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The Impact of Self-Regulated Learning Techniques Derived from Information Processing Theory on Student Outcomes in Distance Education: A Comparative Analysis of 15 Studies

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Abstract

This study investigates the application of self-regulated learning methods, derived from information processing theory, in distance education. It explores how various learning strategies, including rehearsal, elaboration, organizational, comprehension monitoring, and affective strategies, impact the encoding process of learners. The research emphasizes the learner's role in creating and controlling a conducive learning environment in the context of distance education. Through a comprehensive review of 15 studies, the study aims to provide insights into the effectiveness of self-regulated learning methods as supporting elements in distance education.

Keywords: *Self-regulated learning methods, Distance education*

1. Introduction

Digitalization and the shift to distance modes of operation have had a significant impact on 21st century's life. However, the beginning of the COVID-19 pandemic triggered an even stronger, irreversible reliance on digital technologies in general, and the largest "online movement" in educational history in particular. Current educational trends indicate that operating in a distance learning environment is becoming more common and will eventually become the new normal beyond the era of the COVID-19 pandemic. As a result, relevant adaptations and new ways of dealing with the new reality in the field of education are emerging. The pandemic compelled universities all over the world to mobilize and shift all teaching to distance learning programs (Vilkova and Shcheglova, 2021). As a result, distance education has grown in popularity around the world. Because they had to follow their courses from a distance far away from the physical classroom environment,

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the students had to take responsibility for their own learning. They should also actively plan their work, set goals, and monitor their understanding and performance. These activities can be categorized as self-regulated learning (Jansen *et al.*, 2017). That is, self-regulated learning has become necessary for students if they are to be successful in their studies. Distance learning is becoming increasingly popular in the field of education, particularly at the higher education level. Students are already expected to have some level of competence to function independently at this stage, and thus, as long as chances of success increase as the proper instructional design is implemented and learners are further supported in their self-regulated learning needs (Broadbent and Poon, 2015). In this era of unprecedented digitalization and distance learning, it is critical to reconsider the methods used to assist learners in their study process. Although Self-Regulated Learning (SRL) is applicable to Face-to-Face (F2F) learning formats as well, distance learning emphasis the importance of SRL methods (Breslow *et al.*, 2013; Jordan, 2014). In the absence of direct supervision and guidance from the instructor, as seen in many distance learning formats, the importance of SRL methods becomes even more critical and a determining factor for success (Veenman, 2011; Broadbent and Poon, 2015; Wong *et al.*, 2019).

2. Categories of Learning Strategies

Self-regulated learning methods are specific procedures or techniques to attain goals.

2.1. Rehearsal

Repeating information verbatim, underlining, and summarizing are forms of rehearsal. For tasks requiring rote memorization, repeating information to oneself aloud, sub-vocally (whispering), or covertly—is an effective procedure, i.e., remembering the names of the planets. Rehearsal that erroneously repeats information does not connect new information to what is already known. Rehearsal can be beneficial for complex learning, but it must go beyond simply repeating information. Underlining is a useful rehearsal technique (highlighting). This method, which is popular among high school and college students, improves learning when used wisely (Snowman, 1986). Another popular rehearsal technique is summarizing, in which students put the main ideas expressed in the text into their own words (orally or in writing).

2.2. Elaboration

Procedures for formulation (imagery, mnemonics, questioning, and note-taking) expand by adding something to make learning more meaningful. Mnemonics are popular elaboration techniques (Weinstein, 1978). A mnemonic makes information meaningful by connecting it to what one already knows. Mnemonics take various forms. Acronyms combine the first letters of the material to be remembered into a meaningful word. "HOMES" is an acronym for the five Great Lakes (Huron, Ontario, Michigan, Erie, Superior). Sentence mnemonics use the first letters of the material to be learned as the first letters of words in a sentence, i.e., "My Very Educated Mother Just Served Us Nine Pizzas" for the order of the planets from the sun (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto). The peg word method requires students to first memorize a set of objects that rhyme with integer names. Mnemonic techniques employ several valid learning principles, such as rehearsal and relating new information to prior knowledge. Methods of elaboration are also useful for complex learning tasks. Learners may ask, "How does this information relate to what the author discussed in the preceding section?" to address higher-order learning outcomes. Alternatively, "How can this concept be applied in a school setting?" (application). Another elaboration technique is note-taking, which requires students to create meaningful paraphrases of the most important ideas expressed in the text. Note taking is similar to summarizing, except that the former is not limited to information that is immediately available.

2.3. Organization

Mnemonics, grouping, outlining, and mapping are examples of organizational techniques. Mnemonics elaborate and organize information in a meaningful way. Acronyms, for example, organize data into meaningful words. Grouping information before using rehearsal or mnemonics can help organize it. If students are learning mammal names, they can organize them into common families (apes, cats, etc.) and then practice them or employ a mnemonic. When dealing with complex material, organization techniques come in handy. Outlining is a popular one that requires students to create headings. Mapping is an organizational technique that helps

learners become more aware of text structure. Mapping entails identifying key concepts and specifying their interrelationships. Concepts or ideas are recognized, classified, and linked to one another.

2.4. Comprehension Monitoring

Comprehension monitoring assists learners in determining whether they are correctly applying declarative and procedural knowledge to the material to be learned, determining whether they understand the material, determining whether their strategy is effective, or whether a better strategy is available. Strategy is required, and understanding why strategy use will improve learning is essential. Teaching students to monitor their comprehension is a critical component of a strategy-instruction program (Baker and Brown, 1984).

2.5. Affective Techniques

Affective learning techniques foster a positive psychological environment for learning (Weinstein and Mayer, 1986). These techniques assist in coping with anxiety, developing positive beliefs (self-efficacy, outcome expectations, and attitudes), setting goals, and establishing a regular timetable, and a study area and limiting distractions (for example, no talking on the phone or watching television). Affective techniques assist students in focusing and maintaining attention on important task aspects, managing time effectively, and reducing anxiety. Setting goals is an effective time management strategy. Learners who set overall learning goals, subdivide them into short-term goals, and evaluate their goal progress regularly are self-regulating their academic performance. Students' self-efficacy for future learning is increased when they believe they are making progress (Schunk, 1995).

3. Literature Review

Distance learning, according to Simonson and Berg (2016), is a "form of education in which the main elements include physical separation of teachers and students during instruction and the application of various technologies to improve student-teacher and student-student communication". Previous research on distance learning has found that it can be just as effective as in-person instruction (Cavanaugh *et al.*, 2004; Lee and Figueroa, 2012; Means *et al.*, 2013). However, COVID-19 is a novel and challenging situation in terms of distance learning, as mandatory school closures due to a pandemic or natural disaster have never before been required on such a large scale (Huber and Helm, 2020). During the last decade, most schools used digital platforms to support instruction during school closures, in addition to switching to distance learning (Huber and Helm, 2020). Although the digitization of teaching and learning has been frequently advocated in connection with the concept of lifelong learning and adaptation to the modern Labor market (European Commission, 2018), it had not yet been implemented across the board before COVID-19, particularly in primary and secondary education (Schrenk, 2020; Wahlmüller-Schiller, 2017). It is thus crucial to investigate how students coped with this new situation and how students who perceived themselves as competent differed from those who did not. SRL methods have become one of the major areas of research in educational psychology over the last two decades, and it is frequently referred to as the driving competence required for transforming individuals into successful independent learners (Boekaerts, 1999). It is defined as "the control that students have over their cognition, behaviors, emotions, and motivation by using personal strategies to achieve the goals they have set" (Panadero and Alonso-Tapia, 2014, pp. 450-451). Self-regulated learning is a cycle of self-thought, planning, and action used to achieve a learning goal (John *et al.*, 2015; Zimmerman and Pons, 2002). It has been identified as one of the critical factors influencing students' learning success (Dabbagh and Kitsantas, 2004). As has been repeatedly demonstrated, where the emergency shift towards online learning has become a requirement at every level of education, academic success in distant contexts requires a unique set of skills.

In a face-to-face setting, the presence of the teacher assists learners at all stages of learning, including planning and preparation, monitoring and supporting the learning process through close observation and providing just-in-time feedback. The SRL methods required in a face-to-face and distance learning environment cannot be equated and must be investigated separately. SRL methods have models developed by Zimmerman (1989), Pintrich (2000), Boekaerts (1999), Winne and Hadwin (1998), Efklides (2011), and others from various theoretical perspectives (Panadero, 2017). However, the majority of the models agreed that the learning process was cyclical and divided it into three stages: forethought, performance, and self-evaluation (Nussbaumer *et al.*, 2015; Panadero, 2017). Over the last decade, an increasing number of literature reviews on interventions

supporting SRL methods in distance learning have been conducted. The available research has varied in its focus; however, some studies have focused on identifying as many concretes. As many SRL-supporting tools / platforms as possible without carefully examining their actual impact on learners' abilities or performance (Pérez-Álvarez *et al.*, 2018; Yen *et al.*, 2018). Some have attempted to focus on a specific type of online learning environment or distance learning (Pérez-Álvarez *et al.*, 2018) or how to support a specific area (metacognition and its specific aspects) of SRL methods (Dabbagh and Kitsantas, 2004). Others have focused on the effectiveness of concrete interventions such as prompts, feedback, and their combination with concrete technological features specific to study domains or research questionsÿ specific types of tasks (Azevedo *et al.*, 2011). Other studies have examined SRL methods to support interventions over a specific period or focused on SRL support intervention design recommendations (Pérez-Alvarez *et al.*, 2016). Recent studies have looked at how SRL methods measurement tools can be used for SRL support, a new and interesting trend in measuring and supporting SRL at the same time. The potential of SRL measurement and support, the Open Learner Model, and Learning Analytics has also been investigated (Marzouk *et al.*, 2016; Matcha *et al.*, 2020). However, comprehensive and systematic reviews focusing on the effects of interventions on different phases and areas of SRL are lacking.

4. The Current Study's Objective

It is important to keep the scope of the study focused and to investigate SRL methods in the context of distance education. The current study looks into how the best support SRL methods can provide in distance learning environments. It seeks to identify the best uses, which have been found to have a demonstrable effect on supporting each area of SRL methods at each of its phases. The research is also looking for characteristics that can help improve various interventions. The current literature review examines 15 previous studies to investigate the most recent findings.

5. Conclusion

Learning strategies are practices and thoughts that a learner engages in and that have the potential to influence the learner's encoding process. As a result, the goal of any particular learning strategy may be to influence the learner's motivational or affective state, or how the learner selects, acquires, organizes, or integrates new knowledge. A learner, for example, may prepare for a learning situation by reducing anxiety by using positive self-talk. A learner may form a mental image to help associate the objects represented by the members of each pair when learning paired associates in gaining knowledge. A learner may generate summaries for each section of the passage; A learner may take notes while learning about a scientific concept. Coaching, imaging, summarizing, and taking notes are all examples of learning methods. Students in distance learning programs must learn how to learn, remember, think, and motivate themselves. When learning prose, such as reading from a science textbook, rehearsal strategies may include repeating the material aloud (shadowing), copying material, and taking selective verbatim. Make a note of, and highlight, the important parts of the material. The act of rehearsal for each strategy involves the learner actively saying, writing, or pointing to parts of the presented material while learning. This strategy has two major cognitive goals: selection (helping the learner pay attention to important aspects of the passage) and acquisition (ensuring that the material is transferred into working memory). Peper and Mayer (1986) studied note-taking as a generative activity, which is probably the most common type of complex rehearsal strategy. Strategies for elaborating on complex tasks, such as paraphrasing, summarizing, or describing how new information relates to existing knowledge. When elaboration strategies are applied to tasks like prose learning, the activities can include paraphrasing, summarizing, making analogies, taking generative notes, and answering questions. Outlining assigned chapters in a textbook or creating a diagram to show the relationship between stress forces in a structural design are examples of common tasks in this category. Strategies for monitoring comprehension, such as checking for comprehension failures. Common responsibilities in this using self-questioning to check understanding of the material presented in class and using the questions at the beginning of a section to guide one's reading behavior while studying a textbook are examples of this category. Comprehension monitoring necessitates that the student establishes learning objectives for an instructional unit or activity, assesses the degree to which these objectives are met, and, if necessary, modify the strategies used to achieve the objectives. Good and poor comprehension have consistently revealed that poor comprehension is deficient in the use of active

learning strategies, required to monitor comprehension. Affective strategies, such as being altered and relaxed, can aid in the reduction of test anxiety. Common tasks in this category include minimizing external distractions by studying in a quiet place or employing thought provoking techniques. Prevent negative thoughts from diverting attention away from the test and towards fears of failure. Many contemporary approaches to distance learning emphases the learner's role in creating, monitoring, and controlling an appropriate learning environment. This research has focused on the strategies that students use to focus attention, maintain concentration, manage performance anxiety, establish and maintain motivation, and effectively manage time. Performance or test anxiety studies are typical of the research in this area. Learning strategies research is creating a useful data base from which applications can and will be derived by providing strong evidence that these learning strategies can be learn and used effectively. As this literature grows, the implications for classroom teaching, educational practice, and educational research will continue to grow as they mature and develop. Finally, this study investigated techniques for improving learning in educational tasks in distance learning. The learning strategies of rehearsing, elaborating, and organizing represent three types of resources that an active learner may have access. Management strategies (such as comprehension monitoring) and affective strategies (such as anxiety reduction techniques) both rely on making the best use of available resources. The findings of this study support the hypothesis that learning strategies can be used in distance learning program very effectively. The same cautions apply; however, this study is concerned with the explicit use of learning strategics, or general techniques for more effective learning. It should be noted that general techniques are only one component of a learner's arsenal of knowledge required for effective learning. Learning is also aided when the learner has a wealth of domain-specific knowledge. For learning strategies, a related issue is the distinction between non-directed learning and more directed or guided learning. Several researchers argue that instruction should be more explicit and directed (Segal *et al.*, 1985). Most beneficial for less experienced students. Another caution concerns the time requirements of learning strategies. The use of any technique must consider both the time costs and the benefits (Anderson and Annbruster, 1982).

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