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Validation of Learning Management System (LMS) of E-Problem-Based Learning Based on Scientific Communication Skill and Plagiarism Checker

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Abstract— This research aims to obtain the feasibility of Learning Management System (LMS) of E-Problem Based Learning (PBL) based on scientific communication skills and plagiarism checker. The type of research is Research & Development. The subjects of this study are experts and practitioners of information technology and students of graduate program in Madrasah Ibtidaiyah Teacher Education, using Natural Sciences learning materials. The research instrument is a Likert scale questionnaire. Data is analyzed by calculating the average results of the validation of three experts/practitioners, then the average results is interpreted through categorization and description of the results of plagiarism checker. The results show that the average expert/practitioner assessment of the feasibility of LMS prototype of E-PBL using scientific communication skills and plagiarism checker with the aspects of rationality, user friendly, user interface, prototype characteristics, website dashboard, semester learning plans, stages of running prototype, and evaluation is obtained by the average score of 4.78 (very valid). The results of the implementation of plagiarism checker in the LMS E-PBL obtain an average unique increase of 8.30%. Thus, the LMS E-PBL based on scientific communication skills and plagiarism checker is feasible to be implemented in learning. This research can contribute the findings of a website-based-learning LMS platform that is adaptive to problem-based learning and plagiarism checker, so that students can learn in groups independently under the teacher's guidance without doing plagiarism.

Keywords— e-PBL, LMS, plagiarism checker, validation

1. INTRODUCTION

Scientific communication skill is an important part of learning Natural Science in the era of Industrial Revolution 4.0. The government of the Republic of Indonesia gives serious attention to this matter, as seen by the issuance of Permenristekdikti No 44 of 2015. It concerns on the National Higher Education Standards (SN Dikti), with one formulation of learning outcomes that is able to arrange ideas, results of thinking, and scientific argument responsibly and based on ethics academic. All of them are spread through the media to the academic community and the wider community. This is very much related to scientific communication skill. Therefore, learning system in the level of college or university must facilitate students to achieve the learning outcomes. In addition, now universities are also faced with the rapid development of information and communication technology or digital. Thus, universities should also facilitate students in learning scientific skills in accordance with the development of information and communication technology or digital. Prospective teachers of Natural Sciences must be equipped with scientific communication skill in the era of Industrial Revolution 4.0. Scientific communication skill plays a role in delivering ideas, opinions, activity process, results, conclusions, and recommendations from sources of information to the recipient [1]. If the

students that will become the Natural Sciences teachers master scientific communication skill by utilizing information and communication technology or digital, carrying out learning will not encounter difficulties. Scientific communication becomes a competency in learning Natural Sciences in Junior High Schools, namely communicating the results of observation and experiment verbally through various media, in the written reports using correct writing standard. One learning model that can be used to practice scientific communication skill is Problem-Based Learning (PBL) [2]. Problem-Based Learning model uses authentic and meaningful problems as a starting point for acquiring new knowledge [3, 4, 5]. Problem-Based Learning model has syntax, namely (1) leading to problems; (2) organizing for learning; (3) assisting independent and group investigation activities; (4) developing and presenting results; and (5) evaluating problem solving [6]. However, PBL model has disadvantage, that is, it will be effective if the basic concept has been mastered [7], require proper cognitive assistance [8] and require proper knowledge representation [9].

Based on the description in the previous paragraphs, Problem-Based Learning model is developed to improve scientific communication skill for students of prospective Natural Science teacher in the era of Industrial Revolution 4.0, called E-Problem-Based Learning based on Scientific Communication Skill. The development of Problem-Based Learning model is based on its weaknesses, namely by mastering the concepts and cognitive assistance in representation, as well as the support of information and communication technology or digital. The development of E-Problem-Based Learning is certainly done through some stages, one of which is Learning Management System (LMS). LMS becomes very important in online learning and the development of LMS can effectively increase learning activities [10, 11]. This research aims to obtain the feasibility of Learning Management System (LMS) of E-Problem-Based Learning based on Scientific Communication Skill and plagiarism checker according to the needs of prospective Natural Science teachers in the era of Industrial Revolution 4.0. LMS prototype in developing E-Problem-Based Learning, based on Scientific Communication Skill, consists of three main aspects, namely (1) planning, (2) implementing, and (3) evaluating. The novelty of this research is a website-based learning of LMS platform that is adaptive to problem-based learning and plagiarism checker on line <https://smallseotools.com/plagiarism-checker/>. Thus, students can learn in groups independently under teachers' guidance, and they can make the learning report without doing plagiarism. This is in line with relevant research that the integration of information technology and learning communication is needed in the current era [12].

2. Literature Review

2.1 Learning Management System (LMS)

Learning Management System (LMS) is a website-based software application designed to handle learning contents, student interactions, assessment tools, and reports on students' learning progress and activities [13]. LMS can make students easier to find a menu of learning procedures and learning contents. Learning content, interactions, and online learning activities can be accessed in LMS. Online learning system can have a positive effect by achieving higher learning outcomes in students [14]. LMS can be made according to the needs in uploading assignments, questions, and discussions. LMS is recommended for institutions to be used in accordance with the specifications required [15].

2.2 Scientific Communication Skill

Scientific communication is important and integral to the practice activities of the Natural Science. The practice activities of Natural Sciences not only include experimentation, but also are closely related to scientific communication [16]. Scientific communication becomes the essential meaning of scientific activities. Scientists carry out complex scientific communication to present their findings using graphs, pictures, and tables. They symbolically represent or access information scientifically [17]. Several studies

have shown the process of communication in learning Natural Sciences using multi representations in the classroom [18, 19, 20]. Previous researches reveal that there is little emphasis on communication in learning through multi representations [21]. Therefore, it more is done to help students understand multimodal texts as part of learning scientific practice. The results of experiment activities can be presented in the form of research reports, articles, or essays. The findings can also be delivered to others verbally. Illustration scommonly used are with pictures, models, tables, diagrams, graphs, and histograms that can be read by others. The skill of communicating findings is a fundamental skill required in learning Natural Sciences. Effective scientific communication is an important part of learning Natural Sciences. The results of the study reveal that scientific communication improves learning outcomes and supports the mastery of Natural Sciences contents [22]. Scientific communication skill has several indicators. In this study, scientific communication skill adapted from Levy, Eylon, & Scherz consists of: (1) identifying the ability to obtain information; (2) being able to state everyday events in language or scientific symbols, (3) contributing ideas in group work; (4) explaining ideas and tasks in making products/ reports; and (5) communicating products or work results/reports [23]. The role of scientific communication in learning Natural Sciences shows that communication skill is very necessary, and students can practice communication through learning Natural Sciences. Moreover, learning Natural Sciences will be interesting and challenging if the learning process can produce the skill needed, namely communication [24]. The results show that there are generally derived theoretical elements for effective scientific communication in the fields of science, communication, education, and scientific communication of science. These elements are closely in line with the skill of each of these fields and provide useful learning resources for curriculum development to achieve the objectives of scientific communication [25]. The results of other studies also show that the implementation of the open-inquiry wave experiment model is effective for developing scientific communication skill of Physics students [26].

2.3 Learning Process in the era of Industrial Revolution 4.0

Nowadays, education is facing technological development, better known as the era of Industrial Revolution 4.0. There are anti-mainstream things of all living systems previously considered to have been established, including education. There are several challenges in the administration of education, which are focused on learning. The challenge includes supporting infrastructure and mastery of technology to support learning. Various information and communication technology devices that are increasingly sophisticated, such as smartphone, tablet computer, and ipod, can currently be used to support mobile learning process. Learning model in the era of Industrial Revolution 4.0 must facilitate the students of prospective Natural Sciences teachers to utilize the device. Thus, it will become a habit, which can enhance their skills in modern learning. The prospective teachers will need to have skills that will be transferred by the prospective teachers [27].

2.4 Quality of Learning Model

Learning model provides instructions for the learning process [28]. Learning model is a guide for teachers to carry out learning activities, which has a theoretical foundation or foundation of thought about the learning objectives to be achieved, teaching behavior, and learning environment. Based on the understanding of learning model, learning model is a guide for planning and implementing learning activities, achieving learning objectives, and becoming guidelines for creating a learning environment. Learning model has special characteristics. A good learning model has syntax, social system, reaction principle, support system, instructional impact, and accompaniment impact. Syntax is the stages or sequence of learning activities. Social system is a situation, norms, and atmosphere in the learning model. Reaction principle is a pattern of activities that illustrates how the teacher should see and treat students, including how to respond to students. Support system includes all the tools needed to implement the model. Instructional impact is a learning outcome achieved directly by directing students to the expected, and the accompanying impact is another learning result

produced as a result without direction [29]. Based on the explanation above, the components of the learning model include syntax, social system, reaction principle, support system, instructional impact, and accompaniment impacts. Learning model with a good quality must meet three requirements. The first one is validity, which is content validity related to the development needs and state-of-the-art, and construct validity related to logically designed aspect. The second one is practicality, which is a learning model that can be used in real terms in the setting that have been designed. The third one is effectiveness, which is the use of learning model that produces the expected effects [30]. Based on the description above, learning model that will be developed has three criteria. The first one is validity, consisting of content validity (describing the need for model development and the existence of novelty of knowledge) and construct validity (describing the consistency between components of the learning model, syntax, social system, reaction principle, support system, instructional impact, and accompaniment impacts. The second one is practicality, which is implementing the components of learning model during the learning process by lecturers and students, as well as learning constraints that can be taken with a good solution. The third one is effectiveness, which is the impact of implementing learning model in accordance with the objectives.

3. Research Method

3.1 Research Design

The type of this study is research and development (R&D) with stages including preliminary phase, prototype phase, and assessment phase [31]. This R&D is carried out through some stages. The stages of this research are done to obtain the feasibility of LMS in the development of E-PBL based on scientific communication skill and plagiarism checker.

3.2 Research Subject

Subjects of this research are the lecturers of the Study Program of Natural Sciences Tadris in the Indonesian Natural Sciences Tadris Lecturers Association, namely the tadris lecturers of Natural Sciences of IAIN Salatiga, IAIN Ponorogo, IAIN Kudus, Bengkulu IAIN, IAIN Ambon, IAIN Jember, IAIN Syekh Nurjati Cirebon, UIN Sunan Ampel Surabaya, UIN Suska Riau, and UIN Mataram.

3.3 Types of Data

The types of data used are qualitative and quantitative data. Quantitative data is obtained from the percentage of need assessment questionnaire, prototype assessment of LMS E-Problem-Based Learning based on scientific communication skill. Qualitative data is obtained from open questionnaire answers about LMS E-Problem-Based Learning based on scientific communication skill, opinions of science experts, and IT experts on products in the form of descriptive critiques and suggestions from the evaluator.

3.4 Instruments of Data Collection

The research instruments used to collect data are Likert scale questionnaire, open questionnaire, and format of prototype discussion note of LMS E-Problem-Based Learning based on scientific communication skill and plagiarism checker.

3.5 Technique of Data Analysis

The preliminary phase applies a qualitative approach to find out the basic problems needed in the development of E-Problem-Based Learning based on scientific communication skill for students of prospective science teachers in the era of Industrial Revolution 4.0. Data of needs analysis in the form of Likert scale scores is analyzed using percentage techniques. The prototype phase is the stage of prototype formation to find out its feasibility. The activity at this stage is to obtain the validity of LMS E-Problem-Based Learning prototype

based on limited scientific communication skill and plagiarism checker to gain practicality. Activities carried out at this stage are (1) designing a prototype of LMS E-Problem-Based Learning based on scientific communication skill, (2) evaluating the validity of LMS prototype of E-Problem-Based Learning based on scientific communication skill and plagiarism checker, and (3) testing the prototype.

4. Results

4.1 The Real Condition of Learning Management System of E-PBL

The results of needs analysis and interviews about the real condition of online learning among Indonesian Tadris lecturers of the Indonesian Natural Sciences Association are as follows. First, (1) the total 50% respondents have experienced and conducted Problem-Based Learning. Second, (2) there is a lack of understanding of LMS of E-Problem-Based Learning. Third, (3) there is a lack of understanding of the steps of E-Problem-Based Learning so that students have not been able to solve problems. Fourth, (4) there is a number of duplicative answers in the group E-Problem-Based Learning. Fifth, (5) E-Problem Based Learning is still not maximally utilizing references from online sources. Sixth, (6) there is no perfect application of E-Problem-Based learning to manage the percentage of online and non-online activities. Seventh, (7) there is no plagiarism checker in E-Problem-Based Learning to ensure that the work results of the students are made through copy-paste way. Eighth, (8) there is a lack of explanation of steps in using the E-Problem-Based Learning.

4.2 Needs Analysis of LMS of E-PBL Based on Scientific Communication Skill

The results of Needs Analysis of LMS of E-PBL Based on Scientific Communication Skill obtained from 44 respondents are seen in table 1 below.

Table 1. Recapitulation of Needs Analysis of LMS of E-Problem-Based Learning Based on Scientific Communication Skill

No	Elements of LMS E-Problem-Based Learning Based on Scientific Communication Skill	Average
A	Learning Planning of Problem-Based Learning in the era of Industrial Revolution 4.0	3.57
1	Do you need online learning planning in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.64
2	Do you need to upload the Semester Learning Plan or online fill-in menu in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.55
3	Do you need to upload an learning contract or online fill-in menu in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.52
4	Do you need online communication menus with students in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.57
B	Material/Method/Media of Problem-Based Learning	3.55
1	Do you need an online application to deliver learning material in the PBL model in the era of Industrial Revolution 4.0?	3.52
2	Do you need information from the internet to help deliver material in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.68
3	Do you need pictures from the internet to help deliver material in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.45

4	Do you need articles from the internet to help deliver material in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.61
5	Do you need YouTube from the internet to help deliver material in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.45
6	Do you need interactive learning methods in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.57
C	The Implementation of Problem-Based Learning in the Era of Industrial Revolution 4.0	3.50
1	Do you need learning steps in online application for delivering material in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.50
2	Do you need online communication in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.55
3	Do you need case studies/problems directly from nature and the environment in the Problem-Based Learning model of the era of Industrial Revolution 4.0?	3.48
4	Do you need an online application to find out the stages in the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.45
5	Do you need online application in the stages of the Problem-Based Learning model in the era of Industrial Revolution 4.0?	3.48
D	Evaluation of Problem-Based Learning in the Era of Industrial Revolution 4.0	3.36
1	Do you need an online test application in the Problem-Based Learning model in the Era of Industrial Revolution 4.0?	3.52
2	Do you need an online assignment in the Problem-Based Learning model in the Era of Industrial Revolution 4.0?	3.22
3	Do you need an online assessment application in the Problem-Based Learning model in the Era of Industrial Revolution 4.0?	3.41
4	Do you need an online application for final scoring in the Problem-Based Learning model in the Era of Industrial Revolution 4.0?	3.27

4.3 Prototype and Validation of LMS of E-PBL Based on Scientific Communication Skill and Plagiarism Checker

Prototype of E-Problem-Based Learning based on Scientific Communication Skill and Plagiarism Checker, the results of FGD and validation are seen in Figure 1-10.

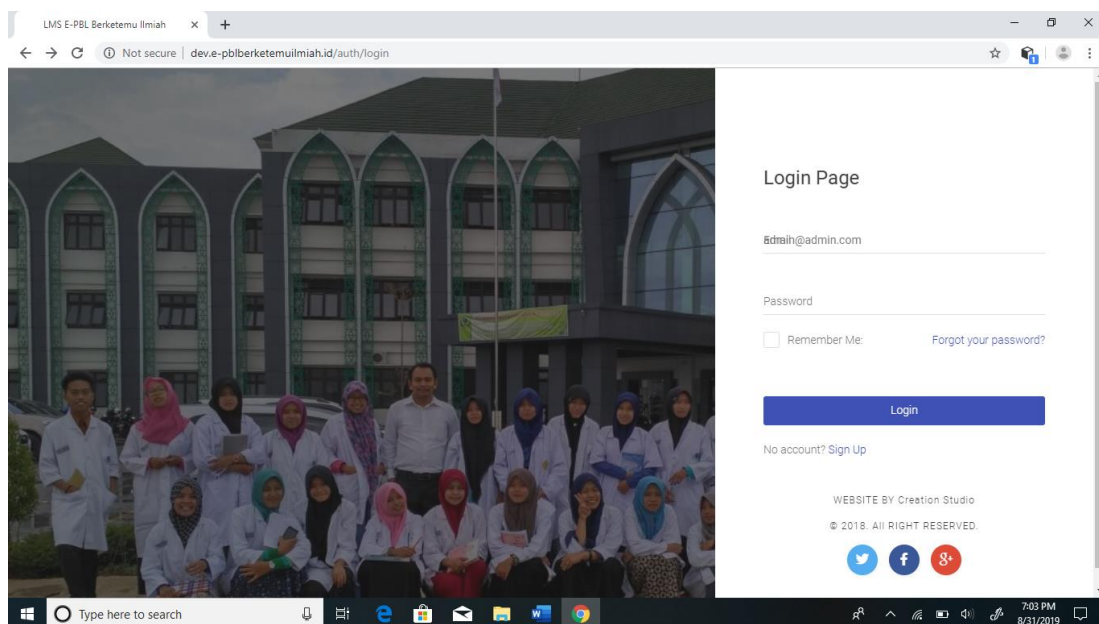


Fig. 1. Home page view of E-Problem Based Learning based on Scientific Communication Skill and Plagiarism Checker

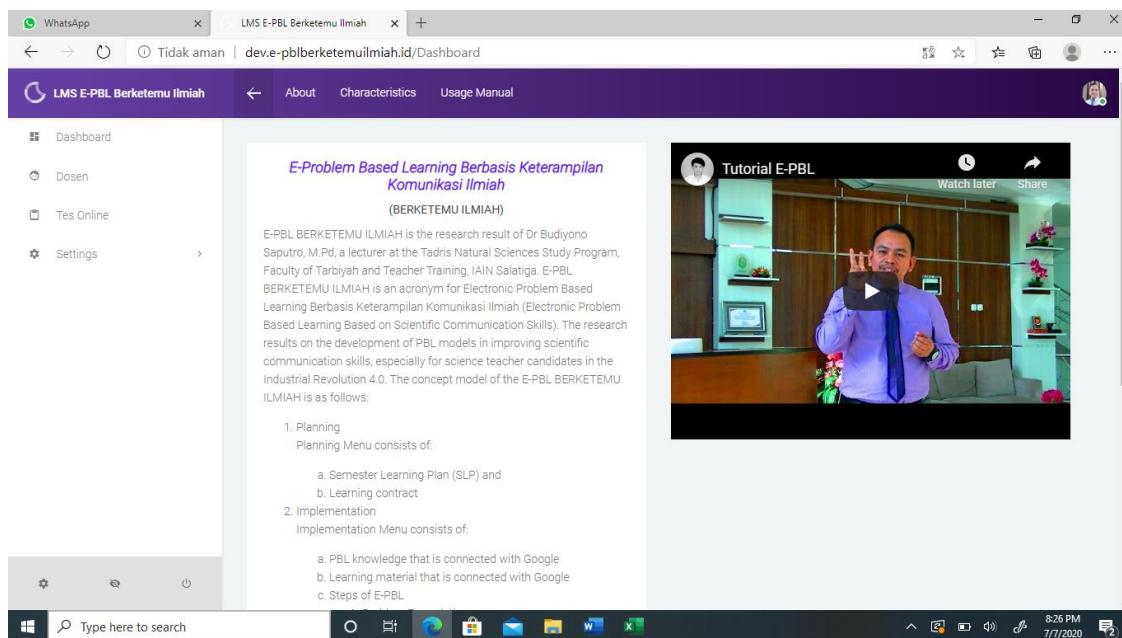


Fig. 2. Dashboard view of E-Problem Based Learning based on Scientific Communication Skill and Plagiarism Checker

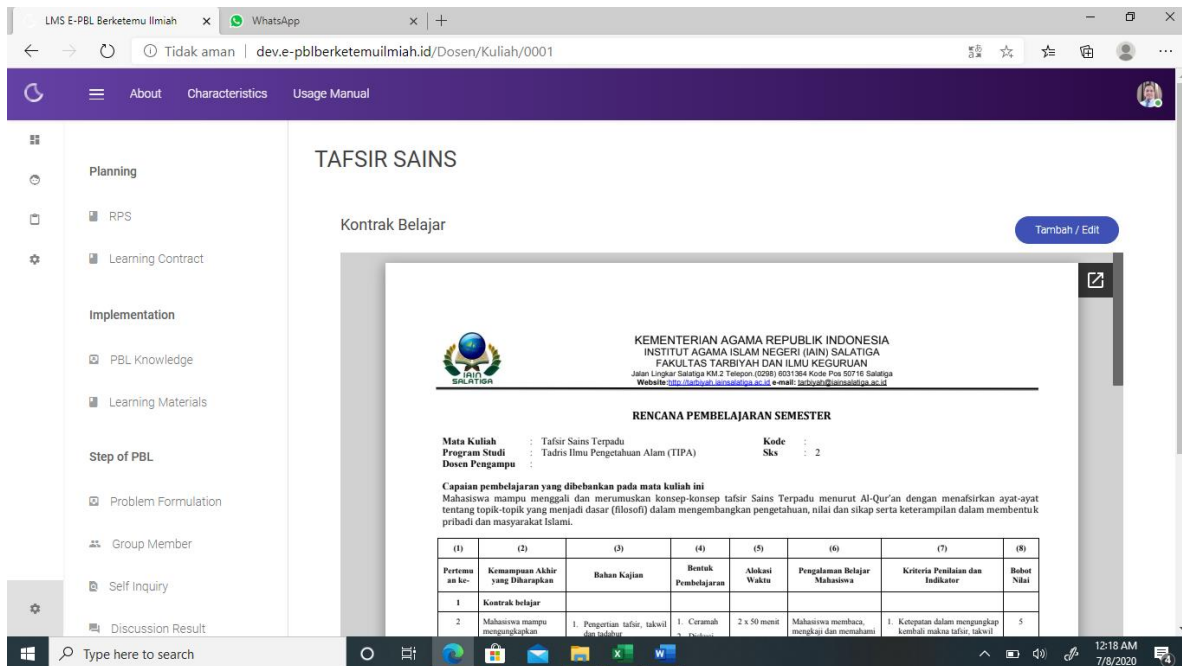


Fig. 3. LMS of E-PBL of Lesson Plan

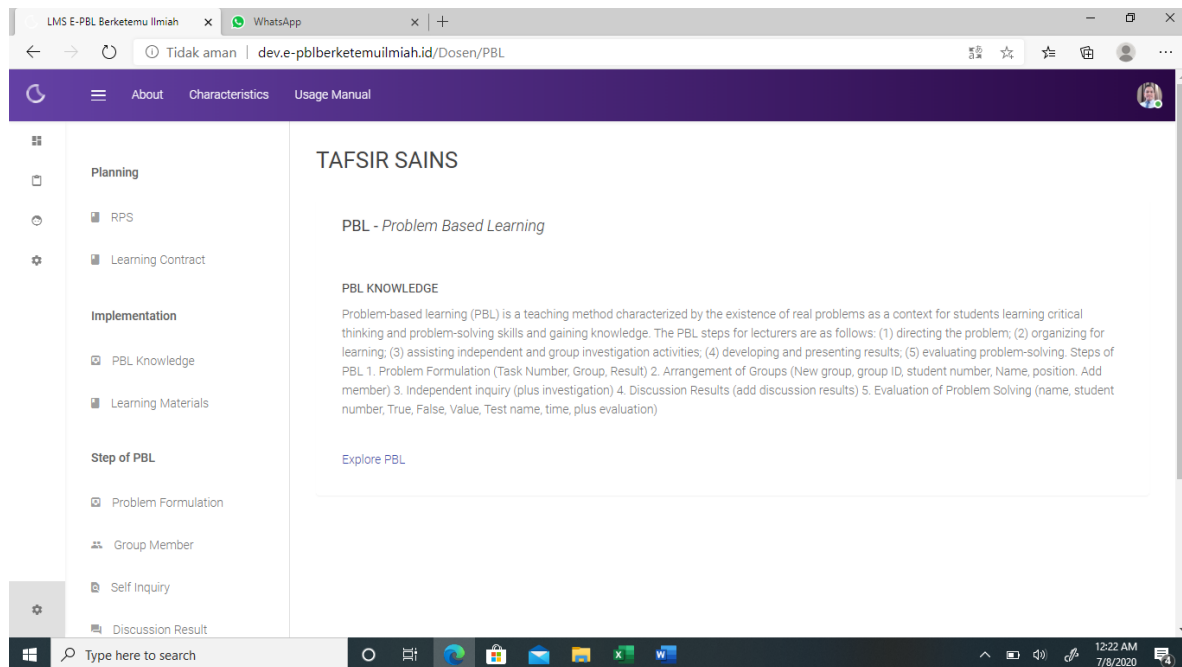


Fig. 4. LMS of E-PBL: Menu of the Implementation of Learning with the Novelty to Explore Google's PBL Connecting Knowledge

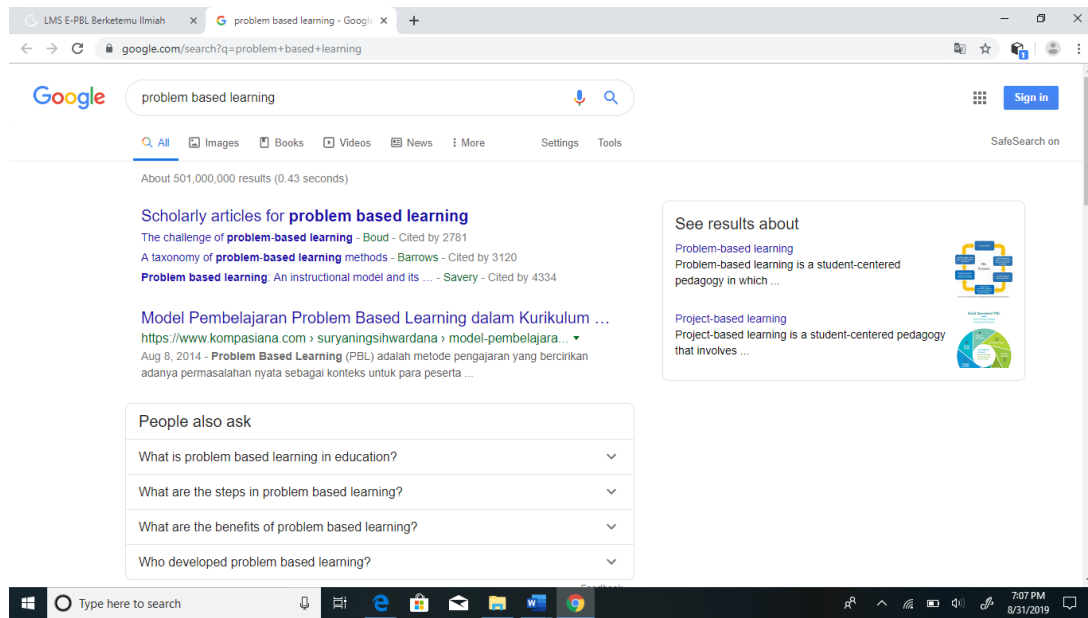


Fig. 5. Connecting google from PBL Knowledge Menu

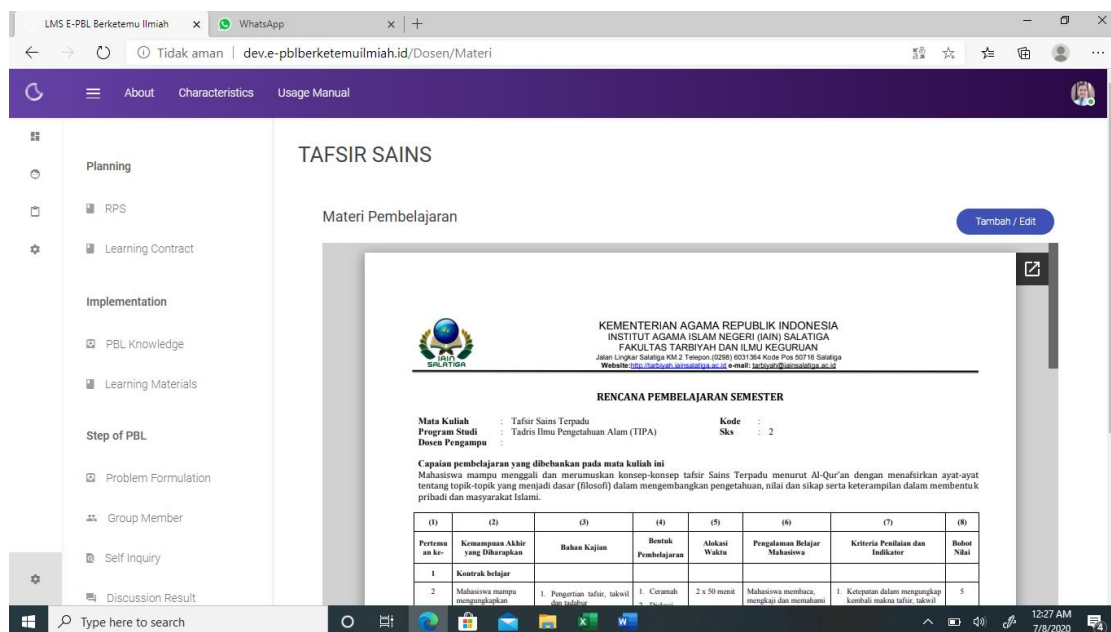


Fig. 6. LMS of E-PBL: Menu of the Implementation of Learning with the Novelty to Explore the Learning Material in Google Connecting

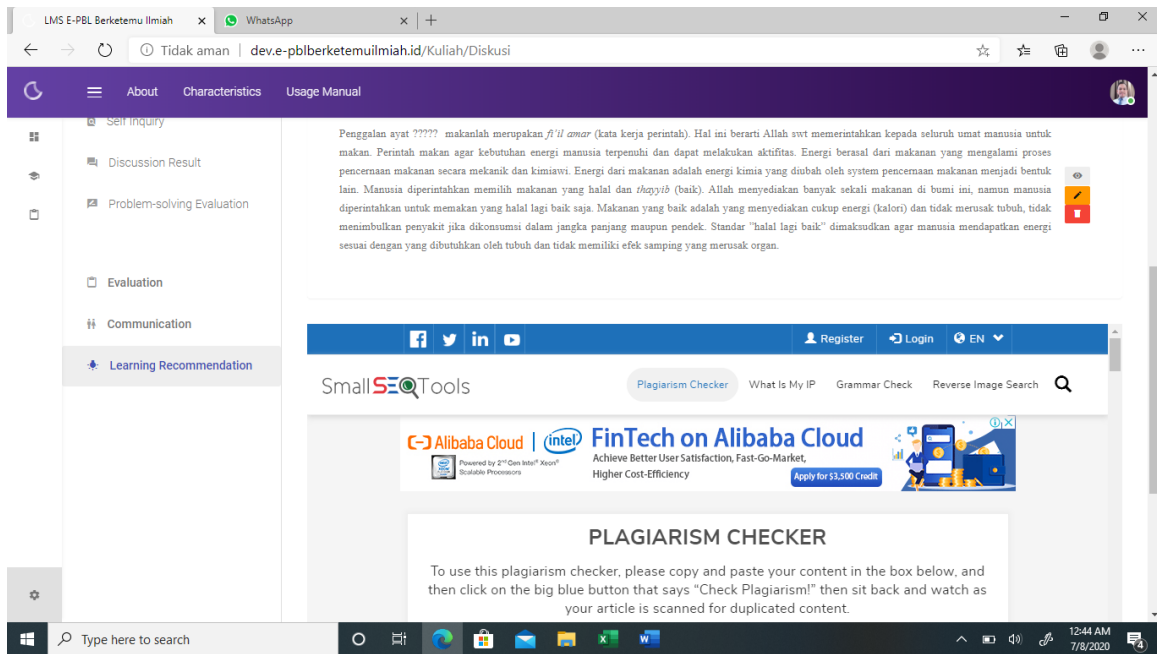


Fig. 7. LMS of E-PBL: Steps of E- PBL with the Novelty of Plagiarism Checker Integration

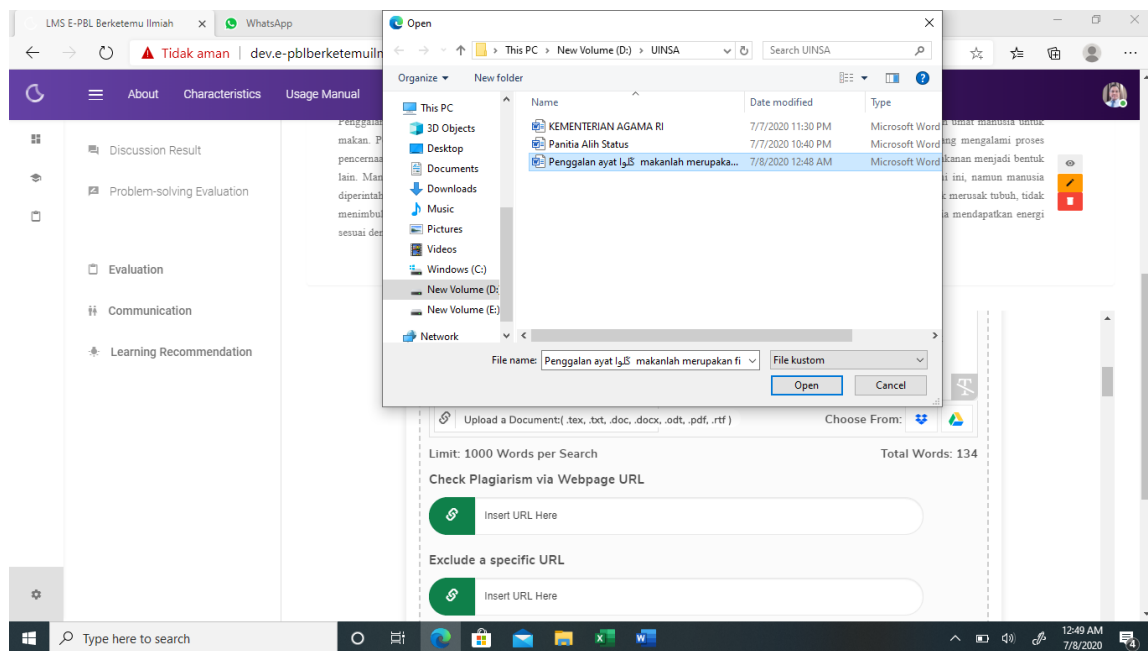


Fig. 8. Upload Process of Plagiarism Check in E-PBL

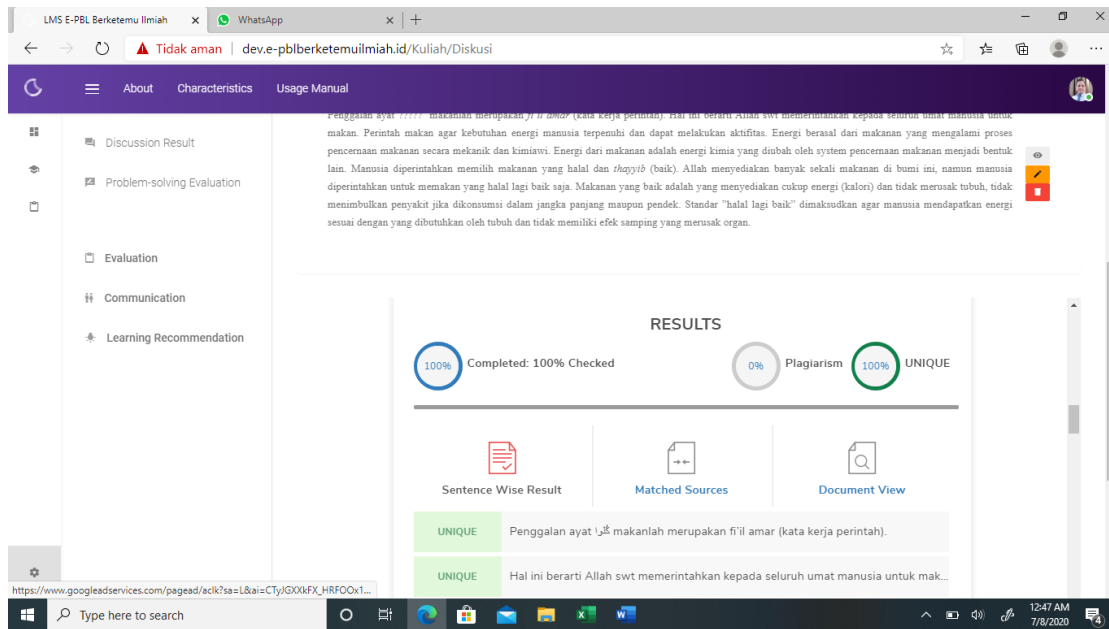


Fig. 9. Results of Plagiarism Checker in E-PBL

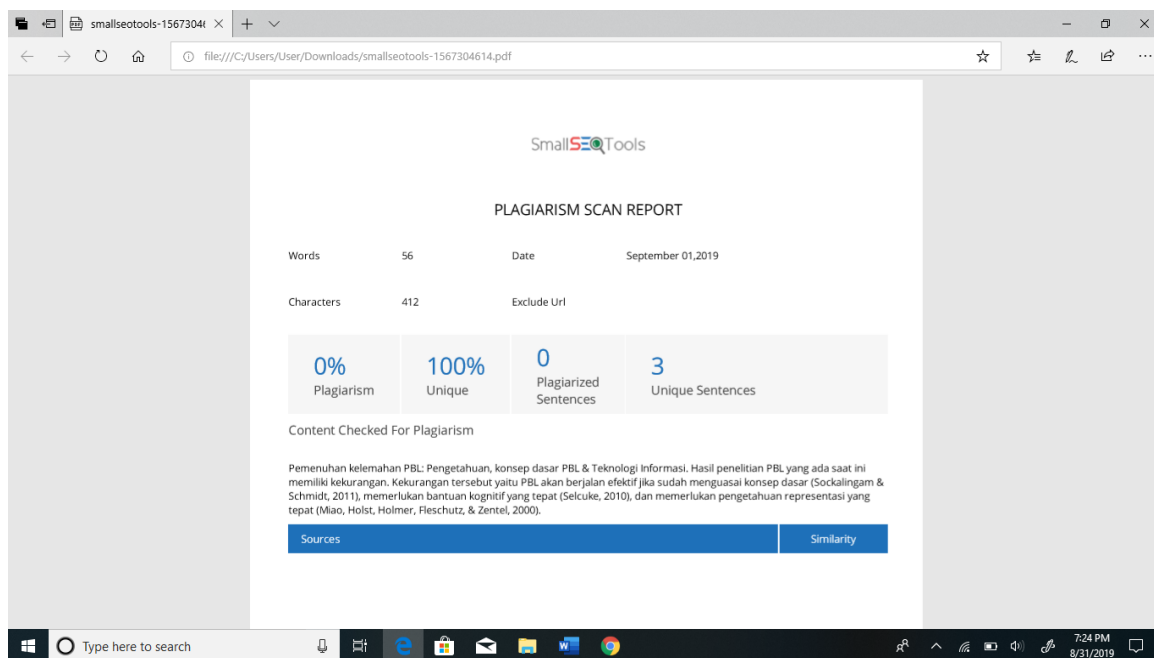


Fig. 10. Plagiarism Report of download results of E-PBL

Table 2 is the results of validation of Information Technology by experts and practitioners to the LMS prototype of E-Problem-Based Learning based on scientific communication skill and plagiarism checker with the aspects of rationality, user friendly, user interface, prototype characteristics, and the stages of running the prototype

Table 2. Results of Validation of LMS prototype of E-Problem-Based Learning based on Scientific Communication Skill and Plagiarism checker

No	Aspects	Average (n-3)	Category
1	Rationality	5.00	Very valid

2	User Friendly	4.67	Very valid
3	User Interface	4.89	Very valid
4	Prototype Characteristics	4.93	Very valid
5	Dashboard Website	4.23	Very valid
6	Syllabus	4.83	Very valid
7	Steps of Applying the Prototype	4.78	Very valid
8	Evaluation	4.89	Very valid

Meanwhile, Figure 11 is a histogram of validation of LMS prototype of E-Problem-Based Learning based on scientific communication skills and plagiarism checker.

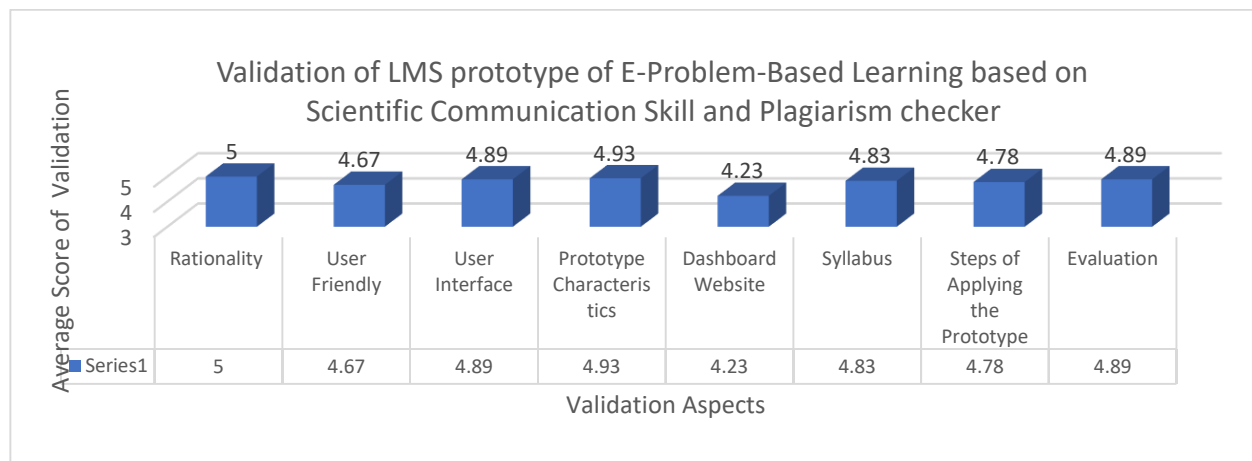


Fig. 11. Histogram of Validation

5. Discussion

Based on the real conditions, 50% of the implementation of the Problem-Based Learning model that was once conducted by respondents of the Indonesian Natural Sciences Lecturers Association members, it is necessary to meet the weaknesses of the Problem-Based Learning model, with the aspects of knowledge, basic concepts, & Information Technology. The details of meeting the weaknesses are as follows (1) factualization of E-PBL in online learning, (2) LMS of E-PBL with facilities to explore PBL knowledge, learning material connecting to Google, and integration of plagiarism checker. This is in line with relevant research results showing that LMS learning in scientific-based networks is effective in improving pedagogical learning outcomes of PPG Madrasah students at IAIN Salatiga [32]. Learning Management System (LMS) of E-PBL based on scientific communication skill is the management of E-PBL learning menus that consist of some details. The first one is the planning menu, including (1) Syllabus (RPS) and (2) Learning contract. The second one is the implementation menu, including (1) PBL knowledge connecting with google, (2) learning material connecting with google, and (3) E-PBL steps. The third one is the evaluation menu that consists of (1) online questions, (2) time duration, and (3) results. The fourth one is the menu of scientific recommendations, and the fifth is the menu of scientific communication skills. LMS of PBL steps based on scientific communication skill includes several aspects. The first one is (1) formulation of the problem, which is, fill-in & view. The second one is (2) group members, including fill-in of group members & view. The third one is (3) independent inquiry, including fill-in of independent inquiry & view. The fourth one is (4) results of the discussion, including fill-in the results of the discussion & view, online plagiarism checker at <https://smallseotools.com/plagiarism-checker/>, and the fifth is (5) evaluation of problem solving, including fill-in & view. The final results of E-PBL based on scientific communication skill is the ability of students to collaborate with their groups in order to solve problems through observation, investigation, discussion, and evaluation and check of the authenticity

of activity reports and the presentation of scientific recommendations of learning. E-PBL based on scientific communication skill has the following characteristics, namely (1) adaptive online learning of natural and environmental learning materials, (2) online connecting maps, (3) knowledge menu and connecting google.com material, (4) recommendation menu scientific, and (5) equipped with online plagiarism checker. Table 3 is the results of the implementation of E-PBL based on scientific communication skill and plagiarism checker.

Table 3. Results of plagiarism checker in the implementation of E-PBL

Group	Unique (%) Pre-test	Unique (%) Post-test
1	100	100
2	0	100
3	100	100
4	100	50
5	100	100
6	67	75
7	100	100
8	100	100
9	100	100
10	100	100
11	100	100
12	100	100
13	50	100
Total	1117	1225
Average	85.92	94.23

Figure 12 is a histogram of the plagiarism checker results in the LMS of E-PBL

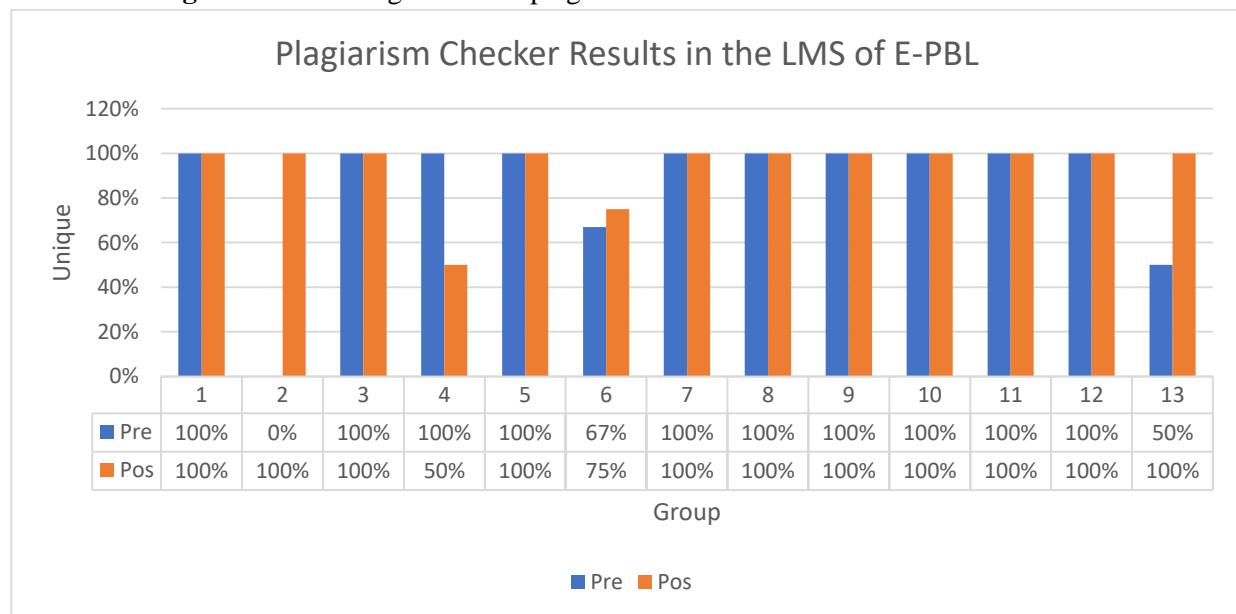


Fig. 12. Histogram of Plagiarism Checker trial of LMS of PBL based on Scientific Communication Skill Based on the results of expert validation and the implementation of Learning Management of E-Problem-Based Learning System based on scientific communication skills and plagiarism checker as in table 2, the

average score is 4.78 (very valid) and in table 3, an increase in unique plagiarism checker is 8.30%. This is in line with the results of the studies, namely the development of mobile learning that is feasible to use based on expert validation and limited testing [33]. Thus, the Learning Management System of E-Problem Based Learning can be used in learning. This is relevant to the results of previous studies stating that the use of the website as a learning medium gives users broad access without downloading additional application that incriminate the device [34]. Other relevant research results also show that the integration of cellular technology is important in teaching today and is effective in learning [35, 36].

6. Conclusion

Platform of LMS of Problem-Based Learning based on scientific communication skill and plagiarism checker from expert/practitioner validation results obtained a mean score of 4.78 with a very valid category. The validation aspects of experts/practitioners are (1) rationality, (2) user friendly, (3) user interface, (4) prototype characteristics, (5) website dashboard, (6) syllabus, (7) stages of applying prototypes, and (8) evaluation. Based on expert judgment, it can be concluded that platform of LMS of E-PBL based on scientific communication skill and plagiarism checker is feasible to be implemented. Based on the platform trial results, the average result of plagiarism checker is obtained and the unique increase is 8.30%. This implies that the LMS of E-PBL based on scientific communication skill and plagiarism checker is feasible to be implemented in learning. Platform resulted from this research is proven to contribute to new innovation in e-learning through the platform of LMS of Problem-Based Learning based on website that is adaptive to Problem-Based Learning and plagiarism checker. The benefit of the research results for lecturers is that it facilitates learning activity in the era of the industrial revolution 4.0. Meanwhile, the benefit for students is that they are able to study in groups independently under teachers' guidance without doing plagiarism. This research platform generally can be used for learning other subjects and can provide solutions for difficulties in the era of covid pandemic. This platform can also be further developed to answer the challenges of technological development in the next era.

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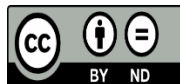
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