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An Exploration of Self-Directed Learning in Numerical Mathematics

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Abstract

The present study aims to describe the students' self-directed learning in numerical mathematics. It also explores the weakness of their self-directed learning based on four determined indicators. One out of four indicators will be prioritized for optimization. Grounded in a quantitative descriptive research, a survey was used to collect the data. 56 third-year students taking numerical methods course were recruited to participate. Population technique was employed to establish the research sample. The findings expose that the students' self-directed learning in numerical mathematics was relatively low. The obtained data illustrated that 54% of participants showed low self-directed learning, 45% of them demonstrated moderate self-directed learning, and 2% of the research respondents were noticed to possess high self-directed learning in numerical mathematics. The indicators that received a priority scale for special treatment were the fourth indicator with the value level of 52%, the third indicator of 58%, the second indicator of 63%, and the first indicator of 75% respectively. This study recommends further researchers to escalate students' self-directed learning in numerical mathematics by prioritizing the fourth and third indicators, namely: performing self-confidence, doing assignments independently, and taking decisions and initiatives to deal with experienced problems.

Keywords: Self-Directed Learning, Numerical Mathematics, Self-Confidence

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Abstrak

Penelitian ini berusaha mendeskripsikan kemandirian belajar mahasiswa pada pembelajaran numerik. Letak kelemahan kemandirian belajar berdasarkan empat indikator dieksplorasi untuk menentukan indikator yang menjadi skala prioritas guna pengoptimalan. Penelitian ini merupakan jenis penelitian deskriptif kuantitatif dengan metode survey untuk pengumpulan data. 56 mahasiswa tingkat tiga yang mengambil mata kuliah metode numerik berpartisipasi dalam penelitian ini. Pengambilan sampel menggunakan teknik populasi. Hasil penelitian ini menunjukkan bahwa kemandirian

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belajar mahasiswa pada pembelajaran numerik masih tergolong rendah. Data yang diperoleh adalah 54% responden memiliki kemandirian belajar rendah, 45% responden memiliki kemandirian belajar sedang, dan 2% responden memiliki kemandirian belajar yang tinggi. Indikator yang mendapatkan skala prioritas untuk dilakukan perlakuan khusus adalah indikator keempat yang tingkat pencapaiannya sebesar 52%, indikator ketiga sebesar 58%, indikator kedua sebesar 63%, dan indikator pertama sebesar 75%. Penelitian ini merekomendasikan para peneliti selanjutnya untuk meningkatkan kemandirian belajar mahasiswa dengan memprioritaskan indikator kemandirian belajar keempat dan ketiga, yaitu: memiliki kepercayaan diri, melaksanakan tugas-tugas secara mandiri, serta mampu mengambil keputusan dan inisiatif untuk menghadapi masalah.

Kata Kunci: *Kemandirian Belajar, Matematika Numerik, Kepercayaan Diri*

A. INTRODUCTION

Normatively, one of the goals to be achieved in the process of actualizing the values of the Qur'an in education is the shape of a cultural or personality dimension. It is expected that Muslims have a steady and independent personality, social responsibility, and nationalism (Al- Munawar, 2005, p. 15). Therefore, Muslims are expected to have an independent attitude in a wide array of ways, including the process of learning mathematics which is often labeled as one of the difficult subjects.

Mathematics is science that is closely related to human life. Mathematics actually comes from the culture of society. An increasingly complex human culture is directly proportional to human needs. Human needs that are increasingly complex certainly denotes emerging complicated problems. These problems need to find solutions that require accurate formulation. The solution offered should refer to the theory of origin of mathematics which states that mathematics is derived from the culture or activities of the community.

In fact, today, lots of people actually do not realize that they have rules of mathematics in their daily lives. Buying and selling activities, the vehicles they use, the technology they enjoy does not necessarily make people aware that mathematics is very close to their routines. Mathematics has been used and applied to various things in this modern life, even people who have never studied mathematics actually have applied mathematics in many ways in their everyday lives. A construction worker, for example, considers how he can estimate the amount of sand needed as well as the amount of bricks used and decide to symmetrical buildings with a special method. Another example is that a trader in the market does not need to think long to calculate the price that must be paid by the buyer, how traders provide discounts, and other activities that can be quickly decided. Construction workers and traders do not need to take school mathematics to do their activities. This means that mathematics is indeed used by the community at a practical level for simple activities.

Mathematics learning should use the right and current context, even better when using realistic conditions that are close to the learning environment of students. Certainly, a variety of mathematical problems will be encountered from the real conditions that are felt immediately by students. The use of contextual mathematics problems enables students to develop more complex thinking patterns because it involves both formal and informal mathematical knowledge. Through contextual mathematical problem solving, students are stimulated to enhance all their psychological potential, especially those related to thought processes (Anggo, 2011, p. 27). Anggo added that contextual

mathematical problems cannot only be seen as problems that are directly related to concrete objects, but also include matters related to abstract objects such as facts, concepts, or mathematical principles. Based on this understanding, it is worth noticing that the contextual nature of a mathematical problem can be directly related to real objects, or related to objects in mind.

Schoenfeld summarizes some of the students' views on mathematics, namely: having only one correct answer, no need to understand why it is done in a certain way, only smart people find and make mathematics, and mathematical problems have little to do with real life (Kamirsyah & Mahfudy, 2016, p. 91). Some of these views certainly yield students' negative attitudes toward mathematics. The negative attitude of students can be seen from the lack of interest and motivation of students to learn mathematics. Finally, mathematics is only a scourge in the classroom. This is the reality of mathematics learning that cannot be underestimated especially by mathematics teachers.

At the theoretical level, the main aim of mathematics is to focus on solving more complex problems in life. Mathematics that is learned at any level must not be separated from everyday life. Mathematics departs from community activities and must continue to develop to improve the quality of community activities. The results of mathematical development must be felt by the community. In addition, a mathematic practitioner and mathematics educator should be able to explain the role of mathematics in various existing technological developments. In the process of developing mathematics, a mathematics curriculum is arranged for elementary schools to high schools. The emerging curriculum is strong enough to support realistic and contextual mathematics learning. It reveals that the problem is the human resources interpreting the curriculum into mathematics learning practices to match what is expected.

Someone at the age of 7-11 years, according to Piaget, is in the concrete operational stage. At this stage, a person is considered to be able to think rationally, but his thinking ability is still limited to real situations. That is, a child at this age must learn mathematics that is directly related to their five senses. The mathematics they get must be able to grasp, see, feel, listen to, and smell. Thus, they can directly assume that mathematics is very close to their lives.

Constructivist ideology puts forward the rediscovery of mathematical knowledge independently. This understanding becomes the answer to the demands of the people who want mathematics to be more meaningful and can provide more benefits for people's life activities. Piaget assumed that educators must adapt the mathematics curriculum to the cognitive structure possessed by a student. However, the Piaget's opinion received some criticism from fellow adherents of the concept of constructivism. Learning must be understood as a unity between individual changes in all things with the development of cognitive structures, learning is not only achieved and understood from the development of cognitive structures alone (Danoebroto, 2015, p. 11).

Someone at the concrete operational stage should already have mathematical reasoning abilities. In fact, students have not been able to understand mathematical concepts well. This statement is indicated by several things, including the ability to restate concepts that have just or been studied is still low and the ability to classify mathematical objects is also still low (Nizarwati et al., 2009, p. 23). This low classification ability is seen in the students' lack of ability to give examples and are not other topics or concepts that have just been learned.

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The students' self-directed learning is a very important thing and needs to be developed in students as individuals who are positioned as students. With the development students' self-directed, making students are able to do everything in accordance with their abilities. Students who have high self-directed learning will try to complete the exercises or assignments given by the teacher with the ability they have, conversely students who have low learning self-directed learning will depend on others. According to Mudjiman, self-directed learning can be interpreted as active learning activities, which are driven by the intention to master a competency in order to overcome a problem and build on the knowledge or competency that has been acquired (Fitriana et al., 2015, p. 89).

Someone at the adult student stage should already have a high level of self-directed learning. This is because the complexity of the material studied is quite high with the intensity of educational meetings with students classified as low, namely a maximum of 14 meetings in one semester. Thus, the self-directed learning becomes absolute for someone who is at an adult learning stage.

Knowing the conditions of students' self-directed learning becomes important to know because of the large contribution of these variables to student learning outcomes. Hapsari & Sutama (2013) in his research mentioned the contribution of self-directed learning in mathematics learning outcomes in terms of learning facilities and distance of student residence. The effective contribution of the independent variable (self-directed learning) to the dependent variable is 60.8%. Darma et al. (2016) in his research also concludes that the higher a person's self-directed learning, the higher the problem solving ability. Furthermore, Darma et al. (2016) also mentioned that the contribution of self-directed learning to the mathematical problem solving ability of prospective teachers of positive education study programs. Tahar & Enceng (2006, p. 100) also reported that there was a significant influence on mathematical communication skills and self-directed learning toward students' mathematics learning achievement.

Other studies also explain how the relationship of self-directed learning with other variables. Research by Tahar & Enceng (2006), for example, promote that self-directed learning has a positive relationship with learning outcomes. According to him the students' self-directed learning has a positive effect of 63.91% on learning outcomes. At the end of his research, they asserted that self-directed learning was one of the predictors of learning outcomes. The higher the self-directed of one's learning, the higher the potential for learning outcomes to be achieved.

Suhendri (2011) through his research also proved the relationship between self-directed learning and logical mathematical intelligence with the results of learning mathematics. Self-directed learning and learning outcomes according to Suhendri has a strong positive relationship, besides that self-directed learning also significantly influences mathematics learning outcomes. This research strengthens previous research which has emphasized that the contribution of self-directed learning to learning outcomes.

The researches mentioned above show that the importance of the role of self-directed learning in mathematics learning outcomes. Therefore, before the implementation of mathematics learning, it is necessary for an educator to first detect the students' self-directed learning. Thus, the learning program that has been compiled can be immediately revised as soon as possible and then adjusted to the conditions of the latest students' self-directed learning. Additionally, the revision of the learning program can be focused on increasing students' self-directed learning.

This study seeks to explore the conditions of students' self-directed learning in numerical mathematics. By knowing the latest conditions of students' self-directed learning, lecturers are expected to design learning that can optimize the potential for students' self-directed learning numerical mathematics. Grounded in a quantitative descriptive approach, this research used a survey to collect the data. This study attempts to describe the students' self-directed learning in numerical mathematics. The results of this research can be used as the basis for the implementation of the further research which is to find solutions to improve and optimize students' self-directed learning, so that students truly become adult learners. The study recruited third-year students of Institut Agama Islam Negeri Salatiga, Mathematics Education Study Program, with a population of 56 students to participate. Population technique was employed to determine the research sample. It indicates that all the population become sample.

The instrument used in this study was self-directed learning questionnaire. The questionnaire used in this study was a type of closed questionnaire, where respondents were given a series of questions and each question had been given a clear alternative answer. The questionnaire given sought to determine the self-direction learning of the respondents after carrying out numerical learning activities for one semester. The scale used in this study was a modification of the four-Likert scale. Modifications on the scale intended to anticipate that respondents' responses did not possess multiple interpretations. The advantages of the four-Likert scale can capture the respondents' responses more accurately. With a scale of four, respondents could not choose the doubtful option because the respondents' responses would have a tendency to the left or right. Thus, the four scale can also minimize the lack of doubtfulness of respondents in filling out a questionnaire.

Data obtained from the questionnaire were then be reduced. Data reduction aims to sharpen and organize data so that final conclusions can be drawn. Moreover, the obtained data were be analyzed using the following categories:

Table 1. 4-Point Likert Scale

Categories	Reference	Categorization
Low	$X < \mu - 1.\sigma$	$X < 65$
Medium	$\mu - 1.\sigma \leq X < \mu + 1.\sigma$	$65 \leq X < 91$
High	$\mu + 1.\sigma \leq X$	$91 \leq X$

The data obtained were reduced and then categorized into a 4-Point Likert Scale categorization. After that the results of the categories will be analyzed in depth and described in detail. In addition, indicators of self-directed learning were analyzed to determine what indicators actually provide the greatest influence on students' self-directed learning.

B. DISCUSSIONS

Some people misinterpret the definition of self-directed learning. The term is not the same as learning alone. Conversely, self-directed learning has a deeper meaning than just learning alone. It is the ability to see one's potential, and is the result of hard work not talent. Self-directed learning can be interpreted as a process that occurs continuously in a person in order to construct cognitive, affective, and psychomotor skills (Sugandi, 2013, p. 144).

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Self-directed learning is a representation of a student's ability to work independently in exploring learning information from various sources. Students are expected to find alternative solutions through various learning media. Thus, the position of the teacher as the source of all information can be transferred by other learning resources.

This point may speak to Basir in H. Suhendri (2015) that self-directed learning is a learning process that occurs in a person, and in his efforts to achieve the learning goals that person is required to be active individually or not dependent on others, including not dependent on the teacher. Heri Suhendri (2011) defines self-directed learning as a learning activity carried out by students without relying on help from others both friends and teachers in achieving learning goals, namely: mastering material or knowledge well with students' own awareness and applying their knowledge in solving problems in everyday life.

Meanwhile, it also agrees with Dhesiana in (H. Suhendri, 2015, p. 7) that defines self-directed learning as the nature and attitudes and abilities of students to carry out learning activities alone or with the help of others based on their own motivation to master a certain competency so that it can be used to solve problems encountered in the real world. H. Suhendri (2015) views self-directed learning as a learning activity carried out by students without relying on others both friends and teachers in achieving learning goals, namely: mastering the material or knowledge well with students' own awareness and applying their knowledge in solving problems. Students' self-directed learning has certain characteristics that can be observed by others.

Self-directed learning is the behavior of individuals who are able to take the initiative, able to overcome obstacles or problems, have confidence and can do things themselves without the help of others. It takes student's self-directed learning, both alone and with his friends to develop the potential that exists within each student. Students are said to have been able to learn independently if they have been able to do the learning task without being dependent on others. Self-directed learning makes students trained and have the habit of doing good actions and can manage every action so that students have discipline in the learning process.

Self-directed learning is an encouragement that comes from within him to take an action, where the action is the responsibility of himself. The indicators of self-directed learning used in this study involved (a) having the ability to determine their own destiny, (b) creative and initiative, (c) responsible, (d) able to hold back, (e) make their own decisions, and (f) able to overcome problems (Subekti et al., 2015).

Subekti et al. (2015) asserts that self-directed learning is still a problem in learning mathematics. Situated at higher education institutions, self-directed learning becomes a major demand for students because they will be active without relying on others. It can be sought from within and support from external factors. To increase self-directed learning, students must be able to communicate problems well. With good communication, the message or meaning will be conveyed properly.

It also confirms Sumarno (2012, p. 24) that describes three steps in working toward self-directed learning, namely: observing and supervising oneself, comparing the position of oneself with certain standards, and giving their own response to themselves whether positive or negative responses. To see someone's self-directed learning, there are several indicators that can be used including learning initiatives, diagnosing learning needs, setting learning goals, managing learning, and viewing difficulties as challenges,

exploring relevant sources, appropriately choosing learning strategies, and evaluating learning processes and self-concept (Sugandi, 2013).

Ranger (1990) asserts that a person is said to be independent if he/she 1) work themselves physically, 2) think for themselves, 3) arrange expressions or ideas that are understood by others, and 4) do activities by himself emotionally. Three characteristics contained in the understanding of self-directed learning cope with (1) individuals design their own learning in accordance with the needs or goals of the individual concerned; (2) individuals choose strategies and carry out their learning designs; and (3) individuals monitor their own learning progress, evaluate their learning outcomes, and compare with certain standards (Sumarno, 2012, p. 26).

Students should be conditioned without pressure, force, or violence from education in the process of developing their potential self-directed learning (Anzora, 2017, p. 11). Through humanistic learning theory, students can be managed in the conditions as desired by Anzora. Furthermore, (Anzora (2017) also revealed that the theory of humanistic learning in its implementation was responded positively by students.

Heri Suhendri (2011) mentions the self-directed learning as an important element in learning mathematics. There are many learning resources that can be accessed by students both with the guidance of lecturers and without lecturer guidance. Learning resources include the environment, the internet, books, experiences, and others. Students who have high creativity tend to feel insufficient about the teaching material delivered by lecturers in face-to-face meetings in class so that they look for information from outside. This condition forces students to increase knowledge from the outside world. Therefore, the self-directed learning is also very important in mathematics learning activities. Nonetheless, practically, there are still many students who depend on the teacher in terms of learning resources. They rely on material provided by lecturers, even though they have textbooks that can be engaged. In addition, most students rely more on the work of their friends, especially during exams both in daily tests and in joint exams.

Students who are independent in learning have the responsibility to monitor themselves in any aspects, both in achieving a goal, and in focusing on what is assigned to them. Students' self-directed learning is indicated by the ability of students to know how they learn and know the learning strategies used so that the learning process will come out as optimal results. The success of students in learning mathematics is determined by the self-directed learning from each individual. Student abilities achieved after learning experience is one of the learning outcomes (Sudjana, 2013, p. 6).

It also confirms Ningsih et al (2017, p. 5) stating that students who get blended learning show higher levels of self-directed learning than students who get regular learning. Increased self-directed learning of experimental class students is in the medium category. Problem-based learning can also be an alternative to improve mathematics self-directed learning. This is in line with the study results conducted by Jumaisyaroh et al. (2015, p. 11)reporting that the increase in students' self-directed learning who were given problem based learning was higher than those who were given direct learning. Jumaisyaroh's research also implies that direct learning is less effective when it is used to develop mathematics self-directed learning. In learning mathematics, self-directed learning is needed. This is due to the nature of mathematics, namely: the truth based on logic, abstract objects, the ability to count and think logically, and meaningful application.

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It demonstrates that students who have high self-directed learning in mathematics tend to achieve higher learning outcomes.

Indicators of self-directed learning in this study deal with 1) having a strong desire or desire to learn for self-improvement, 2) being responsible for every learning activity, 3) being able to take decisions and initiatives to deal with problems, and 4) having self-confidence and carrying out tasks independently. These four indicators of self-directed learning are then formulated into statements in the self-directed learning questionnaire. Details of the statement can be seen in Table 2:

Table 2. The details of self-directed learning indicators

No	Indicators	Items
1	Having a strong desire or willingness to learn for self-improvement	1. When reading the title of the new learning material, I feel interested to read it to the end 2. When the lecturer gives the opportunity to ask questions, I leave it to that opportunity, even though there is material I don't understand 3. I submit a proposal / objection to the lecturer's answer, because his answer is not in accordance with what I have read and learned from the book 4. Every time there are problems in understanding the subject matter, I ask other people who know better 5. After reading the entire contents of the material from the book, I can draw conclusions from the contents of the learning material. 6. Every time there is a difficult assignment / quiz / exam, I cheat from a book or glance at a friend's job. 7. To the opinions of friends who are different from my opinions, I accept these differences of opinion.
2	Being responsible in every learning activity	1. I am very enthusiastic when receiving new material taught by the lecturer. 2. When electronic media (TV/Youtube and the like) broadcast something that is related to the lecture material, I am interested to watch the show to the end. 3. I spend my free time on campus to visit the library 4. When the class is cancelled, I use the time to hang out with friends. 5. When there is a group assignment given by a lecturer, I do the assignment with my friends 6. If there are new terms / vocabulary that I do not understand, I immediately look them out in references in books in the library or ask the lecturer
3	Being able to make decision and take initiative to	1. I believe in my own ability that I will be successful and get good grades in the exam 2. If there are difficulties in learning, I am able to overcome the problem myself without the help of others

	overcome problems	3. Whatever suggestions / input from others for the improving my learning achievement, I want to accept it, even though it came from a junior class. 4. I realize if I have weaknesses in mastering certain subject matter that I think is difficult. 5. By joining study group, I am optimistic that my learning achievement will improve 6. After the quiz / exam, I will try again to answer the test at home
4	Having self-confidence and do the assignment independently	1. I want my learning achievement to be better than my friends 2. To improve my achievement, I diligently attend tutoring outside of school 3. Way before the semester exam, I study regularly for 2 hours every day at home 4. In order to get better grades than last semester, I tried to be more active and concentrate in following the class 5. When there are additional lectures held by lecturers, I join them. 6. I want to get the best grade in class in every exam 7. I am optimistic that in the next semester exam I will perform better than last semester.

Sugandi (2013) explained that there was no interaction between one's initial abilities and self-directed learning. This means that self-directed learning does not depend on the initial ability of the person. Thus, to measure self-directed learning, there is no need to measure one's initial abilities first. The learning approach is more important in influencing the one's self-directed learning. Sugandi (2013) suggests a number of learning approaches that can be used to improve one's self-directed learning, namely the problem-based approach with a Jigsaw cooperative setting. Haerudin (2013) also offers a SAVI (somatic, auditory, visual, and intellectual) approach to improve self-directed learning in mathematics. The SAVI approach optimizes the use of all senses in learning activities. With the SAVI approach, students do the activities of listening, reading, listening, reflecting on themselves, saying things, doing actions, and using intelligence. Such a learning approach according to Haerudin can facilitate students in communicating mathematics and optimizing their reasoning so that it can easily absorb the learning material and ultimately foster high self-directed learning. The interaction between self-directed learning and learning outcomes was also shown by Purwanto (2014). Purwanto's study proposed that high self-directed learning tended to lead to satisfying mathematics learning outcomes.

The results obtained on the percentage of students' self-directed learning in numerical mathematics can be noted in Figure 1.

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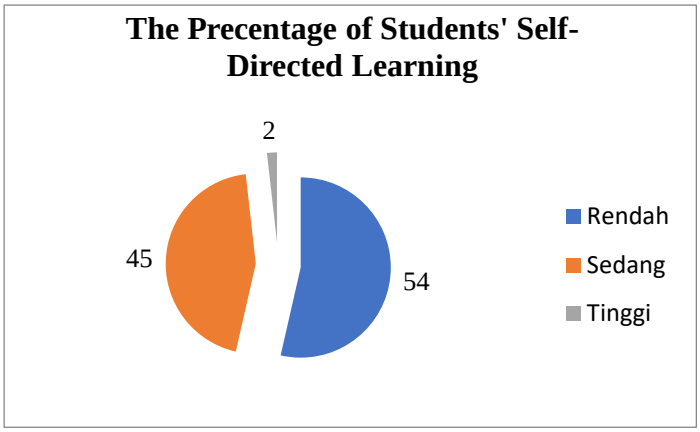

Figure 1. The Percentage of Students' Self-directed Learning Numerical Mathematics

Figure 1 illustrates that most of the students had low self-directed learning by 54%. The percentage of students who possessed moderate self-directed learning was 45%. Meanwhile, the students who demonstrated high self-directed learning were only 2%. This finding reveals the need for re-formulation related to the learning model used by numerical method course. Likewise, low self-directed learning is very likely to affect student learning outcomes.

Table 3. The Classical Score of Students' Self-directed Learning

No	Indicators	Maximum Score	Obtained Score	Percentage
1	Having a strong will to study for self-improvement	1568	1171	75%
2	Being responsible in every learning activities	1344	842	63%
3	Being able to make decision and take initiative to overcome problems	1344	775	58%
4	Having self-confidence and do the assignment independently	1568	817	52%
	Total Score	5824	3605	

Table 3 shows that the fourth indicator received the lowest percentage of 52%. This means that students still find it difficult to build self-confidence and carry out tasks independently. The third indicator attained the percentage of 58%, where students can make decisions and initiatives to deal with problems. The second indicator obtained the percentage of 63%, whereas the first indicator achieved the highest percentage of 75%.

Respondents actually had the initial skills to improve their self-directed learning. This can be observed in indicator 1, which has a strong desire to learn for self-

improvement. The 75% percentage was enough for respondents to make an effort to achieve self-directed learning. The respondents already had a strong desire to learn and to improve themselves. In reality, this strong initial skill has not shown satisfactory results. The level of responsibility of respondents in carrying out their duties was at the percentage of 63%. This result implies that this raises a concern because the performance aspect of self-directed learning was still relatively low.

In terms of decision making, respondents also did not have enough courage. A score of 58% was enough to show that respondents had not been able to take decisions and initiatives to overcome problems. Respondents were still looking for direction from the lecturer in their decision making process. In addition to the individual learning model, respondents had not been able to decide everything carefully. Respondents dared to make decisions when learning was conducted in a group. With the group model, the respondents felt that responsibility for decisions was held by the group to make decisions. Further learning should be designed so that students were able to take initiative and decisions independently in a variety of learning situations.

The level of confidence of respondents was still in the low category of 52%. The respondents did not have the confidence to carry out their tasks independently. Student independent assignments were still strongly indicated that the assignment was the result of collaboration with other friends. Another indication that student assignments were carried out the same or similar to assignments of students from other classes. This needs special attention from the lecturer. Assignments given should be different tasks in each class. However, the task is still in the same questions or assignments with an equal degree of difficulty.

Based on the data, the most important thing to improve student self-directed learning is to improve student confidence in doing tasks independently. Some possible efforts including students being encouraged to maintain a healthy competition atmosphere to achieve high achievements. In addition, lecturers can provide the widest possible opportunity for students to openly express questions or answers and give reasonable appreciation to student questions and answers. In addition, students with authentic work are given special appreciation even though the grades are not optimal. Thus, it is expected that students will not be afraid to do assignments independently because whatever they do will get appreciation from the lecturer. Likewise, thorough attention is required for students' works that have similar patterns of answers that indicate the results of 'cheating' from other friends. Such punishment may create a deterrent effect on students so that in the future the student will no longer copy paste the answers of his/her classmates and can maximize his/her potential to do the assignments given by the lecturer.

Student independence in terms of decision making and initiatives to deal with problems also need to be improved. Several methods can be done to improve this issue, including providing advice and constructive input to students in need, conducting diagnostic tests to measure the students' weaknesses, implementing cooperative learning

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(peer teaching, Jigsaw, and other cooperative learning models), and providing a review of student answers after completing assignments/quizzes/exams/exercises. This suggests that these methods are likely to increase students' self-confidence when making decisions and taking the initiative in solving numerical problems of mathematics.

C. CONCLUSION

The present study highlights that the students' self-directed learning in numerical mathematics was still relatively low. 54% of respondents showed low self-directed learning, 45% of the respondents had moderate self-directed learning, and 2% of respondents possessed high self-directed learning. The indicators that get priority scale for special treatment in the context of increasing self-directed learning were the fourth indicator with the percentage level of 52% that is having confidence and carrying out tasks independently, then followed by the third indicator of 58%, which is capable of making decisions and initiatives to face a problem. This study recommends further research to foster students' self-directed learning by prioritizing the fourth and third indicators. In further numerical learning, it is expected that university teachers should be able to provide learning designs that escalate a great opportunity for students to explore themselves optimally. Likewise, cooperative learning models with a combination of constructivism paradigm could be designed to build students' self-confidence.

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