DESIGN AND IMPLEMENTATION OF SCHOOLOGY-BASED BLENDED LEARNING MEDIA FOR BASIC PHYSICS I COURSE

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ABSTRACT

This research was conducted to: (1) design a Schoology-based blended learning media for Basic Physics I course on the topics of vector quantity, linear motion, and translational dynamics, (2) describe the validity of the product, (3) describe the product's effectiveness in enhancing students' conceptual understanding and problem solving skills, and (4) describe students' responses towards the media and blended learning model. The development procedures employed were ADDIE model which consisedt of five stages: analysis, design, development, implementation, and evaluation. In development stage, the assessment had been conducted by two experts to assess validity of media both in content and construct aspects. The results showed that the validities in content aspect and construct aspect were "very good" and "good", respectively. The results from classroom implementation revealed the effectiveness of the product in enhancing students' conceptual understanding and problem solving skills. Students' responses towards the product's utility, attractiveness, and easiness as blended learning media were also positive. The conclusion was that the media was valid and effective as blended learning media of Basic Physics I course.

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INTRODUCTION

Facing the rapiddevelopment of globalization era in the 21th Century, teachers and educationalinstitutions are demanded to be able to prepare their students to have competences or skills. Problem-solving skill, effective communication skill, decision making skill, collaborating skill, information literacy, information and communication technology (ICT) literacy are parts ofthe21st-Century competencies (Binkley, et al., 2012). As a consequence, teachers should design learning activity which could fulfill the demands of those competencies. One of the ways is through integrating ICT with learning process to train students about information literacy and ICT literacy. In fact, integrating ICT in Basic Physics I course at Physics Education Program University of Lampung is still poor. ICT especially the internet is only used as a source to look for learning materials and questions. On the other hand, the lecturer often feels the limited time for face-to-face meeting since this course covers extent topics. Because of limited time, most assignments given to the students were usually without feedback.

Meanwhile, from the survey about students' internet access, it is known that 90% of 59 students have internet access through laptop, PC or mobile phone. At campus, wifi access is also free. The students who do not have their internet access stated they could access it through internet cafes around the place they live. However, more than half students stated that the speed is not fast enough. The survey showed that the internet ac-

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cess of students supports to integrate internet in learning process.

One of the forms in integratinginternet in learning processis e-learning. Implementing e-learning in science learningby using problem-based learning model could improve students ICT literature (Eliana et al., 2016). Similar with e-learning, another integration is blended learning (BL). BL or also known as hybrid learning is a learning model which combines various presentation model at class with online learning (asynchronous and synchronous) (Wu et al., 2010). Graham (2006) more specifically stated that BL is a kind of learning model which combines two different learning environment: face-to-face meeting and online learning.

Some researchshowed that BL had many advantages like increasing flexibility (Pratt & Trewern, 2011), increasing effectiveness and students' motivation (Barbour & Reeves, 2009), growing students' independence in learning (Parkes et al., 2011), and improving students' ICT skill (O'Dwyer et al., 2007). Compared to the pure-face-to-facelearning or pure e-learning/online learning, BL is said to be more effective (Means et al., 2009) students joining BL model have better performance than those following traditional learning method (Yapici & Akbayin, 2012). The same result also reported by Poon (2013) who compared BL class with traditional classroom. The result was the class given BL method has higher test score than the class using the traditional method. A researchby Kazu & Demirkol (2014) also found that students using BL method have higher average scores than those using traditional learning method.

The use of BL could stimulate students to be more active, creative, and independent in looking for information needed so they could learn independently and understand the concept well. The use of BL also could repair some weaknesses from conventional learning method, one of them is the lack of time in face-to-face meeting. Online learning could be used as an addition to improve students' understanding of the material who has not been explained by the lecturer in class. Besides adding knowledge, features from online learning also make students more enthusiastic and interested in learning since they could access many sources via online.

BL types that are usually implemented are online – face-to-face and face-to-face – online. In the former type, students follow online learning first before face-to-face meetingso that each student has the same initial understanding (Smart, 2006). Face-to-face session is usually used for detail explanation and problem-solving (Smart, 2006) or to extend students' understanding and connect the concept to the further area (Collopy & Arnold, 2009). Whereas in face-to-face– online, the materials are given in face-to-face session then the students are asked to discuss and think critically via online (Aycock et al., 2002). Michinov & Michinov (2008) also supported this kind of BL to deliver togetherness (a sense of community) among students. Another purpose is to help students be familiarwith the online class structure.

The two types of BL have their own benefits. BL does not have astandard type (Aycock et al., 2002). It was also emphasized by Helms (2014) who stated that there may be differences in the best way to schedule a course based on the discipline, course content, and other concerns". By the reasonto have the benefits of both BL types, in this study the researchers used the format of online – face-to-face – online. The first online learning would be used to give initial understanding to students whereas the second online learning would be used to discuss concept application on the certain topic.

Nowadays, many applications could be used to create online learning freely. Those applications are called Learning Management System (LMS). LMS web based is referred to facilitate an access towards learning material and administrator anytime and anywhere (Black et al., 2007). The use of LMS brings good advantages for students or teachers. From the view of students, the advantage is in the increase of control they have wherever and whenever they involve in the learning process.From the view of teachers, the benefits are very structured tasks management, efficient, and safe (Fadde & Vu, 2014), and could grow students' critical thinking through discussion forum (Comer & Lenaghan, 2013).

One of LMS which has the basic version available freely and easy to use because it is similar to social media like Facebook is schoology. The menu which Schoology has are Courses, it is a facility to create one course, Group, which is a facility to create community learning, and Resources, which is a facility to save learning material. In Courses menu, there is quiz menu which has many kinds such as multiple choice, true-false, matching, and short answer. Making questions in Schoology is equipped with tools Symbol and Equation. All questions with Figure, symbol, and equation could be written on Schoology. Besides, schoology has many features and an interesting layout like online assessment book, attendance list, the reminder of feature user from students

(Nugroho, 2015). Other benefits that Schoology has are mobile access, integration with Google Drive, tools to make content, and access to the library, etc. (Medved, 2016).

Based on the explanation above, this study was conducted to develop a product which is technology based BL in basic physics I course with main materials vector, straight motion, and translation dynamics. The developed BL media included handout, material for online discussion, and online questions uploaded in Schoology online class. Not to mention, this study also described the validity of BL content and construct based on expert assessment, the effectiveness in improving concept understanding and students' problem-solving skill, and students' responses towards its benefit, its attractiveness, its ease and its class model.

METHOD

The study was conducted from March to October 2016 in Physics Education Program, Faculty of Teacher Training and Education, University of Lampung. This study referred to development model of ADDIE (analysis, design, development, implementation, and evaluation) (Peterson, 2003). ADDIE model as firstly used in the 1990s had a function as a reference in developing learning set and infrastructure which were effective, dynamic, and supportive (Sumarti et al., 2015).

In analysis stage, the researchers did literature study, field survey, and need analysis. A literature study was done to get information related to BL model and previous relevant studies results. A field survey was done to get the information of supportive facilities belonging to students. In the design stage, the researchers made BL media draft including handout, online discussion questions, online tests. In the development stage, the expert validated to assess the content appropriateness and product construct. In implementation stage, the product was implemented in limited class to test its effectiveness; the test used one shot case study design.

BL type used was "online learning – face to face – online learning" in every week (Figure 1). In every week, face to face class was done once to discuss the main topics. There were three main topics; they were the vector, straight motion, and translation dynamic. Before face to face meeting was done, the students joined online learning, and they also joined online learning after face to face meeting.

Online learning before and after face to face meeting was done with discussion method. The students were given two to four problems to discuss with their classmates through lecturer guidance. Online discussion was done asynchronously, in which the students did not discuss at the same time, but it depended on their availability. Online discussion forum on Technology was organized so that students could answer first before using, reviewing, or studying their friends' answer.
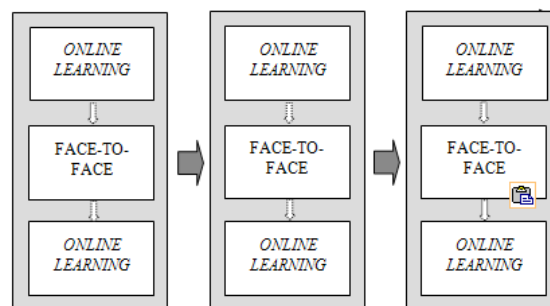

Figure 1. BL type used in the study

The data included expert validation from questionnaire, concept understanding data, and problem-solving skill taken the test, and students' responses taken from the questionnaire. Validation questionnaire was Likert scale with four responses, starting from 1(invalid) to 4 (very valid). Students' responses questionnaire were also in Likert scale with five choices, from 1 (very disagree) to 5 (very agree). The instrument of understanding concept used was short essay questions consisting of 15 numbers with the allocation time 30 minutes whereas the instrument of problem-solving essay questions consisting of 6 numbers with time allocation 75 minutes. Students' responses questionnaire and two instrument tests were validated by the experts of content aspect and instrument construct.

All data taken were analyzed quantitatively and descriptively. The criteria of classification in experts validation data and students' responses were shown in Table 1. If the expert assessment showed product validity with category "good" the learning process could be continued in the next stages.

RESULT AND DISCUSSION

BL media produced were Syllabus and Lesson plan, handout, discussion topic before face to face meeting, and online tests with main topics of the vector, straight motion, and translation dynamics. All those materials were uploaded on online Schoology made with Courses featu-

Table 1. Data classification of experts validation and students' responses

Average score of validity	Category	Average score of responses	Category
3.26 – 4.00	Very Good	4.20 – 5.00	Very Agree
2.51 – 3.25	Good	3.41 – 4.20	Agree
1.76 – 2.50	Less Good	2,61 – 3,40	Doubt
1.00 – 1.75	Not Good	1.81 – 2.60	Disagree
-	-	1.00 – 1.80	Very Disagree

re. The layout of the online class could be seen in Figure 2. Every folder contained: 1) handout, made with *Add File/Link/External Tool* features; 2) discussion forum before and after face to face meeting, with *Add Discussion* feature; and 3) independent test, with *Add Test/quiz* feature.

Meanwhile, the example of the learning process with BL model for vector topics shown in Table 2. Online activity before face to face meeting was used to discuss sub material whereas online activity after face to face meeting was meant to discuss sub material that could not be finished during face to face class and give applied tests to finish some problem.

The produced handout contained material explanation for each discussion topics. The handout was written with emphasizing basic concepts as the reference of the usual textbook. Discussion material on face to face meeting contained questions about the problem related to the brief material of each discussion topics. Those questions were meant to improve students' understanding of each topic. Discussion material on face to face meeting was made to facilitate an online class in the last part of each discussion topics. The contain included concept application, last part of the discussion topic that could not be finished at face to face class, and wider explanation. The emphasize of discussion after face to face meeting focused on students' problem-solving skill. Question test was meant to facilitate students to do interactive exercise independently so that their understanding improved. The questions were made in multiple-choice by giving feedback in every wrong answer.

Product Validity

The product assessed by some experts included handout, online discussion material, and online question test. The assessment of product validity done by an expert of Physics Education and an expert in education technology showed that the validity of product content had 3,48 in average with the category "very good" and the validity of construction aspect had 3,21 in average with category "good." In conclusion, the deve-

loped media could be said relevant to the purpose of development and appropriate to used in BL of Basic Physics I course.

With experts' assessment, the product was then revised by their suggestions. The suggestions given for handout revision were adding material explanation related to the similarity and the difference in vector, consistency in using terms on vector or scale such as distance, position, speed, and motion. In online discussion material, the suggestions were simplifying unclear questions and describing problem illustration. The suggestions related to online test were the consistency of feedback in directing students to answer correctly and adding the questions about problem-solving.

Product Effectiveness

After revision, the product was then implemented in class with topics of the vector, straight motion, and translation dynamics for three weeks in the course of Basic Physics I. In the fourth week, the test was done to measure students' concept understanding and problem-solving skill. The data related to students' concept understanding and problem-solving skill were shown in Table 3.

Byusing minimum achievement (MA) score 66 (B as the minimum category at Lampung University undergraduate program), the percentage of students reaching MA was 80,6% for concept understanding aspect and 74,2% for problem-solving skill. Since the percentage of MA was greater than 70%, the product could be said effective as learning BL media on Schoology in the course of Basic Physics I.

Students' Responses

At the end of the learning process, students were asked to answer questionnaires related to their responses towards the benefit, attractiveness, and ease of BL model with Schoology. There were 31 students responding. The result could be seen in Table 4. In general, students gave positive responses related to the developed media and BL cmodel class in Basic Physics I course.
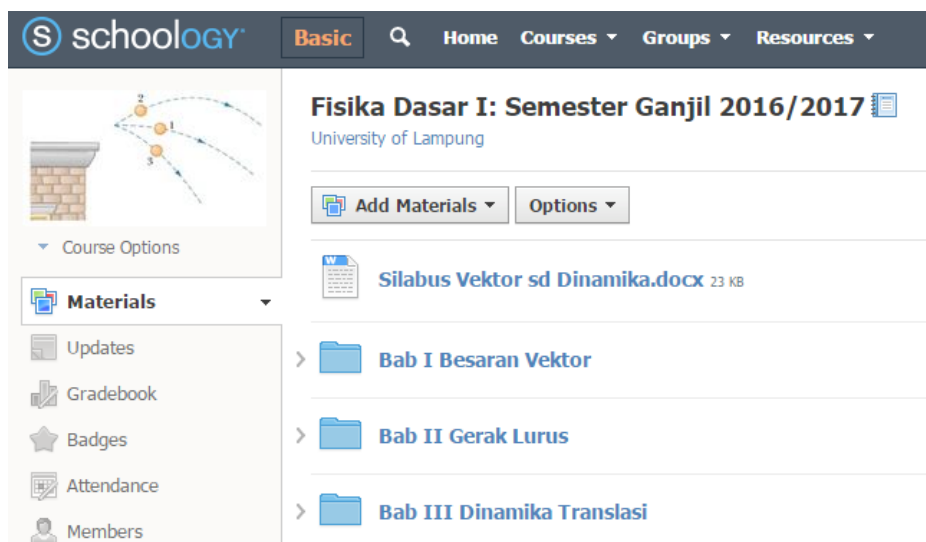
Figure 2. The layout of online class

Table 2. Learning activity sample in BL model with the topic of vector

Standard Competence	Material	Learning Activity	Mode
Operating vector (addition, reduction, and product) with various methods	Vector sub material: Vector representation Vector unit Vector operation	Discuss the definition of vector, unit vector symbol, vector representation in graphic, vector component, and the similarity of two or more vectors	*Online*
		Explain vector writing by using vector unit	Face to face Face to face
		Doing addition and reduction on vector by using graphic method and vector component method	Face to face
		Doing product on vector, including dot product and cross product	*Online*
		Training to do applied addition and product on vector in the context of physics problem	

Table 3. The data of concept understanding and problem-solving skill

Score	Concept Understanding		Problem Solving Skill	
	Total	Percentage	Total	Percentage
≥76	3	9.7	1	3.2
66 – 75	13	41.9	9	29.0
61 – 65	9	29.0	13	41.9
< 61	6	19.4	8	25.8
Total	31	100	31	100

Table 4. Students' responses related to media and BL model

Aspect	Score	Category
Benefit	3.85	Agree
Attractiveness	3.72	Agree
Easiness	3.31	Doubt
Average	3.63	Agree

Based on the table above, it was known that students' assessment towards product benefits and BL model class was considered to be useful. There were 8 items in the questionnaire related to the benefits; they were benefited for improving learning interest and motivation, understanding and problem-solving skill, and students' ICT skill. Besides, the students were also asked about their interest to join the next BL model class. The responses given on all question items were the "useful" category.

In similar with students' responses towards benefit, their responses towards attractiveness aspect were also good. In the questionnaire, there were 6 questions; these were about product attractiveness (handout, online class, online test), the attractiveness of online learning activity, and the attractiveness of BL model. Most students' responses towards each question were good, except for the question about the handout, they suggested that the attractiveness on handout was very good.

Different with two previous aspects, students' responses towards the easiness of BL model, in general, were in "doubt" category. They were not sure about the easiness in joining BL class. In the questionnaire, there were 7 questions, they were about the easiness in joining BL model class, the easiness in accessing the contain, the easiness in communicating via online, and the easiness in answering online test. The lowest response was on the easiness of online discussion. From the interview, the most problem faced was the slow internet connection and students' time management.

This research was conducted to produce a learning media that could improve students' experience and learning performance. Based on the implemented test in the class above, the purpose of this research could be said as a success. More than 70% of students reached the minimum standard 66 in both concept understanding and problem-solving skill aspects. It meant that the developed Blended Learning media could become alternative sources for students, they did not depend only on teachers/lecturers.

Through BL with online-face-to-face-online format every week, students had more opportunity to interact with their lecturer and mates. Online discussion was done before and after face to face meeting. Face to face meeting was on Wednesday. Online class was done before it, Monday to Tuesday, and after it, Thursday to Saturday. Providing more opportunity to interact with students and lecturer was the main important factor to make a quality BL media (King & Cerrone, 2012). Through online discussion activity, students became more ready to join face to face meeting class (Aspden & Helm, 2004). It was thought to influence the performance of standard understanding and students' problem-solving skill.

Choosing online discussion could also influence students' activity in online learning. This online discussion was chosen because it gave more chances to students to search and write answers or opinions before presenting them in the discussion forum (Alim, 2007), and also make students stay interacting with the lecturer whenever they have time to Aspden & Helm, 2004). Also, based on the observation in class, the asynchronous online discussion also helped students who have limited internet connection. They could easily find the time when the internet access was fast. However, it' weakness was the lecturer needed a long time to gave feedback on their answers.

Providing handout and the online test could also improve students' concept understanding and problem-solving skill. By explaining the material in detail and providing answers of question examples, handout helped students learn course material. It was reflected in their responses towards questionnaire in which they evenly really agreed with handout attractiveness, related to online test; there were 15 multiple choice questions filled with feedback if their answers were wrong. With the existence of exercises that could be accessed many times, students were easier to learn course material. It was also reflected in their responses stating that online exercise could improve their understanding.

In line with product effectiveness, students also responded positively towards the developed product and BL model based in Basic Physics I course. Their responses indicated that learning with Bl model gave another benefit, it could improve their interest and motivation as it was said by Barbour & Reeves (2009), grow students' independent learning, as said by Parkes et al., (2011), and improve students' ICT skill, as stated by O'Dwyer et al., (2007).

The result of this research was relevant with previous researches about BL effectiveness.

Lim & Morris (2009) explained that traditional (face to face) class equipped with online material had the postive effect towards students' competencies. Applying BL was even more effective in improving their learning performance compared to face to face meeting only or fully online learning (Means et al., 2009). Kazu & Demirkol (2014), Poon (2013), Yapici & Akbayin (2012), and Uzun & Senturk (2010) researched revealing that the performance of students joining BL was greater than those following face to face meeting only.

Therefore, there were some obstacles faced during implementing Schoology based BL model at class. First was internet speed was not fast, so it became the main factor for students to join online learning. The second was students were difficult to write their answer containing mathematic equation, symbol or graphic, in Schoology discussion forum. Indeed there were symbol and equation tool facilities for students. But, they were not used to them, also, how to use them was different from Microsoft Office Word, the solution given by students was that they wrote their answers on paper and uploaded them on the discussion forum. Uploading and reviewing Figure answer took more time and needed fast internet access.

Other problems were the lack of students' activeness in discussing and their time management. In the discussion, they only gave the answer without asking or responding to others' answers. Indeed, in this research they were not asked to comment each other, they were only obligated to give their answers. Online discussion forum on Schoology could be set so that the students would send their answers before they could see, review, or learn each other answers. From the interview, there were two reasons why they seemed not to discuss with each other, first was they felt afraid, shame, or hesitate with their lecturer and mates. The second was they always met every day at the campus, so they felt easier and more comfortable to ask directly. About time management, most students tended to submit their answers on the late deadline. At the beginning of the discussion, some students even did not send their answer, and they also mistook the schedule.

Previous researchers had also stated problems found in this research. Kenney & Newcombe (2011) stated that some students wait for the last minutes to send and submit their answers on the discussion forum, submit tasks, sometimes they also face technical problem during online learning. From the researchers himself, the problem was more burdening work. Besides to design and prepare learning sources took more time, preparing online discussion forum also need much time like stated by Kenney & Newcombe (2011). However, the students felt no meaningful learning burden in following BL model, as previous researchers explained it.

In this research, there were some limitations, not all facilities available in Schoology were used. The researcher did not use facilities like test or assignment (including project assignment) via online. It should be studied further, considering that in Indonesia online assessment is rarely done (Wijayanti & Basyar, 2016). Face to face meeting was also limited to lecture, discussion, and question session. This research also did not consider the quantity of BL media use by students, which could influence their learning performance (López-Pérez, 2011).Another limit in this research was the amount of topic discussion and time duration which was short. So, further research about this should be conducted.

CONCLUSION

Based on the result and discussion, it could be concluded that it was produced Schoology based BL media in main materials vector, straight motion, and translation dynamic with the score of content validity 3.48 (very good), and the score of construction validity 3.21 (good) from the maximum score 4.00. From the result of implementation at class, it could be concluded that the BL media was effective to improve students' concept understanding and problem-solving skill where more than 70% students reached the standard minimal score. In general, the students also responded positively towards benefit, attractiveness, and easiness of NL media, with average score 3.63 from 5.00 as the maximum score.

About the result of this research, physics teachers especially should develop and apply blended learning at class. However, there were some problems found during the research like slow internet access, students' difficulty in writing answer containing mathematic equation, symbol, or graphic on Schoology forum, students' lack activeness during the online discussion, and needing much time to prepare online asynchronous discussion. So, it needs following researches related to field study in a bigger scale, developing BL for other courses, and optimizing other features on Schoology.

ACKNOWLEDGEMENT

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