The Influence of Digital Class Instructional Strategies and Self-directed Learning on Mastery of the Concept of Natural Sciences

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Abstract

This research aims to determine the influence of external factor learning strategies and self-reliance on learning (internal factors) on the mastery of the concept of Natural Sciences. The experimental method with the design used treatment by level 2x2 consisting of learning strategy (A) and self-reliance learning (B). Sampling techniques in this study are random sampling. The research findings that the first hypothesis p-value 0.000 < 0.05 then the statistic hypothesis rejects H0, so it can be interpreted that there is a significant influence of learning strategies (A) on the results of mastery of the concept of science. The first hypothesis test showed differences in science concepts of students treated with digital classroom learning strategies (A1) with problem-solving (A2) learning strategies. The second hypothesis is that the p-value 0.000 < 0.05 then the statistical inference rejects H0, so it can be interpreted that there is a significant influence of self-reliance learning (B) results of mastery of science concept. The second hypothesis test showed differences in the science of students who have high learning independence (B1) with low learning independence (B2). The conclusion is that learning strategies and self-reliance of learning significantly influence the mastery of the Natural Sciences' concept.

Keywords

Introduction

Technology is an integral part of our lives, including learning processes both in the classroom and outside the classroom. According to Eggen & Kauchak (2012), technology learning is not a learning goal but rather a tool to help students achieve learning objectives (Eggen & Kauchak, 2012). The teacher assumes that all learning processes carried out in the classroom must use technology is an inappropriate assumption. Technology can help students achieve learning goals more efficiently than other instruments. Education technology is one element in Education that must be mastered and understood by all parties involved in Education, especially teachers and students (Wu et al., 2012). In technology, teachers and students need to understand the standards that show what should be known and done by both teachers and students related to technology use (Büth et al., 2018). Digital Class instructional strategies for learners must actively communicate Natural Sciences' idea to friends and teachers.

Science learning is not only a compilation of information in the form of data, definitions, laws, or abstract material submissions, but science learning is a process of exploration of knowledge, the creation of scientific attitudes, and the ability to apply the principles of science to everyday life itself (Cahyo, 2013). Digital Class Learning is a term to explain that classroom activities use as optimally as possible the role of the Internet and digital technology in preparation, implementation, and assessment of learning, both by students, teachers, parents, and sustainable teacher professional development activities (Huang et al., 2020). Digital Class learning requires a fundamental cultural change in the school. Hence, the school's stage creates a common question for daily repeats (complete Education or mastery learning) (Smeda et al., 2014). You can schedule tasks according to the required time (for example, five days of studies from 8:00 to 21:00). Digital learning becomes an issue, as parents, teachers, administrators, and schools accept the idea of student learning about media literacy with safe and responsible use of the Internet (Gleason & Von Gillern, 2018). With the digital world's help and the innovations and technological advancements, everyday social life and lifestyle become more comfortable than ever.

Technology provides a positive impact not only on lifestyle but also on Education (Hariharasudan & Kot, 2018). In all stages of integrating digital tools into the classroom, more and more teachers have gained flexibility. Teachers with digital tools can do various activities such as distributing classroom work, fostering student collaboration, and providing assessment (Vermette et al., 2019). In addition to the learning models that need to be developed, other factors can also influence science learning success, one of which is
self-directed learning. Developments in learning technology emphasize the importance of self-directed learning (Bajrami & Ismaili, 2016). The implementation of complete learning systems, individual teaching, module systems, active learner learning methods, and process skills approaches emphasizes high learner learning independence. In the learning process, learners become the main subject (Albay, 2019) because they are considered individuals who try to improve their abilities by mastering various knowledge, skills, values, and attitudes. Self-directed learning is an essential principle in learning interactions to achieve predetermined learning goals (Rascón-Hernán et al., 2019).

Self-directed learning has the same meaning as self-assessment in psychology. Self-assessment includes the process and determination of how to behave. Self-assessment consists of a willingness to judge how to behave and make decisions due to previous behavior (Akgunduz & Akinoglu, 2016). In other words, both of these understandings imply controlling the action that a person has. However, this is a brief statement to equate to the notion of self-reliance of learning and self-assessment. Self-assessment has two meanings, namely: (1) as a way to clarify the concept of self-directed learning, (2) self-directed learning is rarely found in psychological terms. In psychology, self-directed learning is also often replaced with the notion of learning independence (Warren & Jones, 2017). According to Knowles (Knowles, 1991), some of the main things related to student teaching independence are: (1) each student has full responsibility to make decisions with respect to learning; (2) self-directed is best seen as a series or characteristic that occurs in each person and learning situation; (3) self-reliance does not necessarily mean a student is isolated from others; (4) self-learning means successfully transferring learning, in relation to knowledge and learning skills from one situation to another; (5) self-reliance studies may involve various activities and resources, such as guidance, participation in the study group; training period of expertise, dialogue through electronic devices, and reflection of activities writing; (6) enable the influential role of teachers in learning independence, such as dialogue with students, safeguarding resources, evaluating results, and promoting critical thinking; (7) several educational institutions find ways to support self-reliance studies through open learning programs, individual learning options, more innovative learning, and other innovative programs.

The application of self-directed learning in the classroom requires more than just changing the approach of knowledge (Jarudin et al., 2018). Self-directed learning requires a change in assumptions about students, self-motivation, and class conditions. Specific strategies in self-directed learning include giving students hope to set their own goals, develop themselves, and develop learning and planning strategies to achieve learning goals (Zhoc et al., 2018). When students work on their purposes, they are more motivated,
more efficient, and achieve better results than teachers' plans. According to Zumbrunn 
(2011), Self-directed learning is a process that helps students in managing ways of 
thinking, behaving, and emotions towards the learning experience (Zumbrunn et al., 2011). The success rate of teaching is affected by many factors, including teacher abilities, students' necessary abilities, learning patterns, instructional strategies, learning materials, infrastructure, motivation, creativity, assessment tools, and environment, all of which are closely related to it. Units that work in an integrated manner to achieve set 
goals. Although the objectives are well-formulated, the selected material is appropriate; if 
the instructional strategies used are insufficient, perhaps the expected goals are not 
achieved properly.

Instructional strategies are one of the critical components and very beneficial to the 
educational process's success (Akdeniz, 2016). Teachers must select the proper teaching 
method by paying attention to this—selecting unique teaching methods from teachers to 
 improve learners' activities in the classroom. Students dare convey ideas and accept ideas 
from others, and creative in finding solutions to a problem. Based on these problems, the 
purpose of this research is to find out the influence of external factor instructional 
strategies and self-directed learning (internal factors) on the mastery of the concept of 
Natural Sciences, specifically Biology subjects. In this study, self-directed learning of 
learners' understanding is the independence of learners in learning science both at home 
and in school in class VIII Madrasah Tsanawiyah (MTs) Negeri 6 East Jakarta Year 

Research Method

This research was conducted in Madrasah Tsanawiyah (MTs) Negeri 6 East Jakarta, in the 
street Condet Batu Ampar Kramat Jati East Jakarta by experimental method. The design 
used is treatment by level 2x2. The variables tied in this study are mastery of science 
students' concept, while the free variable is an instructional strategy that considers self-
directed learning as a moderator variable. The instructional strategy factor (A) consists of 
Digital Class (A1) and Problem Solving (A2) instructional factors, while the high self-
directed learning factor (B1), and low self-directed learning (B2).

The population of objects in this study is all students of grade VIII MTs Negeri in East 
Jakarta. In contrast, the affordable population is students of grade VIII MTs Negeri 6 East 
Jakarta Class of 2019/2020 consisting of 9 classes. Sampling techniques in this study are 
random sampling. Samples come from grade VIII students who have studied together to 
have the same ability and homogeneity. The number of nine classes VIII representatives
were randomly selected, with four courses taken as research samples. Questionnaires must be distributed first to measure self-directed learning before interfering in the classroom and the actual control level. The scores obtained by learners in the study self-directed learning questionnaire were sorted from lowest to highest scores, after which the two groups scored highly as high self-directed learning.

In contrast, the group scored low as intense self-directed learning. It uses ANOVA Analysis Techniques to test hypotheses that represent average differences between groups. This research will test the signification of instructional strategies (Digital Class, Problem Solving) and self-directed learning (high-low) on mastering science concepts. Then a test of the interaction signification between instructional strategies and self-directed learning to master the concept of natural science. Descriptive analysis is performed by presenting data with frequency distribution tables, histograms, mean and standard deviation.

Results and Discussion

The study results will explain the data description, hypothesis testing, discussion of research results, and limitations of research. The calculation of average data, and standard deviation, can be seen in table 1.

<table>
<thead>
<tr>
<th>Table 1 Results of descriptive analysis of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-directed Learning (B)</td>
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<td></td>
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<tr>
<td>High self-directed learning (B₁)</td>
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<tr>
<td>Low self-directed learning (B₂)</td>
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<td></td>
</tr>
<tr>
<td>N: 34</td>
</tr>
<tr>
<td>Minimum: 70</td>
</tr>
<tr>
<td>Std. deviation: 7,664</td>
</tr>
</tbody>
</table>

Variable A₁ is a group treated with a digital class instructional strategy with a score interval between 70-97, an average score of 82.41, and a standard deviation of 7.664.
Variable $A_2$ is a group given treatment with problem-solving that has a score interval between 61-87, the average score is 76.47, and the standard deviation is 7484. Variable $B_1$ is a group of students who have high self-directed learning with a score interval between 80-97, an average score of 85.76, and a standard deviation of 4,868. Variable $B_2$ is a group of students with low self-directed learning with a score interval between 61-79, an average score of 73.12, and a standard deviation of 5,180.

Variable $A_1$ $B_1$ is a group of students given the treatment of digital class instructional strategies with high self-directed learning to get an average score of 89 and a standard deviation of 4,637. Variable $A_2$ $B_1$ is a group of students given problem-solving treatment with high self-directed learning getting an average score of 82.53 and a standard deviation of 2,267. Variable $A_1$ $B_2$ is a group of students who passed the treatment of digital class instructional strategies with low self-directed learning getting an average score of 75.82 and a standard deviation of 2,721. Variable $A_2$ $B_2$ is a group of students who are given problem-solving treatment with low directed learning getting an average score of 70.41 and a standard deviation of 5,691. Based on table 1 can be illustrated with a graph chart as in figure 1.

![Figure 1. Data Description](http://www.webology.org)

**Hypothetical Test Results**

Hypothetical test results using Two-Way ANOVA analysis as in table 2.
Table 2 Hypothesis Test Results

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructional Strategy (A)</td>
<td>600.059</td>
<td>1</td>
<td>600.059</td>
<td>36.134</td>
<td>.000</td>
</tr>
<tr>
<td>Self-directed Learning (B)</td>
<td>2719.118</td>
<td>1</td>
<td>2719.118</td>
<td>163.737</td>
<td>.000</td>
</tr>
<tr>
<td>Instruction Strategy (A) * Self-directed Learning (B)</td>
<td>4.765</td>
<td>1</td>
<td>4.765</td>
<td>.287</td>
<td>.594</td>
</tr>
</tbody>
</table>

The results of the two-way ANOVA test calculation obtained that the value of $F_{\text{count}} = 36.134 > F_{\text{table}} = 3.92$ or with p-value (Sig.) = 0.000 < $\alpha = 0.05$ then the statistic hypothesis rejects $H_0$ so that it can be drawn there is a significant influence of instructional strategies (A) on the results of mastery of the concept of science. This shows differences in students' skills of science concepts treated with digital class instructional strategies ($A_1$) with problem-solving ($A_2$) instructional strategies. The average score result of knowledge of students' scientific concept given treatment with digital class instructional strategy ($\bar{A}_1=82.41$) is higher than the result of mastery of science concept of students given problem-solving instructional strategy treatment ($\bar{A}_2=76.47$).

The results of the two-way ANOVA test calculation were obtained that the value of $F_{\text{count}} = 163.737 > F_{\text{table}} = 3.92$ or with p-value (Sig.) = 0.000 < $\alpha = 0.05$ then the statistic hypothesis rejects $H_0$ so that it can be withdrawn there is a significant influence of self-directed learning (B) on the results of mastery of the concept of science students. This shows differences in the works of knowledge of the science concepts of students who have high self-directed learning ($B_1$) with low self-directed learning ($B_2$). The average score result of mastery of the science concept of students who have high self-directed learning ($B_1 = 85.76$) is higher than students who have low self-directed learning ($B_2 = 73.12$).

The results of the two-way ANOVA test calculation obtained that the value of $F_{\text{count}} = 0.287 < F_{\text{table}} = 3.92$ or with p-value = 0.594 > $\alpha = 0.05$ then the statistic hypothesis rejected $H_1$ so that it can be drawn there is no interaction between instructional strategies (A) with self-directed learning (B) to master the concept of science. This shows that there is no interaction of the results of mastery of the science concepts of students given the treatment of instructional strategies (A) and self-directed learning (B). The interaction form can be seen in figure 2.
Instructional strategies are needed to improve student attitudes and skills (Rascón-Hernán et al., 2019). Instructional strategies are ways and approaches taken by teachers in achieving the fundamental objectives of the instruction. Instructional strategies are conceptual frameworks for instructional implementation and managing learning tactics (Akdeniz, 2016). Instructional strategies to improve student achievement and prevent random or unclear learning processes (Marzano, 2003). Instructional approaches must be structured, implemented, and evaluated by establishing a planned, systematic goal. One instructional strategy includes activities in creating a quality digital classroom environment. The exercises should consider the instructional objectives and curriculum content, determining which moves and instructional approaches in the learning process (Lee et al., 2016). Teachers should integrate digital technology into the classroom (Çoklar & Yurdakul, 2017) to utilize technology to improve learning outcomes (Tsandilas & Schraefel, 2005). Teachers must also carry out various activities such as distributing classroom assignments, fostering student collaboration, and providing assessments by utilizing digital technology (Vermette et al., 2019). Therefore, it is essential to make Education independent of location and time in increasing the learning process's flexibility (Lakhal et al., 2017). Digital technology is a possible solution to change the education model and make it more flexible to access larger students' groups (Cain, 2015). Digital classes can reach more students and provide flexibility. They can offer services to students who work, are abroad, or are sick and can participate in the learning process remotely between students and teachers (Raes et al., 2020).

Discussion

Figure 2 The interaction between variables

Estimated Marginal Means of Mastery of Concepts

- Self-Directed Learning
- High Self-Directed Learning
- Low Self-Directed Learning

A1= Digital Class
A2= Problem Solving

Diagram shows the interaction between variables.
Self-directed learning plays an essential role in Education, especially the mastery of natural sciences. This is because the independence of knowledge is students' ability to do learning activities with their encouragement and without coercion. Self-directed learning plays a role in improving learning achievement (Boyer et al., 2014). Self-directed learning a learning process that occurs in a person, and in his efforts to achieve learning goals, is required to be active individually or not dependent on others (Khodabandehlou et al., 2012). Self-directed learning is a learning activity carried out by students without relying on others, both friends and teachers in achieving the goal of learning, namely mastering the material or knowledge with their own awareness and being able to apply it in solving problems in daily life (Torabi et al., 2013). In the self-directed learning, students are required to be able to matter information not only sourced from teachers (Temmen & Friederic, 2016). This means that from other sources such as the Internet, students are able to do learning activities without the influence of others or friends. Students who have good learning independence can be observed directly from their behaviors and attitudes. This shows that one's self-directed learning can be illustrated by attitudes, opinions, and behaviors. The self-directed learning that a student has, encourages the student to be able to behave independently of others (Douglass & Morris, 2014).

Conclusion

This paper outlines the main principles of the influence of instructional strategies and self-directed learning on the mastery of the concept of Natural Sciences. They are used to show how teachers consider actions in designing learning to improve student learning outcomes. It is conceived that when implementing the framework of instructional strategies, recording, and visualizing the affordability that arises in the activities and resources of the learning environment in the community should be under special attention. Affordability as a connector of environmental goals, actions, and help is a powerful bringer of knowledge in technology systems for dynamic changes in learning cultures and paradigms and guidance for optimal learning space activities. The use of technology makes Education independent of location and time in increasing the learning process's flexibility. Digital technology is a possible solution to change the education model and make it more flexible to access students everywhere, both domestically and abroad. Using digital technology, students can do learning activities without any obstacles.

References

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