily absorb information, organize and process information. Appropriate learning styles can also help someone to know exactly the situation in learning and improve learning achievement (Sternberg & Zhang, 2001).

### **Neuroscience Learning Theory**

The theory of learning neuroscience is a learning theory that emphasizes the performance of the brain which is about how the whole process of thinking, the process of thinking also includes the broad range of thinking processes that produce knowledge, attitudes, and behavior. This theory studies the brain and all nerve functions. This theory also studies various types of diseases in the brain. This is very important, especially in the process of learning and learning because the ability of a person to capture the information or knowledge delivered is determined by the readiness of the brain to capture information or knowledge if the brain is not ready, the learning process will never occur (Schunk, 2012).

The information processing system includes sensory registers, short-term memory (STM) or working memory (WM), and long-term memory (LTM). The sensory register accepts input and holds it a fraction of a second, after which the input is discarded or channeled to WM. Most sensory input is discarded, because at certain times we are bombarded with many sensory inputs. For example, the auditory stimulus received by the thalamus will turn into a neural equivalent to the perception of the stimulus (Guy & Byrne, 2013). This perception is also responsible for matching information with what is stored in memory, a process known as pattern recognition. So, if a visual stimulus is a class teacher, perceptions sent to the cortex will correspond to the teacher's representation stored and stimuli will be recognized.

Sensory input is processed in the sensory memory of the body parts of the brain, and which is maintained for a long time will be transferred to WM. WM appears to be in many parts of the brain but especially in the frontal lobe prefrontal cortex. Information will disappear from WM in a few seconds unless trained or transferred to LTM (Wolfe, 2001). In order to keep the information stored, the nerve signal must be turned on, meaning that the information is still considered important and needs to be used. With declarative information, sensory registers in the cerebral cortex (for example, visual, auditory) receive input and transfer it to the nearest hippocampus and medial temporal lobe (Artelt, Weinert, & Handel, 2013). Input is registered in the same format as seen (for example, as a visual or auditory stimulus). The Hippocampus is not the main storage place, it acts as a processor and input conveyor. As we will see in the next section, entries that occur more often make the nerve

connection stronger. With some activation, memory forms artificial neural networks that are firmly embedded in the frontal and temporal cortices. LTM for declarative information, therefore, appears to be in the frontal and temporal cortex (Guy & Byrne, 2013).

Cognitive neuroscience supports the idea that many things can be learned through observation (Bandura, 1999). Research shows that the cortical sequence involved in performing an action also responds when we observe others doing the action. With nonmotor procedures (for example, word decoding, simple additions), the visual cortex is very involved. Repetition can actually change the neural structure of the visual cortex. This change allows us to recognize visual stimuli (e.g., words, numbers) quickly without consciously having to process their meaning. As a consequence, many of these cognitive tasks become routine. Conscious information retrieval (eg, stopping to think about what the reading means) requires longer activity in other parts of the brain (Sternberg & Zhang, 2001). With repeated stimuli or information, artificial neural networks can be strengthened so that neural responses occur quickly. From the perspective of cognitive neuroscience, learning involves the formation and strengthening of connections and neural networks (synaptic connections).

### **Metacognition in Learning**

To foster student attitudes towards the importance of learning, it is necessary and even absolute to be taught to students about various learning strategies (cognitive strategies) that students must possess to deal with various academic or non-academic problems (Livingston, 2003). Academic problems are related to problems in understanding mathematical concepts, while non-academic problems are related to students' problems in their lives. As a result if students have a good cognitive strategy, students will be able to compete in a healthy manner, and be able to live side by side with anyone and under any circumstances.

There are three types of cognitive strategies that are very important to be taught to students are: (a) rehearsal strategy (b) elaboration strategy (c) organizational strategy is to recognize or take the main ideas from a collection of lots of information (Anderson & Krathwohl, 2001).

Other variables related to metacognition are individual variables. As a basic capital to become a good self-learner, students must have knowledge of their weaknesses and strengths in dealing with cognitive tasks (Baltaci, Yildiz, & Özcakir, 2016). Even further students must be able to choose, use, and monitor cognitive strategies that match the type of learning, style of thinking, and cognitive style they have in dealing with cognitive tasks. This ability is one of the components of metacognition called cognitive monitoring (Flavell, 1976, 1979).

Cognitive abilities can be classified based on students' ability to remember, understand, apply, analyze, evaluate and create (Anderson & Krathwohl, 2001).

Differences in cognitive levels allow students to have different ways and needs in managing the learning process. Cognitive ability can influence the learning process in the context of the extent to which the learning process can work. This can be seen from the ability, speed and effectiveness in learning (Blummer & Kenton, 2014). This condition implies that learning designed by educators basically must be in accordance with the cognitive abilities of the students.

Knowledge of how much students' cognitive abilities are not enough to be the basis for developing ideal learning. It takes a much higher cognitive study to determine the extent to which students in learning is by studying the ability of students to regulate their own cognitive processes. This ability is better known as metacognition. Metacognitive awareness is believed to have a role in self-regulation control of the ability to think, the learning process and the products it produces (Hartman, 2001). The learning process will take place well if the individual is able to develop his metacognitive awareness. Someone who has good metacognitive development will be better at solving problems, making decisions and thinking critically, more motivated to learn, better able to regulate emotions (even in difficult situations) and better able to overcome difficulties.

To get extraordinary learning success, the teacher must train students to design what they want to learn, monitor student learning progress, and assess what they have learned. There are 3 metacognitive strategies that can be developed to achieve student learning success (Hartman, 2001), including:

(a) The learning conscious process stage includes the process of setting learning objectives, considering learning resources that will and can be accessed (for example: using textbooks, searching for source books in the library, accessing the internet in the computer lab, or studying in a quiet place), determining how performance best students will be evaluated, considering the level of learning motivation, determining the level of student learning difficulties.

(b) The stage of learning planning, includes the process of estimating the time needed to complete learning tasks, planning learning time in the form of a schedule and determining priority scales in learning, organizing subject matter, taking appropriate steps to learn by using various outlining, mind mapping strategies speed reading, and other learning strategies).

(c) The monitoring and reflection phase of learning includes the process of reflecting the learning process, monitoring the learning process through questions and self-testing (self-testing, such as asking questions, is this material meaningful and useful to me? How can I understand this material? I am easy / difficult to master this material?), maintain concentration and high motivation in learning.

In the practice of teaching in class, the teacher is recommended to provide wide opportunities for students to discuss and exchange ideas in learning. The hope is that each individual student can assess their own abilities in learning, each student can determine the success of

learning by using their own learning styles, and most importantly, each student can learn effectively by empowering their own unique and incomparable learning modalities.

Implementation of these strategies, for example, students need to be accustomed to making daily journals from every learning experience they experience. This journal will greatly assist students in translating their thoughts and attitudes in various forms (symbols, graphics, pictures, stories), looking back at their initial perceptions of something and comparing them to the new decisions they make, explaining their thought processes about strategies and ways make decisions in learning activities, they will know certain weaknesses in the choice of attitudes taken and recall their difficulties and successes in learning (Houtman, 2015).

Metacognitive strategies convey a special message for anyone who wants to live life effectively that is the reality of life what happens at this time is the result of our past choices. Today we become successful people, today we are a failure, even today even though we are confused by the strengths and weaknesses of ourselves, it is caused by the weakness of ourselves in designing our lives, monitoring the quality of our development, assessing success our lives, and change the attitude of our lives if necessary to achieve a better level of quality of life.

### **Learning Style in Teaching**

A person's success in the learning process is determined by several factors, one of which is how the person learns. In the context of classroom learning, various instructional strategies compiled by educators must also be oriented to the conditions in which learners can learn comfortably in accordance with the characteristics of students and their learning styles (Kelley, 1995; Margaret & Roberta, 2006; Sarabdeen, 2013). Learning style is one of the factors that can influence participants in learning. Learning style is a psychological concept about how individuals can choose and process information and adopt strategies to achieve effective learning. Every individual must have a dominance of learning styles that are different from one another. If the learning process and experience experienced by an individual corresponds to his learning style, there is a tendency that he will be able to learn better (Kolb & Kolb, 2013; McKain, 1993). Learning styles can influence how learners learn, how teachers teach and how they can interact. Therefore, information about the learning style of each student needs to be done as a first step for educators in developing the learning process. This information can give consideration to what educators have to do related to the design of instructional strategies, media selection, and management of learning.

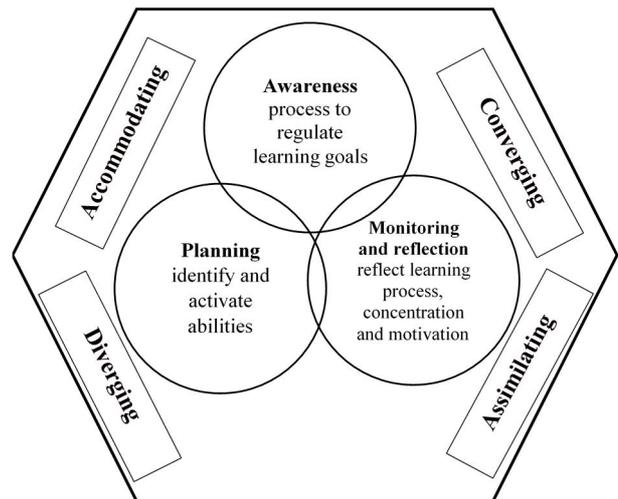
Learning models that place teachers like lecturers are often liked by many students. Teachers are expected to talk at length about various theories with a myriad of illustrations, while students listen while describing the content of the lecture in a form that they only understand

themselves. Whatever method is chosen, the different learning styles show the fastest and best way for each individual to absorb information from outside him. If we can understand how different people's learning styles are, it might be easy for us if one day, for example, we have to guide someone to get the right learning style and provide maximum results for him (Kelley, 1995; Quirk, 1988). Before we ourselves teach others, the best step is to recognize our own learning style. This consideration is often forgotten. In other words, we ourselves must feel the experience of getting the right learning style for themselves, before passing it on to others. There are many reasons and benefits we can get if we are able to understand a variety of learning styles, including our own style.

Learning style is a relatively stable cognitive, affective and psychomotor behavior as a learning method to relate and react to the learning environment (Joyce & Weil, 2003; Kolb & Kolb, 2013). Kolb has presented experience learning styles that have four experience ratings, namely: (1) convergence (a combination of abstract conceptualization and active experimentation), these individuals are able to find and use theory; (2) diverging (a combination of elements of concrete experience and reflective observation), individuals with this learning style are able to see information from various perspectives; (3) assimilation (a combination of abstract and reflective conceptualizations), people who use it in processing a lot of information and placing it in a definite and logical form; (4) accommodating (a combination of experience and active experimentation), this individual has the ability to learn from direct experience.

**The Learning Style role for Student Metacognition Capabilities is viewed from the Neuroscience Learning Theory**

Before students are able to apply metacognition to help their learning, they are first taught strategies to assess their own understanding, calculate how much time they need to learn something, and choose effective plans for learning or solving problems. Students with high cognitive abilities tend to be able to learn quickly and independently. They will prefer challenging learning and explore their thinking abilities. If students with high cognitive abilities are faced with learning that is not challenging and far below its potential, it can lead to inhibition of cognitive development and other potentials it has (Saenz, Geraci, Miller, & Tirso, 2017). Learning will feel boring and result in reducing the participation of students in learning. Self-regulating skills in learning styles that suit themselves are metacognitive skills.



*Figure 1: Metacognition in (Kolb's) Learning Style*

The style and ability of students to absorb subject matter varies. This requires an effective strategy so students can understand the contents of the material. Some students develop sufficiently adequate metacognitive skills and some other students do not develop. Teaching metacognitive strategies to students can lead to real improvement in their learning outcomes (Byers, Akresh, & King, 2016; Marzano, Pickering, & Pollock, 2001).

In developing learning-based learning styles of students and by adapting Marzano's metacognitive concepts include 3 (three) stages of the strategy as follows: (a) the stage of the learning conscious process (awareness), is the most basic component of metacognition. These precautions include two ways whether students usually approach the tasks and alternative ways they might do. Students who are well aware of how they think and can make intelligent choices regarding effective strategies include the process of setting learning goals, considering learning resources that will and can be accessed (for example: using textbooks, searching source books in the library, accessing the internet in the lab computer, or learning in a quiet place), determining how the best performance of students will be evaluated, considering the level of learning motivation, determining the level of student learning difficulties; (b) The planning stage, is a plan component of metacognition is responsible for "identifying and activating certain abilities, tactics, and processes that will be used in" achieving goals ". Students at this stage have a dialogue within themselves about what they can do and what is most effective in this situation. If the task is simple, people may not be aware of what choices they make. With complex tasks, however, the metacognitive process is more open when students choose other choices in their minds including the process of estimating the time needed to complete learning tasks, planning learning time in the form of a schedule and determining priority scales in learning, organizing subject matter, taking steps appropriate steps for learning using various outlining, mind mapping, speed reading, and other learning strategies; (c) Monitoring and reflection phase (monitoring and reflection), is the final component of

metacognition is monitoring. This function works on the effectiveness of the plans and strategies used. Includes a process of reflecting the learning process, monitoring the learning process through questions and self tests and maintaining concentration and high motivation in learning.

Learning that uses a neuroscience perspective will strengthen the relationship between the characteristics of learning styles with the improvement of students' metacognition skills. Knowledge of learning styles can help teachers to create a multi-sensory learning environment, which serves as best as possible the learning needs of each student. By utilizing the concept of diversity and accepting different styles, teachers will be more effective in determining learning strategies and students will become more confident and more satisfied with their learning abilities. From this it is expected that the learning process will become more effective (Daw, 2008; Guy & Byrne, 2013).

### Conclusion

Optimal development in all aspects is the success factor of a child in the future. Parenting and education patterns carried out by parents, teachers and the environment will affect the quality of children. Without ignoring other aspects, cognitive development becomes an important focus in addition to physical development in childhood.

As cognitive abilities improve, students begin to realize that the mind is separate from one's object or action, it begins to regulate its mind in a simple form. Students can use metacognitive strategies in learning which include three stages: designing what they want to learn; monitor the development of yourself in learning; and assess what is learned. This is important to direct them to be able to consciously control the process of thinking in learning.

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