Using moodle to improve self-directed learning of mathematics in vocational school

B R Takaendengan¹ and R H Santosa²
¹Mathematics Education, Postgraduate Mathematics Education Program, Yogyakarta State University, Depok, Sleman, Yogyakarta, Indonesia.
²Department of Mathematics Education, Faculty of Mathematics and Natural Science, Yogyakarta State University, Depok, Sleman, Yogyakarta, Indonesia.

bertutakaendengan93@gmail.com

Abstract. This research aimed to find the effect of using moodle on self-directed learning at mathematics students of 11th grade in SMK N 1 Bitung. This research was a mix method between qualitative and quantitative methods. Instruments used in this research were a self-directed learning questionnaire, observation sheets and interview sheets. The subject was thirty two students of class XI of Computer Network Engineering (CNE). The result of this research is an increase of self-directed learning mathematics after using moodle in studying mathematics. Aspects of self-directed learning that improve are: (1) students are more active in learning mathematics; (2) students have more initiative in learning mathematics; (3) students are more independent in learning mathematics.

1. Introduction

Internet users in the world is increasing, based on the data of Internet World Stats (IWS), from 2000-2017 internet users are increasingly evolving nearly 1000 % and the biggest percentage of internet users is in Asia attaining 55% [1]. The raising of internet users globally also have an impact on the raising of internet users in Indonesia. Based on the data of Association of Internet Service organized in Indonesia (APJII) internet users in Indonesia attain 51.8 % of the total resident. Furthermore, APJII states that percentage of students that use internet attains \( \approx 70\% \). It shows that almost all students in Indonesia are internet users [2]. The using internet can facilitate us to get information because using network wireless, laptop, smartphone will enable us to access information and connect with people around the world [3]. Furthermore, our challenge is how to utilize the internet in educational sectors especially in mathematics learning. The distance between students’ everyday experiences and their experiences in school may diminish if the Internet becomes accepted in the schools. It is very possible that, if we bring the Internet into the classroom, we will bring more technology into schools. We may start to think that maybe it is time to bring schools into technology [4]. Technological advances have had an impact in education, learning using the internet technology will make teachers easy to get closer to students and can increase students’ participation to improve their knowledge [5]. Students in this current generation are expected to utilize available resources by using technology to solve challenging tasks and soon get a feedback when needed like having difficulties to understand learning materials [6]. Some schools have introduced and provided teaching-learning activities via online. But even so, many teachers tend to transfer what they had done on their class to online environment, as a
learning result does not work optimally [3] and then the most of Indonesian internet users using internet for update status on social media [2] do not use internet as a media for learning especially in mathematic learning, whereas using internet in learning mathematics has many benefits, for example improving self-directed learning student [7].

Based on Undang-Undang number 20 of 2003 about National Education System, Indonesian national education knows elementary and middle level which consist of nine years at elementary level and three years at middle schools level [8]. In middle level there is vocational school (SMK). The main goal of education is preparing students to work on self-directed learning. The vocational education is an effort to improve human resources as manpower, maintenance, acceleration, and quality of certain manpower in order to raise the productivity of society [9]. Problems of learning mathematics in SMK are that teachers have difficulties to plan the whole subject matter because the lesson of mathematics in the classroom is reduced by the field work program (PKL), an assignment in the form of the Student Worksheet or the portfolio is considered less effective because students have difficulties to understand a subject matter, interact or communicate with teachers and also teachers have difficult to control the learning without any face to face so that the objectives of learning mathematics are difficult to achieve. In addition, students are accustomed to rely on teachers to solve problems in difficult categories, and also students tend to be unsure with their answers. This indicates that the independence of student math learning is low. Self-directed learning is one of the important skills that must be mastered by students because one of the main challenges for 21st century learners is to be able to learn from many resources such as web, lectures, textbooks etc. and master complex ideas that often develop so that independent-learning skill is an effective way to help them meet the 21st century challenges [10].

Using Platform moodle in learning can facilitate students to increase self-directed learning. Moodle is a free learning platform software having some features that can be used in learning [11]. MOODLE is a learning means that can facilitate students to improve their knowledge as a result of active and collaborative activities during learning processes. It can support learning in various ways, for example it allows teachers to be creative in providing various sources of learning for students and also improving students’ learning flexibility to optimize their learning potency [12]. Using Moodle can give student a chance to have an active communication with teacher without meeting up in a class so that learning can run flexibly. Moreover, teacher can upload learning materials that can be a learning source for students everywhere and everytime. Using moodle in learning hopefully will increase self-directed learning student. So the aim of this paper is to discuss whether using moodle will improve Self-directed learning student especially on mathematic learning in vocational school.

2. Experimental Method
This research type was mix method between qualitative and quantitative research. Instruments used were questionnaire of self-directed learning, observation sheet and interview sheet. Non-test instrument in the form of a questionnaire used in this research was to measure self-directed learning in mathematics consists of 20 questions in form of checklist using likert scale. Indicators of self-directed learning in this research included: activeness, discipline, independence, initiative, responsibility. Questionnaire of self-directed learning had been validated by two lecturers of Yogyakarta State University and it was reasonable to be used.

This research was conducted in the even semester of 2017/2018, precisely in February 2018 with 4 times of meeting. The subject was 32 class XI students majoring in Computer and Network Engineering (TKJ), this class was chosen because the students of TKJ have become accustomed of using internet technology which was appropriate with their skills so researcher did not need to give more explanation about how to use platform moodle.

The steps in this study include:
1. provide a questionnaire to determine the initial conditions of student self-directed learning mathematics before treatment
2. perform treatment by applying experimental learning using platform moodle
3. provide a questionnaire to determine the final condition of student self-directed learning on mathematics after treatment

Data analysis used in this research was percentage and gain test to measure student self-directed learning improvement.

3. Result and Discussion

The application of mathematics teaching-learning using platform moodle and designed by researcher provides: learning material, book source, video learning, and assignment either individually or group and all of them can be accessed and downloaded by all students.

The result of pre-test of 32 students of class XI vocational school majoring TKJ is shown in table 1

| Interval     | Criteria | Frequency | Percentage (%) |
|--------------|----------|-----------|----------------|
| 80-100       | Very High| 0         |                |
| 66.67 - 80   | High     | 4         | 12.5           |
| 53.33 -      | Medium   | 11        | 34.37          |
| 66.67        |          |           |                |
| 40 – 53.33   | Low      | 17        | 53.13          |
| 20-40        | Very Low | 0         |                |
|              |          | 32        | 100%           |

From the table 1, known that more than half of students’ scores in pre-test (53,13) is in low criteria. This indicates that students in this level have reached self-directed learning that is not optimal. Furthermore the result of post-test is shown in table 2.

| Interval     | Criteria | Frequency | Percentage (%) |
|--------------|----------|-----------|----------------|
| 80-100       | Very High| 16        | 50             |
| 66.67 - 80   | High     | 12        | 37,5           |
| 53.33 - 66.67| Medium   | 4         | 12.5           |
| 40 – 53.33   | Low      | 0         | 0              |
| 20-40        | Very Low | 0         | 0              |
|              |          | 32        | 100%           |

From table 2, known that a half of students’ scores in post-test (50) is in very high interpretation. This indicates that students in this level have reached the optimal level of self-directed learning in each aspect (75%-100%), in other words, students in this level have a very high level of self-directed learning. Furthermore based on the result of observation and interview with some students, using platform moodle in learning mathematics can facilitate students to understand materials taught because students can access the subject matter, communicate or discuss about it with teacher and other students by online.

After doing the pre-test and post-test and getting the data, researcher did the gain test to find the improvement of students’ self-directed learning level. Furthermore, the comparison of gain test is shown in table 3.
Table 3. Result of Gain Test Self-directed Learning.

| Interval | Criteria | Frequency | Percentage (%) |
|----------|----------|-----------|----------------|
| ≥ 0.7    | High     | 14        | 43.75          |
| 0.3 - 0.7| Medium   | 15        | 46.87          |
| < 0.3    | Low      | 3         | 9.38           |
|          |          | 32        | 100%           |

From table 3, known that from 32 students, there are 14 students (43.75%) get improvement (gain) with high interpretation, 15 students (46.87%) get improvement (gain) with medium interpretation, and the other three students (9.38%) get improvement (gain) with low interpretation. The gain test result shows that all students get improvement in self-directed learning. If reviewed on each aspect of self-directed learning, the result of gain is shown in table 4

Table 4. Result of Gain Test Self-directed Learning on each Aspect.

| Aspect    | Index Gain | Criteria |
|-----------|------------|----------|
| Activiness| 0.71       | High     |
| Discipline| 0.19       | Low      |
| Independent| 0.72      | High     |
| Initiative| 0.7        | High     |
| Responsibility| 0.21 | Low      |

From table 4 self-directed learning improvement is attained by students in each aspect. Activeness, independence, and initiative aspects have increased in the high criteria. Nevertheless there are still aspects of self-directed learning that need to be improved namely discipline and responsibility.

According to the result of this study, using platform moodle can improve self-directed learning of mathematics. The web using makes students easy to access information related to learning materials being studied as long as it is connected to an internet network, each student is given an username and a password in order to access the learning web so that students can obtain the information that can be accessed inside or outside classroom as shown in figure 1. Using moodle allows students to be actively involved in learning by utilizing each moodle context (forums, chat and others) so that it can increase student and teacher participations that can help improve the learning quality [13]

Figure 1. Display of learning web.
Furthermore, the student tasks both independently and in groups are collected online so that this can increase the learning time allocation in the classroom as shown in figure 2. Moreover, the learning web provides a means of online discussion to help students who have difficulties in learning.

![Figure 2. Collection of online tasks and examples of student work.](image)

The use of internet technology in learning can facilitate the development of students' mathematics learning independence because it provides online content components that can enable students to learn anywhere and anytime so that the material presented online can be used by students to be learned independently [14]. This gives students an opportunity to access learning independently so that the teachers do not become the only source of information.

This result of this research is consistent with some previous researches such as Amandu, Mulira, and Fronda research showing that using moodle platform on student on college can increase self-directed learning student [15], that consists with Caridade & Rasteiro (2016) resulting that using moodle can facilitate development of self-directed learning [16]. The aspects of self-directed learning improved in high criteria were activeness, independence, and initiative because the moodle platform provides a variety of learning resources so students can learn anywhere and anytime as long as there is an internet connection so that they have flexible time to develop their knowledge and then they can actively communicate to both teachers and fellow students when having difficulties to understand the material being studied.

Besides, there are discipline and responsibility aspects with low criteria because there was not a lot of evidence that students accessed these resources on a regular basis, unless instructed to do so [17] and then this study was limited to 4 meetings, so it was not enough to change the students’ habits in the discipline and responsibility aspects. This result was supported by the observation result which shows that students did not collect the tasks on time and also during the learning process in the class there were students who chatted things not relating to the subject matter being studied.

4. Conclusion

Teacher should be able to facilitate students to learn independently by providing many learning sources that can be accessed by students everywhere. Based on the result of this research, we can conclude that learning with using moodle can improve self-directed learning in mathematics. The aspects of self-directed learning that improve are: (1) students are more active in learning mathematics; (2) students have more initiative in learning mathematics; (3) students are more independent in learning mathematics.

5. References

[1] Internet World Stats 2017 World internet usage and population statistics retrieved 29 December 2017 from: http://www.internetworldstats.com/stats.htm
[2] APJII 2016 penelitian & perilaku pengguna internet di Indonesia: survey 2016 (Jakarta: APJII) p 6-15
[3] Stein J and Graham C R 2014 Essentials for blended learning (New York: Routledge) p 9-11
[4] Borba M C 2009 ZDM Math Edu 30 464
[5] Guillen-Gamez D, Mayorga- Fernández M, and Alvarez-Garcia F J 2018 Technology, Knowledge and Learning 23 2
[6] Khlaisang J and Songkram N 2017 Tech Know Learn 23 2
[7] Supriani 2016 J. Ilmiah Pend. Mat 1 210
[8] Undang-undang Republik Indonesia No.20 Tahun 2003 tentang Sistem Pendidikan Nasional
[9] Clarke L and Winch Vocational education international approach, development and system (New York: Routledge)
[10] Weerasinghe A, Mitrovic A, Mathews, Holland and Elmadani 2008 Supporting self-directed learning skills in learning management systems in research gate Intelligent Computer Tutoring Group (New Zealand: University of Canterbury) p 1
[11] Moodlerooms 2017 About moodle retrieved 20 January 2017 from http://www.moodlerooms.com
[12] Jackson A J 2015 Educ Inf Technol 23 9-10
[13] Rodrigues P A, Brandao L O, and Brandao 40th ASEE/IEEE frontiers in Education Conference (Washington DC) session T1A-1 p 1
[14] Carman J M 2005 Blended learning design p2 retrieved 15 January 2018 from: http://www.agilantlearning.com/pdf/blended%20learning%20Design.pdf
[15] Amandu G, Muliiira J, and Fronda D 2013 Procedia - Social and Behavioral Sciences 93 677 – 683
[16] Caridade C and Rasteiro D 2016 Lesson moodle for a self-directed learning of mathematics in The 18th SEFI mathematics working group seminar on Mathematics in Engineering Education (Gothenburg) p 69
[17] Muir T 2014 Math Ed Res J 26 17