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Generative Learning Strategies to Improve Students' Cognitive Involvement in Online Classes at Islamic School: A Systematic Review

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ABSTRACT

Purpose – This research aims to reveal generative learning strategies for increasing students' cognitive involvement.
Design/methods/approach – This systematic review research was carried out using seven stages. The stages include formulating research questions, determining the type of research, conducting a comprehensive literature search, filtering literature search results, assessing research that meets the criteria, synthesizing research, and assessing heterogeneity between studies.
Findings – This research shows how the learning process occurs in individuals based on generative learning theory. The generative learning strategies include learning through summarizing, learning through mapping, learning through drawing, learning through imagination, and learning through teaching.
Research Implications/Limitations – These findings can be used as a reference for teachers in implementing learning strategies that can involve students' cognitive aspects to produce more meaningful learning achievements.
Originality/value – These findings provide educators with insight into the information processing occurring in a person's cognition and reveal several learning strategies that align with information processing theory.

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Introduction

Online learning is the most popular learning model applied today. The student engagement factor is an important component that determines the effectiveness of this learning model (Kahu, 2013; Pellas, 2014). Even some researchers state that the quality of online learning can be measured by the extent to which students actively participate in it (Jaggars & Xu, 2016). Several studies have reported the effect of student learning engagement on student achievement. Students can interpret the knowledge they build when engaging in their activities (Jonassen & Carr, 2020). For example, when students are actively involved in academic activities, participating in campus activities, and interacting frequently with instructors, their skills and self-efficacy develop to complete their education (Orona et al., 2022). Accordingly, it has been a general consequence that students who are actively involved in learning activities will show faster learning improvements than those passively engaged (Markant et al., 2016).

However, these studies cannot explain the extent of student learning quality (Chingos, 2016). These assessments are based solely on student participation in online learning and are not considered to reflect the actual process and quality of student learning (Dumford & Miller, 2018). Low participation rates do not necessarily reflect disengagement (Chipchase et al., 2017). Active participation does not necessarily result in learning, and quantity does not equal quality (Rezaei, 2022). Students' knowledge does not develop when they engage in argumentative activities (Iordanou & Rapanta, 2021). In other words, students may be able to respond frequently, but the responses delivered reflect a general scientific understanding (Pather et al., 2020).

Therefore, researchers need to look for other critical variables that are more reliable as parameters of online learning quality. One variable that can be used as a benchmark for the quality of online learning is the cognitive engagement level of students who learn in an online environment (Lee et al., 2019). Cognitive engagement refers to how much mental effort students employ when completing learning tasks (Huang et al., 2019) and when interacting with learning material (Boekaerts, 2016; Halverson & Graham, 2019) by using strategies to learn more intelligently, not superficially. In-depth cognitive processing allows the formation of mental connections and the elaboration of knowledge that improves higher-level cognitive learning outcomes. Conversely, superficial processing allows rote learning to occur due to a lack of active engagement with the learning material (Hoidn & Reusser, 2020).

Several studies have shown that cognitively engaged students can form new knowledge (Wang et al., 2019) and achieve higher understanding in online discussions (Amichai-Hamburger et al., 2016). According to Galikyan & Admiraal (2019), in-depth cognitive engagement is also a significant predictor of academic achievement. The abilities can be assessed in online learning by analyzing student behavior in their written messages in online discussion forums (Kent et al., 2016; Martin et al., 2020).

However, cognitive engagement is the most challenging issue to address regarding student performance, especially in online learning environments. Study findings of Kew & Tasir (2021) analyzed 267 discussion forums created by students during a semester that examined the effect between student cognitive engagement, gender, and the number of posts on the forum. The results revealed that half of the students posted without explanation, showing low levels of cognitive engagement. Most of these posts had a small contribution to the cognitive engagement level. Martin & Borup (2022) concluded that student disengagement is a hallmark of online learning. Low levels of engagement have been found in several countries around the globe. As explained earlier, students' cognitive engagement is essential in online learning. Therefore, instructors must find strategies to increase students' cognitive engagement in an online learning environment (Czerkawski & Lyman, 2016).

Such strategies should be based on the science of learning about how humans learn (Gooding et al., 2017). In other words, implementing effective learning strategies prepares for proper cognitive processes during learning. The cognitive processes that lead to learning include paying attention to relevant material, mentally organizing it into coherent representations, and integrating it with prior relevant knowledge (Hidayat & Syahidin, 2019; Mayer, 2019). Fiorella & Mayer (2016) call this activity generative learning. Learning is a generative activity if students enthusiastically produce learning outcomes by interpreting what is presented instead of just accepting it.

According to generative theory, learning is a selective activity, an activity of building structure, and an activity of integrating knowledge. These activities can be influenced by student learning strategies, such as summarizing the material or giving an advance organizer before learning to provide an overview of the material (Kwon et al., 2018). In short, learning outcomes depend on the material delivered to students and students' cognitive activity during learning (Lin et al., 2017). Effective teaching not only presents or delivers material to students but also helps students direct cognitive processes toward the material during learning (Latipah, 2021; Scheiter et al., 2018). This study aims to describe several generative learning strategies based on learning outcomes, which lead to appropriate cognitive processes during learning and higher academic achievement. Therefore, the research question for this research is what is the cognitive and generative learning process in online classes? What are generative learning strategies?

Methods

1. General Background

This systematic review research was carried out by following the steps of systematic survey techniques in the social sciences proposed by Petticrew & Roberts (2008). Petticrew & Roberts suggest seven steps in conducting a systematic review including formulating research questions, determining the type of research, conducting a comprehensive literature search, filtering literature search results, assessing research that meets the criteria, synthesizing research, and assessing heterogeneity between studies.

2. Procedures

This systematic review research has seven steps that are related to each other. The first step in this research is to clearly define the research question. The research questions used to answer the objectives of this research are as follows.

a. How does the learning process occur according to cognitive learning theory?
b. What learning strategies support generative learning theory?

The questions used in this research were taken from the literature regarding information processing systems according to cognitive learning theory and learning strategies according to generative learning theory. The literature used comes from research that has been published in various reputable international journals.

The second step in this research was to determine assessment criteria to determine the types of previous research that were worthy of inclusion in this systematic review. This research only comes from literature written in English and published in peer-reviewed journals that have a high reputation. The years of publication of the literature range from 2000 to 2022. Meanwhile, the next step is to determine the inclusion and exclusion criteria to filter the results of the literature search and then select the literature that best meets the requirements. Apart from that, this research also adapted indicators from an experimental quality study conducted by Gersten et al. (2020) as criteria to ensure the validity and reliability of the results of the review and assessment of the quality of the selected literature. Table 1 shows the inclusion and exclusion criteria for the selected literature.

Table 1. Literature Inclusion and Exclusion Criteria

Inclusion	Exclusion
All levels of formal academic education.	Non-formal training or courses that do not focus on academic skills.
Quantitative studies or mixed methods studies (with evidence of learning effects).	Qualitative studies or conceptual studies.
The study focus relates to subjects in school or college.	Studies are focused on areas in the world of work, training, courses, and others.
Empirical studies have applied generative and cognitive learning theories as the main theoretical framework.	Empirical studies did not make generative and cognitive learning theories the main theoretical framework.
Empirical studies applied generative and cognitive learning theories as the main theoretical framework.	Empirical studies that did not use random sampling techniques.

Based on the criteria in Table 1, several databases and search terms can be determined, and relevant literature can be found. The databases used in this search were ERIC, APA PsycInfo, APA PsycNet, Web of Science, Google Scholar, IEEE Xplore, Willey, Elsevier, Sage Journals, Springer, and Science Direct. The search terms used in this research can be seen in Table 2. A total of 23 search terms were used with the Boolean expressions (A1 OR A2 OR A3... OR A23) AND (BI OR B2OR B3... OR B6).

Table 2. List of Search Terms

Search Terms	
A1. Generative*	B1. Online Learning*
A2. Generative Learning *	B2. Blended-Learning*
A3. Generative Learning Strategies	B3. Massive Online Open Course *
A4. Generative Learning Theory	B4. MOOC
A5. Studying*	B5. Traditional Learning*
A6. Learning Engagement	B6. Face-to-face*
A7. Learning Strategies	
A8. Cognitive*	
A9. Cognitive Learning Strategies	
A10. Cognitive Engagement	
A11. Online learning*	
A12. In-depth Learning	
A13. Summarizing* Strategy	
A14. Teaching* Strategy	
A15. Mapping* Strategy	
A16. Drawing* Strategy	
A17. Imagining* Strategy	

Results and Discussion

1. Cognitive Process and Generative Learning

How does the learning process occur? According to generative learning theory, learning occurs when students apply cognitive processes that correspond to incoming information (Wang et al., 2021). Figure 1 illustrates the model of selecting, organizing, and integrating abbreviated to SOI (Fiorella & Mayer, 2016). This SOI model focuses on three cognitive processes exhibited by arrows. As the arrow from learning to sensory memory shows, external stimuli enter our cognitive system through the eyes and ears (or other senses). The information is briefly stored in sensory memory for a few seconds. If you pay attention to some of this quick information, it will transfer the attended material to working memory for further processing (indicated by the selection arrow). In working memory, everyone can mentally reorganize selected material into a coherent mental representation (indicated by arranging arrows). Everyone can also activate previous relevant knowledge from long-term memory and integrate it with new material in working memory (indicated by integration arrows).

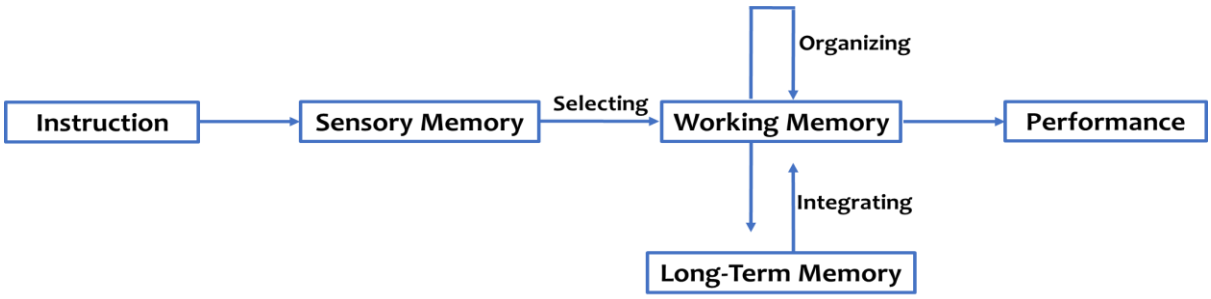

Figure 1. SOI Generative Learning Model

Knowledge constructed in working memory can be stored in long-term memory for future use. This can be shown by an arrow from working memory to long-term memory as presented in Figure 1. Apart from that, it can also be used to solve problems encountered in the real world (shown by an arrow from working memory). An important learning implication of the SOI model is the instructor's task of presenting information and ensuring that students are involved in appropriate processes during learning through selection, organization, and integration (Ponce et al., 2023). Similarly, the student's task is not only to remember the information precisely as it is presented but also to engage in corresponding cognitive processes during learning (List & Alexander, 2017).

2. Generative Learning Strategies

Generative learning strategies have various stages that need to be considered. The stages of a generative learning strategy are summarized based on several relevant research studies as follows.

2.1 Learning by Summarizing

Summarizing involves repeating the main ideas of the lesson in everyone's own words. For example, a student might read a chapter in a textbook on the history of Islamic civilization and write a one-paragraph summary stating the main ideas of each paragraph. The theoretical rationale for summarizing encourages students to select the most relevant material from textbooks, organize it into a concise representation, and integrate it with existing knowledge using their words (Cavanagh & Kiersch, 2023). A summary can show the comprehension level of a reading (Hjetland et al., 2019) since studying the summary can also increase comprehension of a reading (Kočiský et al., 2018).

Summarizing can be used to help students understand lessons presented orally such as lectures or presentations that display sentences and images simultaneously such as slide shows. Summarized sections range from presentation slides to animated narrative segments, or paragraphs within a chapter, and student-produced summaries vary in length. The main characteristic of a summary is a shorter but coherent statement of the main points of the lesson (Rakedzon & Baram-Tsabari, 2017). Figure 2 is a summary example of a learning strategy.

According to the Gujarat theory, which originated in India, it is said that Muslim traders brought the teachings of Islam. Islam entered the territory of Indonesia and gradually spread to all corners of the archipelago around the 13th century AD. Besides the Gujarati theory, there is the Meccan theory. This theory states that Muslim traders pioneered the initial conversion to Islam in Indonesia from Arabia, which occurred around the 7th century AD. The Persian theory reveals another view. Although the role of the merchants is very prominent, the merchants were the main goal to trade with Gujarat.

Write a summary sentence here.

As a test of understanding of the story, without looking back at the reading or summary, please circle the letter that corresponds to the most appropriate answer to the following questions:

Who is the most instrumental group in the spread of Islam in Indonesia?

a. Immigrant workers
b. Warriors
c. Merchants
d. Tourists from India

Figure 2. Examples of Summarizing as a Learning Strategy

2.2 Learning by Mapping

Learning by mapping occurs when students transform text into spatial arrangements of words, such as concept maps, knowledge maps, or matrix graphic organizers. A concept map is a spatial arrangement of nodes that is usually oval or rectangular and contains words that describe relationships written along connecting lines. Balaid et al. (2016) define mapping as a link between two nodes where the link represents a relation, and the node represents the state of knowledge.

The theoretical rationale for mapping is that students mentally select key elements and organize them into a coherent structure. In terms of practical application, mapping can be used as an effective learning strategy, especially for students with low learning ability. Mapping can visualize facts, concepts, and essential relationships (Bergstrand et al., 2015). However, effective mapping strategies require lengthy training, depending on the student's willingness to do additional work. Implementing a mapping strategy requires learning material that has a clear basic structure. Figure 3 is the material that will be used as a concept map.

Walisanga plays several roles in Indonesian civilization, which can be grouped into five areas, namely education, making mosques or Islamic boarding schools centers of da'wah; architectural art, making the mosque a house of worship as well as a center for community activities; arts and culture, building harmony between old culture or traditions and Islamic teachings; culture, getting used to greetings, pronouncing sentences and good prayers; politics, adding elements of Islamic politics to the political system of Islamic kingdom government. In the field of education, the guardians educate and educate the public about Islam and other fields. In the art of architecture, the saints built mosques with beautiful architecture with a touch of ethnicity and local culture. In the field of cultural arts, the saints used wayang art from the Hindu stories Ramayan and Mahabharata and replaced the content of the stories with Islamic teachings, introducing the art of the tambourine and qasidah. In the field of culture, the saints spread Islamic customs in the lives of Indonesian society and nation. In the political field, the saints influenced the Islamic city planning system which combined the palace as a place of government activities, the mosque as a place of worship, the market as the center of the community's economy, and the square as a gathering place for the community.

Figure 3. An example of a material to be mapped

Now we can turn the text above into a concept map by creating nodes that represent important concepts and lines between them that represent relationships. The concept map can be shown in Figure 4.

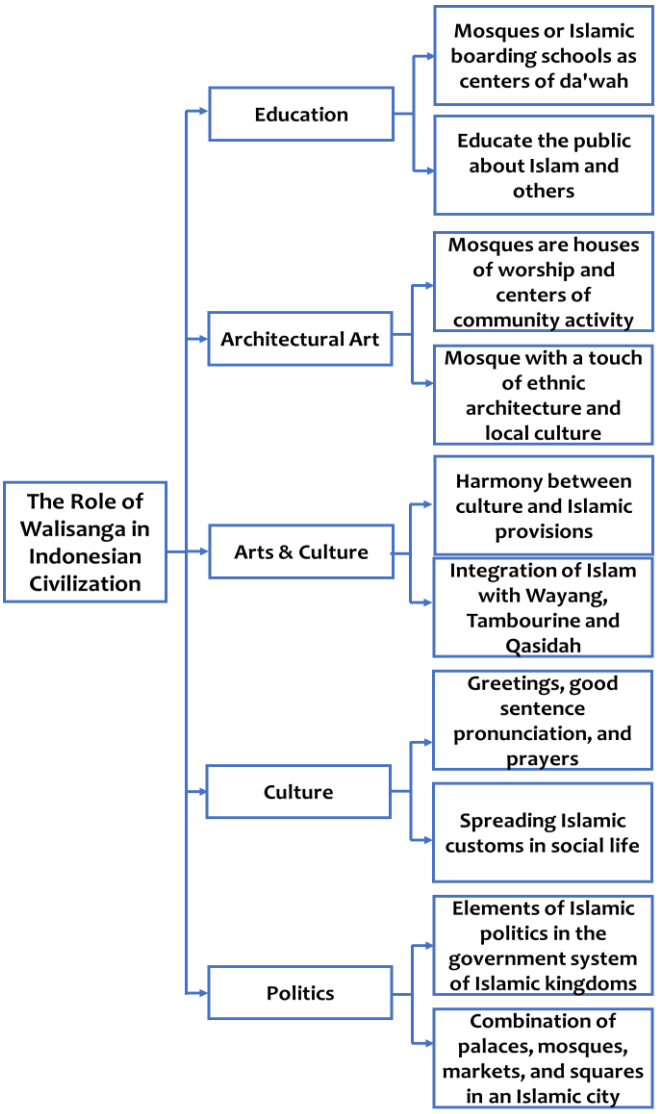

Figure 4. An example of a mapped material

2.3 Learning by Drawing

Learning by drawing occurs when students create drawings that illustrate the content of a text-based lesson (Fiorella & Zhang, 2018). Learning by drawing includes determining which components are included in the illustration and how to structure them spatially to show structural and causal relationships (Buckley et al., 2018). For example, students reading a lesson on how metabolic systems change in the body during fasting can be asked to draw, following the text how the body converts fat into an energy source. The theoretical reason for learning from drawing is that building illustrations according to the text can prepare students for the generative processes of choosing which components to include, arranging those components in a spatial layout, and integrating (students translate words into pictures). When students actively draw, corresponding cognitive

processes such as activating prior knowledge, increased attention, and better memory as new information is integrated into long-term memory (Sweller et al., 2019).

Learning by drawing is intended to help generative processes by preparing cognitive processes such as selecting, organizing, and integrating (Quillin & Thomas, 2015). Selecting occurs when students must determine which important components are included in their drawings. Organizing happens when students must arrange these components in a spatial layout that shows their interconnectedness. Integrating takes place when students must use their prior knowledge to translate from verbal representations or learning texts to visual or spatial representations or illustrations. Figure 5 is an example of the application of learning by drawing on a text.

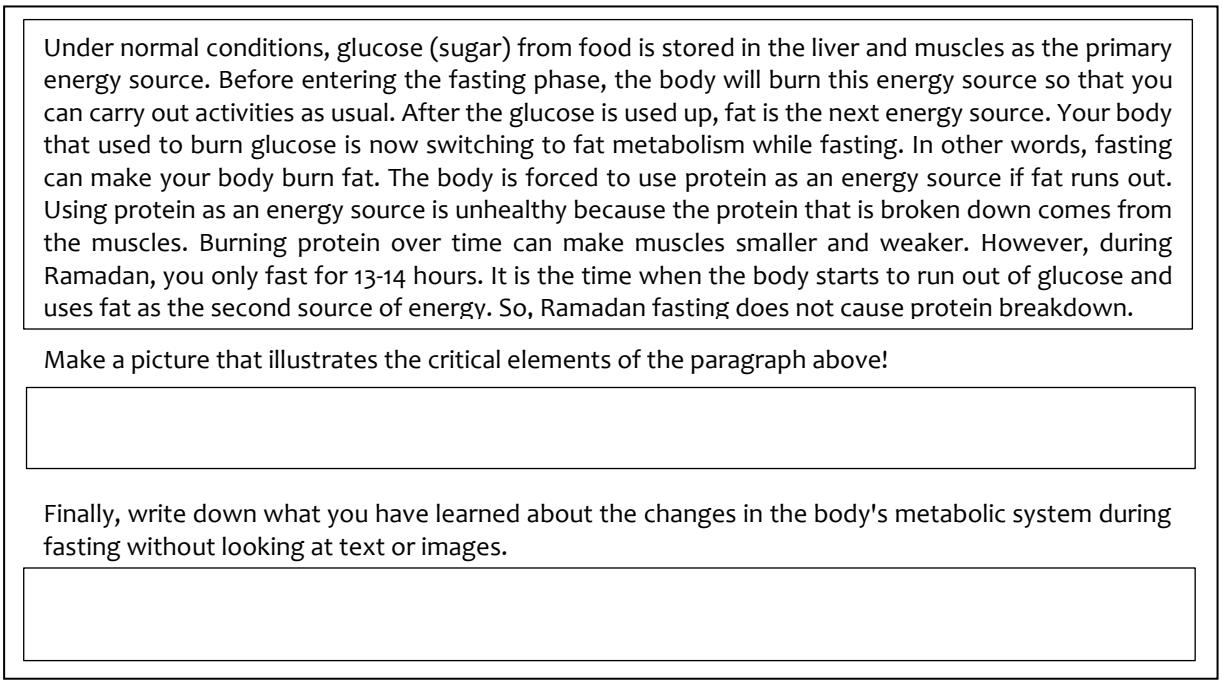

Figure 5. An example of drawing as a learning strategy

2.4 Learning by Imagining

Learning by imagining occurs when students capture mental images illustrating the content of a text-based lesson. Learning by imagining involves determining which components are included in the image and how to arrange them spatially to show their causal and structural relationships (DeSutter & Stieff, 2017). For example, an instructor may ask students, who are reading a lesson on how the fat-burning process becomes the main source of energy in the metabolic system of a fasting person, to form a mental image according to the text about the structure or process. system.

The theoretical notion for envisioning as a learning strategy is that the act of constructing a mental image based on the text can facilitate the generative process (Leopold et al., 2019). Such as students selecting which components to include, organizing these components in a layout, and integrating, where students translate words into pictures. In short, students form a mental representation depicting the process or main structure outlined in each section of the text (Crane, 2015).

Although imagining aims at developing generative processes, an important consideration is that students must be highly motivated to persevere in tasks that require invisible activity. In practical application, imagining can be an alternative to drawing as a generative strategy, if students obtain proper guidance on what is imagined and have sufficient knowledge to carry out the task (Cheng & Beal, 2020). Therefore, it can be said that the learning motivation provided by teachers is closely related to student activeness in learning (Han & Yin, 2016). Figure 6 is an example of the application of learning by imagining a text.

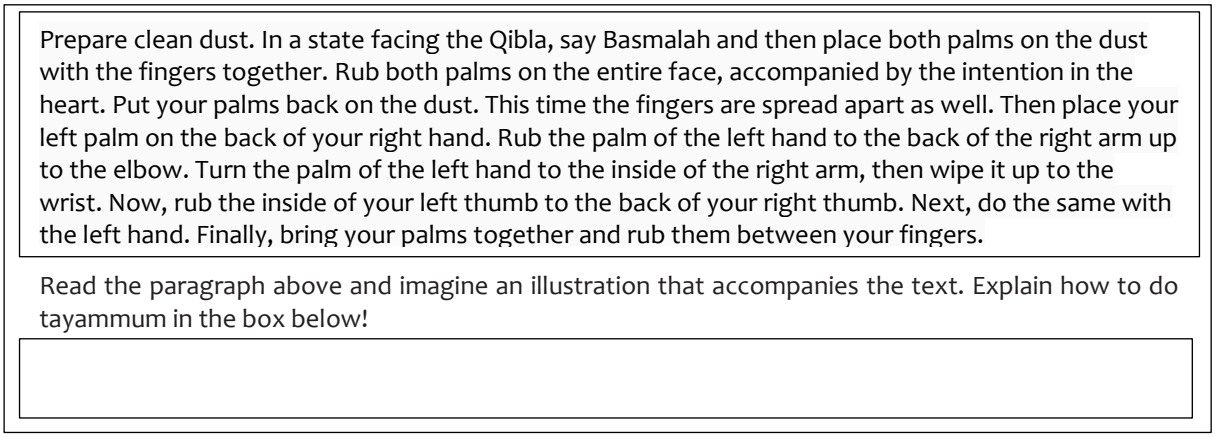

Figure 6. An example of imagining as a learning strategy

The generative learning model is based on the study of how humans learn. According to this theory, students construct their knowledge actively and not only passively receive lessons (Fajarwati, 2014; Konopka et al., 2015). Students actively engage in appropriate cognitive processing during learning, including selecting relevant information in lessons, organizing them into coherent mental representations, and integrating them with active knowledge from long-term memory (Chamberland & Mamede, 2015). According to the principles of multimedia learning, generative learning asks students to make connections between verbal and visual representations (Bobek & Tversky, 2016; Park et al., 2021). It is what happens when students translate verbal lessons into mental images (Van Marlen et al., 2018).

2.5 Learning by Teaching

Learning by teaching is an activity that aims to increase the understanding of an individual who previously has learned material by teaching it to others. For example, after reading a moral textbook, a student can improve his understanding of the material by explaining important concepts to other students. Teaching is most effective when students can provide explanations that reflect an understanding (comprehension) of the material rather than simply repeating it (Goldman et al., 2016). Also, learning by teaching is most effective when students intend to reteach and when the activity involves interaction with other students (Kim, 2020). The cognitive science and educational research work also support that teaching others is a powerful way of learning (Swedberg, 2016).

Learning by teaching can also be applied to learning activities through text, multimedia (Abdulrahman et al., 2020), and interaction with computer-based pedagogical agents (Johnson & Lester, 2016) to help students understand scientific concepts. It is also a fundamental component of classroom activities, such as peer tutoring, small group discussions, and cooperative learning (Miquel & Duran, 2017). Although the availability of empirical research is limited, learning by teaching is a promising learning strategy for improving an in-depth understanding (König et al., 2020). Figure 7 is an example of learning by teaching as a learning strategy.

Buying and selling transactions are activities that are often carried out, as proof that humans are social creatures who need each other. Of course, humans cannot fulfill their needs without getting help from other people, whether mu'awadoh (commercial) help such as buying and selling etc. or snacks (non-commercial). In general, buying and selling is divided into three; First, buying and selling known goods between the seller and the buyer. Legally permitted. Second, buying and selling is still the responsibility of the seller and only the characteristics of the goods are mentioned. This contract is permissible according to Sharia if it is based on the properties of the goods mentioned at the time of the contract. This transaction is called a salam contract (order). Third, buying and selling goods that do not exist or cannot be witnessed by the seller or buyer. By law, this kind of transaction is not permitted. In the study of fiqh, the activity of selling is known as bai', while buying is known as syara'. Therefore, the seller is called Bai', and the buyer is called musytari. After the sale and purchase transaction occurs, the bai' and musytari can continue or cancel the contract with several conditions. Known as khiyar.

Figure 7. An example of learning by teaching as a learning strategy

According to the cognitive theory of multimedia learning, teaching prepares cognitive processes ranging from selecting, organizing, and integrating (Almasseri & AlHojailan, 2019; Namestovski, & Kovari, 2022). In the process of selecting, one picks only the most relevant information from a student to explain to others. In the organizing process, a person reassembles the selected information into an explanation easily understood by others. In the integrating process, a person understands the material to be studied by relating it with relevant prior knowledge. Thus, the cognitive benefits of learning by teaching depend on the extent to which students devote their cognitive efforts to actively construct a coherent representation of the material during the learning process (Berger & Hänze, 2015; Fiorella & Kuhlmann, 2020).

Conclusion

Learning activities occur in the cognitive aspects of everyone. Instructors must have a clear and solid theoretical foundation during learning activities. Generative learning theory places its theoretical thinking on the cognitive psychology of human learning. Learning strategies based on generative learning theory prepare students' cognitive processes through three stages, namely selecting, organizing, and integrating activities. Based on the study results, several learning strategies based on generative learning theory have included learning by summarizing, learning by mapping, learning by drawing, learning by imagining and learning by teaching. Future researchers can then use these study results as a basis for finding other learning strategies based on the principles of generative learning theory. Apart from that, generative learning strategies can also be used by Islamic religious education practitioners to teach Islamic religious content to students in a fun way.

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