

THE RELATIONSHIP BETWEEN SELF-REGULATED LEARNING AND TECHNOLOGY LITERACY WITH CONCEPTUAL UNDERSTANDING OF SALT HYDROLYSIS

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Abstract – *The problems faced with learning chemistry at SMA Negeri Gondangrejo are students' low self-regulated learning and technology literacy, along with the student's lack of conceptual understanding. This research aimed to determine whether there is a relationship between self-regulated learning and technology literacy toward the conceptual understanding of salt hydrolysis subject matter. The research subject was 60 students of the 11th IPA SMA Negeri Gondangrejo. The research method used was a quantitative descriptive method with a correlational approach. The instrument used was a self-regulated learning and technology literacy questionnaire, also a two-tier multiple-choice question. The result of this research showed: 1) there was a positive relationship between self-regulated learning toward conceptual understanding, 2) there was a positive relationship between technology literacy to conceptual understanding, and 3) there was a positive relationship between self-regulated learning and technology literacy towards conceptual understanding.*

Keywords: *Self-Regulated Learning; Technology Literation; Conceptual Understanding*

INTRODUCTION

The COVID-19 pandemic has had a major impact on all sectors of life, including education. Almost all colleges and schools affected by COVID-19 worldwide carry out distance learning. Distance learning, also known as online learning (digital learning), provides challenges for teachers and students. Teachers have to prepare various methods for the learning materials presented can be accepted by students properly. Meanwhile, the students need more effort to accept.

Distance learning is a teaching and learning activity in indirect interactions between teachers and students. This communication goes both ways, bridging through infrastructure such as laptops, television, radio, telephone, internet, video, and so on (Munir, 2009). Independent learning is a priority in distance learning. Students absorb the material provided by the teacher through indirect interactions in the classroom because this learning is not limited by space and time (Prawiyogi et al., 2020). Independent learning without direct supervision by the teacher and using the internet as the main means of learning are emphasized in distance learning (Indrayanti et al., 2021). Self-regulated learning and technology literacy is needed in distance learning (Anthony et al., 2020). Self-regulated learning is key to developing technology literacy skills and leads to successful online learning (Shopova, 2014; Ejubović & Puška, 2019). In addition, self-regulated learning and technology literacy is the most prominent skills for education and work (Scott, 2015).

The nature of learning that can make students responsible for their learning is formed by self-regulated learning (Sutikno, 2016). Self-regulated learning is one's efforts to regulate oneself in learning. This effort involves knowledge, emotions, and personal behaviour to achieve learning

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goals (Hamonangan & Widyarto, 2019). According to Zimmerman (1986), self-regulated learning is a concept regarding students becoming controllers in their learning activities. Self-regulated learning also results from an internal process of goals, planning, and self-esteem for what has been achieved.

Technology literacy ability is a person's skill in obtaining, running, then integrating, assessing, creating, exchanging data using technological tools, effectively, responsibly, and appropriately working independently and with others (Tunardi, 2018). In addition to mastering old literacy, such as reading and writing, students must master new literacy (data literacy, technology literacy, and human literacy) in the Industrial Revolution 4.0 era (Fitriani & Aziz, 2019). The effectiveness of the learning process is influenced by one's competence and level of technology literacy (Latip, 2020). With technology literacy skills, students can participate in online learning well.

Solving chemistry problems is necessary to build students' conceptual understanding abilities. Concept understanding becomes the basis for developing knowledge and is the key to learning because understanding refers to explaining a more meaningful concept (Parker, 2006). According to Bloom (Susanto, 2013), understanding is how far the students' ability to obtain, know and master the material that has been given or how far students can understand and know it. While conceptual understanding is how much students can digest the ideas given, it can help students take what is learned in class and apply it throughout the material (Moser & Chen, 2016). Students need to have a good understanding of concepts to be better able to participate in activities at home, in preschool, and in the school environment.

Indonesia's technology literacy still faces many challenges. In the World Digital Competitiveness Ranking 2020 (WDCR 2020), Indonesia ranks 56th out of 63 countries. This WDR measures the adoption and exploration of digital technology by 63 countries in carrying out economic and social transformation. The survey conducted by the Research and Development Center of the Ministry of Education and Culture of the Republic of Indonesia shows that students who learn by doing assignments from the teacher are 85.9% elementary students, 86.4% junior high school students, 87.5% high school students, and 86.9% vocational students. At the same time, there are 33.9% of elementary school students, 47.1% of junior high school students, 59.7% of high school students, and 49.1% of vocational students learn to use digital communication technology.

Digital skills in the environment of teachers and students should be improved. Furthermore, 18.2% of elementary students were included, 25.6% of junior high school students, 41.7% of high school students, and 24.2% of vocational students who learned to use online learning applications, such as Google Classroom, Edmodo, Teacher's Room, and Quippers. This condition shows the impact of the low application of digital systems.

Based on observations during the 3rd Educational Internship, class XI IPA Gondangrejo State Senior High School belongs to capable students who dare to ask questions and express opinions during distance learning activities. However, there are still students who have not demonstrated the nature of self-regulated learning and technology literacy in themselves. This phenomenon can be seen from the number of students submitting assignments late. In the results of interviews with students at SMA Negeri Gondangrejo, students said the teacher gave too many assignments, so they had difficulty in dividing the time doing assignments. This is caused by the low attitude toward self-regulated learning in students, which results in students having difficulty in dividing their study time with their playing time. Students with low self-regulated learning are 26.7%, and technology literacy is 28.4%. Most students have difficulty using the Microsoft Teams application as an online learning medium. Students use WhatsApp groups, Google Classroom, Google meet, quizzz.com, and so on to support the learning process. Teachers and students need adjustments in applying technology to the learning process. However, there are several challenges to the use of technology in education, such as unstable internet networks and the limited ability of communication tools

owned by students and teachers, as well as differences in the level of generation and age of technology users.

Chemistry itself is considered a difficult subject. The difficulty level for each material varies, but students still face difficulties in salt hydrolysis materials. Mathematical ability tends to be more needed than understanding concepts in practice questions, so students memorize understanding without paying attention to concepts. Salt hydrolysis equipment is a difficult material to understand; learning activities and student learning outcomes are not close to the desired ideal learning conditions. Amelia & Nurbaity (2014) stated that students experienced misconceptions about the pH of hydrolyzed salt solutions and the nature of hydrolyzed salts. Students cannot distinguish between "not dissociated" and "not hydrolyzed". This phenomenon must be considered so that misunderstandings do not occur in the future (Habiddin et al., 2022). Students also cannot answer questions about the causes of an event, have difficulty giving opinions and accuracy in reading questions is still low and less able to analyze data in graphs or tables.

There is a relationship between self-regulated learning and concept understanding, as revealed by Ruswana & Zamnah (2018), "the level of self-regulated learning affects the level of concept understanding, the high level of self-regulated learning students means the ability to understand concepts is also high. Then according to Ningrum & Wulandari (2020), there is a significant relationship between the implementation of online science learning and technology literacy in class VIII of SMP Negeri 1 Candi.

METHOD

This research is quantitative in the form of a survey. The method used is descriptive quantitative with a correlational approach, with the independent variables being self-regulated learning (X_1) and technological literacy (X_2), and the dependent variable being conceptual understanding (Y). This research was conducted on XI Science students at State Senior High School from March to April 2021 at SMA Negeri Gondangrejo. The population of this study were all students of class XI IPA at SMA Negeri Gondangrejo semester 2020/2021, which had a total of 122 students. While the cluster random sampling technique is used by randomly selecting two classes, namely class XI IPA 2 and XI IPA 3, totalling 60 students.

This research started with instrument trials in classes that had already obtained the material (Class XI IPA besides the sample class), followed by data collection on self-regulated learning, technological literacy, and conceptual understanding. The validity and reliability tests were carried out in the analysis phase of the questionnaire. Then proceed with the prerequisite test, namely the normality test, linearity test and multicollinearity test. After the prerequisite test is met, it is continued by testing the hypothesis through correlation analysis using SPSS. Then they proceed with descriptive statistics for each variable, followed by a discussion of each hypothesis to obtain a research conclusion.

Table 1. Indicators of Self-Regulated Learning and Technology Literacy

Independent Variable	Indicator
Self-regulated learning	<ol style="list-style-type: none">1. Goal setting2. Seeking information3. Seeing adversity as a challenge4. Task strategies5. Learning initiative6. Metacognitive monitoring7. Self-concept
Technology Literacy	<ol style="list-style-type: none">1. Basic information technology skills2. Problem-solving skills3. Analysis and Development Skills4. Information and interaction skills

The instruments used were self-regulated learning and technology literacy questionnaires and two-tier multiple-choice questions. The two-tier multiple-choice questions are data collectors for students' conceptual understanding obtained from daily test scores on salt hydrolysis material. This self-regulated learning questionnaire was adapted from research by Zamnah (2019), which is valid and reliable with an item reliability coefficient of 0.81 and student reliability of 0.87. While the technological literacy questionnaire used was adapted from Erniwati's research (2019) which is valid and reliable with an item reliability coefficient of 0.81 and student reliability of 0.81. This question is valid and reliable, with an item reliability coefficient of 0.86 and a student reliability of 0.70.

RESULTS AND DISCUSSION

After carrying out and fulfilling the analysis requirements test, which includes: (1) test for normality of population distribution using Kolmogorov-Smirnov, the normality test is used to determine whether sample data has been drawn from a normally distributed population (within some tolerance) (2) The linearity test is a requirement in the correlation and linear regression analysis (if the Deviation from Linearity Sig. > 0,05) (3) A multicollinearity test helps to diagnose the presence of multicollinearity in a model (looking at the tolerance value and VIF). Furthermore, it is necessary to conduct hypothesis testing **on** whether or not there is a relationship between one variable and another, which is then expressed **as** a mathematical equation (regression).

Table 2. Correlation Test of the Relationship between Self-Regulated Learning and Understanding Conceptual

		Self-Regulated Learning	Conceptual Understanding
Self-Regulated Learning	Pearson Correlation	1	0,587
	Sig. (2-tailed)		0,000
	N	60	60
Conceptual Understanding	Pearson Correlation	0,587	1
	Sig. (2-tailed)	0,000	
	N	60	60

According to Table 2, self-regulated learning with conceptual understanding has a positive correlation coefficient of 0.587 with a significance value of 0.000 < 0.05. This **value** confirms that H_0 is rejected, which means there is a positive and significant relationship between self-regulated learning and conceptual understanding with a fairly strong level of closeness.

The correlation coefficient with a positive value indicates that self-regulated learning increases with the increase in the value of understanding the concept. According to the value of the correlation coefficient, it can be concluded that the level of concentration of the relationship between self-regulated learning and understanding of the resulting concept is fairly strong.

This study's results align with Ruswana & Zamnah (2018) research, which shows a relationship between self-regulated learning and students' mathematical understanding abilities with a correlation coefficient of 0.649 with a strong positive and significant relationship. Simatupang, Islami, & Nasir's research (2017) also shows a relationship between self-regulated learning and physics learning outcomes with a correlation value of 0.448 with a positive and moderately significant relationship. An increase will follow the increase in self-regulated learning in student learning outcomes with a coefficient value of 0.448.

Students need the skill to organize their learning and cross different rules, especially in acquiring thinking, writing, and analyzing skills (Yarnall et al., 2019). Students with self-regulated learning always re-learn the material, design the goals, manage the learning time, form a supportive learning

environment, look for other learning resources, find the help of friends and teachers and always practice questions (Simatupang et al., 2017). Students with a self-regulated learning attitude will have a high level of learning outcomes and can understand knowledge more deeply (Ejubović & Puška, 2019).

Table 3. Correlation Test of the Relationship between Literacy Technology and Understanding Conceptual

		Technology Literacy	Conceptual Understanding
Technology Literacy	Pearson Correlation	1	0,558
	Sig. (2-tailed)		0,000
	N	60	60
Conceptual Understanding	Pearson Correlation	0,558	1
	Sig. (2-tailed)	0,000	
	N	60	60

According to Table 3, technology literacy with conceptual understanding has a positive correlation coefficient of 0.558 with a significance value of $0.000 < 0.05$. This **value** confirms that H_0 is rejected, which means there is a positive and significant relationship between technological literacy and conceptual understanding with a fairly strong level of closeness.

A positive correlation coefficient means that an increase will follow an increase in technological literacy skills in students' conceptual understanding. Conversely, students who have low technological literacy lower their understanding of concepts. Based on the analysis results, it can be concluded that technological literacy helps students' study and review the concepts of the material being studied. The level of closeness of the relationship between technological literacy and understanding of concepts is at a sufficient level when viewed from the value of the correlation coefficient.

Research by Giovanni & Komariah (2019) also shows a positive and significant relationship between digital literacy and student achievement in terms of information, communication, content creation, and security competencies. In addition, the research of Siswoyo & Mulyati (2021) also shows a positive relationship between information and communication technology (ICT) literacy with student learning outcomes in a positive direction. Students with ICT literacy want to use the internet as a learning resource to get the desired knowledge.

The use of technology is not only needed by students in the learning process but also to build their motivation in improving technological literacy skills, which aim not only to improve academic learning outcomes. Technological literacy also provides opportunities for success in social life, work, and constantly changing life. This technological literacy builds on several different areas of learning, such as knowledge, attitudes, and skills needed to identify, find, access, retrieve, store, and organize information. The focus on technological literacy is the ability to solve problems and build new knowledge through technology and media in a critical, creative, flexible, and ethical manner (Shopova, 2014). With technological literacy, students will find it easier to understand the concepts of the material that has been given.

Table 4. Multiple Correlation Test of the Relationship between Self-Regulated Learning and Technology Literacy with Conceptual Understanding

Model	R	R square	Std Error of the Estimate	Sig.
1.	0,624	0,389	9,681	0,000

According to Table 4, self-regulated learning and technology literacy with conceptual understanding has a positive correlation coefficient of 0.624 with a significance value of $0.000 < 0.05$. This **value** confirms that H_0 is rejected, which means that self-regulated learning and technology literacy with conceptual understanding has a positive and significant relationship with a strong level of closeness.

Table 5. Multiple Linear Regression Equation Test

Model	Under-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	8.134	10.559		.770	.444
Self-regulated learning	.519	.193	.386	2.687	.009
Technology Literacy	.354	.174	.291	2.028	.047

Table 5. confirmed that self-regulated learning and technology literacy had a significance value of < 0.05 , so the regression coefficient is significant. According to Table 5., the following regression equation is obtained:

$$Y = 8.134 + 0.519 X_1 + 0.354 X_2$$

From this equation, it can be interpreted that if self-regulated learning (X_1) and technological literacy (X_2) have a value of 0, then conceptual understanding is worth 8.134. If the value of self-regulated learning increases by one point and the value of technology literacy remains, then conceptual understanding will increase by 0.519. On the other hand, if the value of self-regulated learning remains constant and the value of technology literacy increases by one digit, conceptual understanding will increase by 0.354

The effective and relative contribution of independent variables is obtained from the regression equation with the calculation results in Table 6.

Table 6. Calculation of Effective Contribution and Relative Contribution

Independent Variable	Effective Contribution	Relative Contribution
Self-regulated learning	22,64%	58,20%
Technology Literacy	16,26%	41,80%

Table 6 shows that self-regulated learning and technology literacy have an effective contribution of 38.90%, and other things influence the remaining 61.10%. Technology literacy has an effective and relatively smaller contribution compared to self-regulated learning. This indicates that students' self-regulated learning in distance learning contributes more to conceptual understanding. This is because self-regulated learning is needed, especially in distance learning. After all, teachers cannot fully supervise student learning activities at home. With self-regulated learning and technology literacy, it is easier for students to access learning resources via the internet, study them independently and discuss salt hydrolysis materials with their peers and teachers.

Underwood, Steffens, Lefrere & Carneiro (2011) state that the role of digital technology, especially in improving the learning environment through technology (TELEs), supports student self-

regulated learning. Self-regulated learning is beneficial because it leads to more effective embedded learning. Self-regulated learning combined with technological literacy in learning environments (TELEs) found many challenges, especially in commitment, motivation, social relations, and student feedback (Urbina, 2021). The concepts of self-regulated learning and TELEs seem like two different educational trends: student-centred learning activities and dependence on technology-based learning.

This research is also in line with Braten, Stromso, & Olaussen (2003), which suggests that students should learn to use information and communication technology for educational purposes and emphasizes that students have self-regulated learning skills that enable them to plan, implement, and evaluate processes. Learning and planning learning to achieve its goals. The integration of ICT learning in education can accommodate students in building cognition and developing higher-order thinking skills. The use of ICT can help develop higher-order thinking skills such as problem-solving and critical thinking.

Students' understanding of complex concepts must start with understanding simple concepts. If simple concepts are well understood, students will more easily understand more complex concepts properly (Nusi et al, 2021). However, based on the results of research by several researchers, it was stated that students' difficulties in learning chemistry concepts were caused by students who did not have a proper understanding of the initial concepts of chemistry. So, it can be said that the concept of salt hydrolysis will be easier to understand if students have understood the acid-base concept well.

CONCLUSIONS

Based on the results of research and discussion, it can be concluded there was a significant positive relationship between self-regulated learning and technology literacy towards conceptual understanding. Students need high self-regulated learning to improve better understanding of concepts. A high level of conceptual understanding will follow a high level of self-regulated learning. Students can develop personally and socially so that they can evaluate their abilities, get to know their degree of understanding, and learn how they can achieve the goals they want to achieve. Technology literacy can help students carry out distance learning to increase their understanding of the concepts they have. Technology literacy needs to be owned by students in the learning process. Student's ability to learn material concepts can increase with technology literacy so that students have a better understanding of concepts.

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