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by I Putu Artayasa Dkk

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Analysis of Students' Self-Regulated Learning in Terms of Gender Using Blended Learning-Based Laboratory Inquiry Teaching Materials

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Abstract. The Covid-19 pandemic has affected the way students learn from face-to-face to online learning. This condition is a challenge for educators to provide online teaching materials. Teaching materials developed to facilitate students to learn independently. The characteristics of the teaching materials developed give students the freedom to learn and facilitate the development of their abilities and skills. This study aimed to analyze the effectiveness of blended learning-based laboratory inquiry teaching materials in improving students' self-regulated learning in terms of gender. This type of research is a quasi-experimental research. The test subjects in this study were class XI in one of the public high schools in Mataram City, which consisted of two classes, namely the experimental class and the control class, which consisted of 67 students. There are 34 male students and 33 female students. The data collection technique used a self-regulated learning questionnaire instrument. The instrument refers to seven indicators of self-regulated learning. Data analysis was carried out using N-gain and T-test. The results showed that blended learning-based laboratory inquiry teaching materials could increase students' self-regulated learning. Based on the results of the T test, there was a significant difference between the control class and the experimental class. The third self-regulated learning indicator, namely goal setting and planning, got the highest increase compared to other indicators. The second indicator, namely organization and information, obtained the lowest increase compared to other indicators. Self-regulated learning of male students is higher than female students. With the availability of online class media in the blended learning learning model that can be accessed anytime and anywhere by students, it can increase the readiness of students themselves before face-to-face learning in class takes place. Student activity also increases because by providing material earlier through media uploaded to online classes it will stimulate students to look for other material that is still related and be more active in asking things they do not understand.

INTRODUCTION

Students' self-regulated learning is still an obstacle [1]. Various levels of difficulty experienced by students in independent learning ranging from lack of understanding of concepts to lack of learning motivation [2]. This affects the learning outcomes achieved and the characters that are embedded far from targets and expectations [3]. Independent learning is defined as a learning process within a person in achieving certain goals that are required to be active individually or not to depend on others including teachers [4][5].

In general, there are several reasons related to the importance of independent learning for students in the learning process. One of the problems faced by students in the classroom and outside the classroom is curriculum guidance which is useful for reducing students' dependence on other people who are increasingly complex in everyday life [6]. The learning independence of male and female students is different. Both male and female students in the aspect of

learning independence are very low, but female students are better in the aspect of asking questions related to questions that have a high level of difficulty, this shows that there are differences between male students. Male and female students in the aspect of independent learning.

An important element in learning is independent learning [8]. This is due to learning resources that are not only teacher-centered. Other learning resources are the environment, social media, books [9]. People who have high creativity tend to feel that the learning they get from the teacher is still lacking so they look for information from outside [10]. With the new information they get from outside, they will increase their knowledge. Therefore, student learning independence is very important in learning activities [11]. However, the reality in the field is different from the fact that there are still many students who depend on the resources provided by the teacher alone [12]. They do not have the initiative to learn even though they have textbooks or worksheets that can be used. self-study outside of school. And most of the students when there are assignments given by their teachers depend on other friends. In addition, it can also be seen that during daily tests or semester exams they steal each other's opportunities to get answers.

These problems also occur in students in one of the senior high schools in Mataram. This can be seen from the motivation of students who are still lacking to learn independently even though they are quite active during class learning. This can be seen from the results of the Mid-Semester Assessment (PTS) which are still low. They consider science learning a difficult, difficult and stressful subject. Students are less able to regulate themselves properly resulting in feelings of regret and disappointment, delayed work, wasted free time and decreased achievement [13]. The role of self-regulation in learning (self-regulated learning) is very important for student success and student learning outcomes [14].

Meaningful learning is seen when it involves students in direct experience to develop students' competence, skills and thinking abilities, and provides full freedom and responsibility so as to help students understand and master concepts in solving problems. Problems they face, so the quality of their knowledge and skills is high [15]. In addition, based on the results of observations in schools, Blended Learning-based learning has never been done before. Learning independence is also rarely measured, and teachers still rarely develop learning tools that are integrated with Blended Learning. Teachers rarely develop and use learning media that are able to visualize abstract concepts. Although using learning media, learning media are not exploratory and the media used rarely involve the active role of students, in fact if the learning media can actively involve students, student achievement will increase [16].

One of the learning models that are able to facilitate students to develop their abilities and skills optimally by not being separated from the increasingly developing technology is laboratory inquiry based on Blended Learning. This learning model can provide opportunities for students to develop the basic skills needed in the 21st century, including training students to regulate their learning patterns independently [17].

Laboratory inquiry learning is an effective and meaningful learning in science learning and is the basis for developing science and technology. Laboratory inquiry learning aims to familiarize students with working like a scientist, because this learning model requires students to find new knowledge, observe, classify and communicate in the learning process faced with problem situations in everyday life (illstructured) [18]. The learning model is based on the active participation of students in the process of collecting data, analyzing facts, improving problem solving skills and having a positive attitude towards science [18].

Laboratory inquiry also utilizes the surrounding environment as a place for research. A wide environment will also provide broad opportunities for students to develop their abilities and skills because the research is not only limited to a room but outside the room can also be used as a research vehicle for students. Students can also use technology in their learning so that in addition to being skilled in learning, students are also technology literate. In addition, students will find it easier to learn because the learning resources that can be used are diverse and contextual so that it will be easier to understand. Laboratory inquiry facilitates students to develop skills and gives freedom to students to find out and try new activities with scientific steps. The active involvement of students both physically and mentally in laboratory activities will affect the formation of student action patterns which are always based on scientific matters, by treating students like scientists in science learning activities [19].

Laboratory-based inquiry learning models can improve students' psychomotor abilities [20]. There is a relationship between critical thinking skills and student learning outcomes through an inquiry model based on Blended Learning on the material of the human respiratory system [21]. Laboratory-based inquiry learning models can improve student learning processes and outcomes [22].

METHODS

This type of research is a quasi-experimental research with non-equivalent control group design. The research design used was a pretest-posttest control group design. This study used two classes in a senior high school in Mataram City, which consisted of an experimental class and a control class. The sampling technique used cluster random sampling. The experimental class applies mixed learning by using a laboratory inquiry based blended learning device. The control class is taught using conventional teaching materials. There were 67 students involved in this study, consisting of 34 male students and 33 female students.

The collection of self regulated learning data was obtained by using a questionnaire which refers to seven indicators of self regulated learning. The self-regulated learning indicator refers to the indicator developed by Zimmerman and Schunk [14] presented in Table 1.

TABLE 1. Indicators of self regulated learning

Indicator	Name
1	evaluating self-esteem
2	organization and information
3	goal setting and planning
4	information seeking
5	environmental structuring
6	revision and memory
7	seek peer, teacher, adult assistance

Analysis of the data used in this study is the N-gain and T-Test which can determine the effectiveness of mixed learning using laboratory inquiry based blended learning teaching materials. N-Gain can measure the increase in the measured variable [24].

RESULT AND DISCUSSION

N-gain analysis and T-test were performed based on the findings of the research on laboratory inquiry learning devices based on blended learning. The purpose of this study is to determine the significance of increasing students' self-regulated learning. The results indicate that the experimental class has a higher average N-Gain value than the control class. The results of the N-Gain test for students' self-regulated learning are presented in Table 2.

TABLE 2. The results of the N-Gain score of self regulated learning

Class	Pre-test	Post-test	N-gain	Category
Control	45.86	57.43	0.29	Low
Eexperiment	51.38	86.62	0.69	Moderate

Based on the results of the self-regulated learning test of students presented in Table 2 the experimental class and the control class showed significant differences. The results of the self-regulated learning test of students in the experimental class showed an increase in numbers in the medium category compared to the control class in the low category. This shows that blended learning-based laboratory inquiry teaching materials in the experimental class can improve students' self-regulated learning.

The increase in SRL in the experimental class was due to the use of laboratory inquiry teaching material based on blended learning. Learning using a laboratory inquiry model based on blended learning provides freedom, flexibility and opportunities for students to develop their skills and train students to regulate their learning patterns independently. With this learning model, students will become accustomed to making plans and learning objectives, searching for information if educators' information is perceived to be lacking, evaluating the progress of tasks assigned independently, creating and managing the desired learning environment, and repeating and remembering what educators have conveyed during learning. As a result, the SRL of students is expanded and trained.

The T-Test was used after the N-Gain test to determine whether there was a significant difference between the control and experimental classes after being taught using the developed teaching material. Table 3 demonstrates that there is a significant difference between the control and experimental class.

TABLE 3. Results of the SRL T test

SRL	Levene's Test for Equality of variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig.(2 tailed)	Mean Difference	Std.Error Difference	95% Confidene of the Difference	
								Lower	Upper
Equal variances asummed	1.782	.186	-53.560	68	.000	-50.89185	.95018	-52.78791	-48.99579
Equal variances not asummed			-54.388	66.463	.000	-50.89185	.93572	-52.75983	-49.02387

The high SRL is due to the teaching materials developed provide flexibility to students, which means that the presence of laboratory inquiry facilitates students to optimize their knowledge, both independently and in collaboration with others. Because this learning model provides the freedom to interact, both in the environment and socially, that is, if the problems found in the field are difficult to solve, students can discuss them with other people, such as peers, parents, teachers, brothers, sisters and so on. So that besides being able to provide direct experience, this model also gets used to interacting with the environment so that it is easier for students to regulate their learning patterns independently. Good self-regulation (SRL) in learning will be perfect if there is good support both financially and materially, especially from family or parents [25]. Self-regulation ability (SRL) in learning cannot develop by itself, without a conducive environment [26].

In addition, with the blended learning-based laboratory inquiry teaching materials, it can provide active participation of students, so that in the learning process students are motivated in learning and enthusiastic in various learning activities. Students who have self-regulation in learning (SRL) are students who are metacognitively active, motivated and behave in the learning process. Self-regulation in learning is also an active metacognitive individual ability who has the drive to learn and participate actively in the learning process [27]. So, students who play an active role in class are students who have high self-regulation in learning, and vice versa children who tend to be passive in class, it can be indicated that the child has low self-regulation in learning.

Through learning using blended learning-based laboratory inquiry teaching materials in the teaching and learning process, students and groups can discuss problems scientifically with the aim of knowing the benefits and impacts that occur in the environment and society related to the application of science and technology. There is an interaction between students that allows them to exchange ideas and opinions through research or scientific procedures before they find answers and results that can train students' skills.[9] Blended learning-based laboratory inquiry is learning that requires students to actively think, communicate, search and process data, until finally conclude to find a solution to the problems that occur. The stages that must be carried out include (1) student orientation to problems, (2) organizing students to learn, (3) guiding individual and group investigations, (4) developing and presenting work, (5) analyzing and evaluating the problem solving process [28]. Learning using the inquiry model in the experimental class can improve learning outcomes compared to learning using conventional models in the control class [15].

Learning using conventional teaching materials in the control class is dominated by the teacher, so students tend to feel bored and not interested in learning and make less effort to practice independent learning. Higher order thinking skills cannot emerge without treatment, and only focus on methods dominated by lectures [17]. The ability to think does not appear by itself in the learning process [29]. The treatment given to the experimental class was in the form of learning by using material that had been developed using a blended learning-based laboratory inquiry method. Learning in the experimental class can improve self-regulated learning because the teaching materials have been facilitated with self-regulated learning indicators, so that when students in the experimental class answer the questionnaire, they do not find it difficult. This is evidenced by the results of the N-Gain analysis.

Applying blended learning-based laboratory inquiry teaching materials is suitable in science learning. It is proven that this learning helps students to understand the concepts being studied, to be more enthusiastic and actively involved in teaching and learning activities. For teachers, this method requires many abilities that must be possessed by them. For example, the teacher must master the material, be accustomed to thinking logically as a scientist, and have an open (democratic) attitude, be responsive to others, and willing to increase knowledge to become a good educator. SRL reflection using the inquiry learning model has the potential to produce changes in teaching and scientific thinking, so that students can become critical thinkers and are more scientifically literate [30].

The next analysis is the analysis of Self Regulated Learning (SRL) and each indicator, the SRL indicator [14]. The test results for each self-regulated learning indicator are presented in Fig. 1.
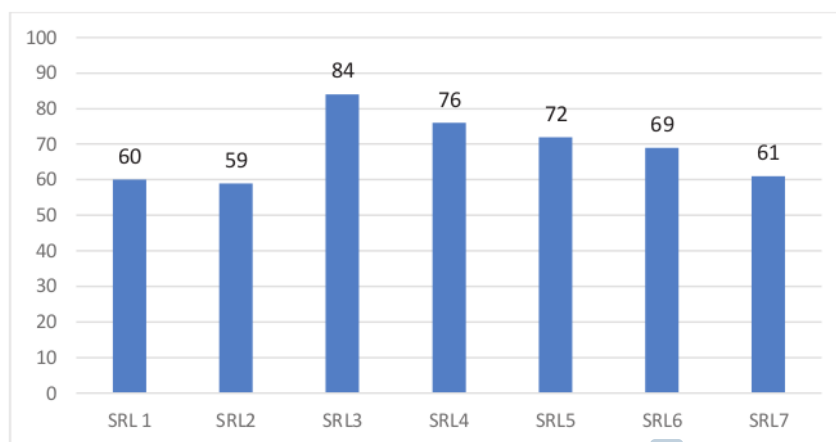
FIGURE 1. The results of the self-regulated learning test for each indicator.

Based on Fig. 1, it can be seen that there is a difference in the average score of N-gain self-regulated learning. The highest increase was in the SRL 3 indicator, namely making plans and learning objectives by 84% in the high category. The SRL 2 indicator, namely organization and information, obtained a lower increase compared to other SRL indicators.

The SRL 3 indicator, which is making plans and learning objectives, gets a higher score than other indicators in the high category. This happens because the teaching materials developed lead students to make plans and learning objectives before class begins. In addition, this developed learning materials provides complete freedom to students in managing the desired learning while still paying attention to the goals to be achieved. With this freedom, students can optimize their abilities, skills and interests. So that students will tend to get used to making plans and goals they want.

The high percentage increase in SRL in indicator 3 is due to the teaching materials developed are very closely related to each student's Self Regulated Learning indicator, especially the SRL 3 indicator, namely making learning plans and objectives. SRL 3 is closely related to phases 2 and 3 of laboratory inquiry, namely the phase of collecting test materials/prelab inquiry activities and the phase of collecting data in experiments. With these two phases, students will automatically be trained to make good planning and learning objectives. Students can manage how far and how deep the material and materials they want to achieve, so that the self-regulation pattern of students will be trained and formed automatically with the application of the developed learning materials. Continuous application will make students accustomed and then independently able to regulate other learning patterns.

After performing the general N-gain analysis, T-test, and testing for each SRL indicator, then an analysis based on gender was carried out. The results of the analysis by gender are presented in Table 4.

TABLE 4. Gender data on self-regulated learning

Test	Criteria	Men	Women
Amount		34	33
Pretest	Average	50.86	52.84
	Homogeneity	0.23	
	Hypothesis testing	0.65	
Posttest	Average	87.32	85.94
	Homogeneity	0.74	
	Hypothesis testing	0.000	

Based on Table 4, it can be seen that the average posttest score of male students, both experimental class and control class, male students obtained higher scores than female students. This means that male students have higher self-regulated learning than female students.

This study also provides an overview of the differences in self-regulated learning of male and female students, where the results obtained indicate that the scores of male students are higher than female students. The thinking

ability of male students scored higher than female students [15][31]. The interest of male students in learning to use teaching materials in this study is increasing. Meanwhile, female students' interest in learning is lower than that of male students. One study showed that female students were more influenced by the teachers they chose as their role models and showed high levels of intrinsic motivation [32]. The main factor in the development of self-regulated learning is the student's self. The personal learning environment is a pedagogical approach that has the potential to integrate formal and informal learning using social media and supports students' independent learning [33].

Self-regulated learning is the key to students' academic development. The results showed that the students' approach to problem solving consistent with the epistemic profile had a relationship with the regulation of cognition [34]. The teacher's role in providing support for students in learning can increase self-regulated learning as an external factor. The results showed that the support of teacher autonomy and teacher structure had an impact on student learning independently, motivation and problem solving behaviour [35].

CONCLUSION

The blended learning-based laboratory inquiry teaching materials used can help students increase their learning independence. There are differences in student learning independence in the experimental class with the control class. The experimental class obtained an increase with moderate criteria, while the control class obtained an increase with low criteria. The SRL 3 indicator has the highest improvement compared to other indicators, while the SRL 2 indicator has the lowest score. The self-regulated learning of male students is higher than that of female students.

ACKNOWLEDGMENTS

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GENERAL COMMENTS

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