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Validation of Embedded System Courses in Product-Based Learning -3D

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Abstract

This research is development research that aims to develop the learning model of Project and Production Based Learning using the Borg and Gall development model with 10 stages of research then reduced to 5 stages to improving student competency in Embedded System Courses. The research produced several products such as (1) Blended Learning-Based PBL-3D Learning Model Book on Embedded System Courses, (2) Embedded System Teaching Module, (3) Lecturer Handbook on LMS media, (4) Student Handbook on LMS media**.** Syntax Model PBL-3D, i.e. (1). Start with the essential question and Identification production analysis, (2) Design a plan for the Project, (3). A Project of making a product based on 2D, video, and 3D animation, (4). Evaluated regularly and (5) Creating a business plan. The respondents used were students of the fourth semester of Polytechnic LP3I Medan Indonesia, with the number of 48 students divided into control classes and experimental classes of each class of 24 students. The validity of the model was analyzed using Aiken's V measured by experts. The PBL-3D model results in 0.92, Learning Management System and 3D Media used are also very valid with an average of 0.91

Keywords: Project-Based, Production Based Learning, Embedded System, PBL-3D Model.

I. INTRODUCTION

The development of learning models according to the development of era and technological disruption resulted in more innovative strategies and contributions to human life in various fields such as education, multimedia technology, health, tsunami technology, data processing, and various other issues. Model development is an elaboration between Project-Based and Production Based Learning (PBL). Vocational Education and Training (VET) is part of the education system that prepares a person for a job or group of jobs, and can also develop itself in the field of employment itself [1]. The PrBL teaching model is the main step in improving the entrepreneurial skills of students, this is because this model will synergize the knowledge (cognitive) and psychomotor abilities of students who have not achieved Good. The implication is that faculty and instructional designers need to design learning that facilitates students to have firsthand experience, especially in entrepreneurship programs [2].

The subjects studied were Embedded System (ES), ES integrated into our daily environment in all fields, this course has two main components namely lecturers with expertise in hardware and software, direct experimental environment, this research shows that online learning models can be a viable alternative to supporting face-to-face lectures [3]**.**

To improve students' ability to master this lesson, use 3-dimensional animations shared through LMS. 3D animation can increase students' learning interests, such as studying difficult subjects such as engineering [4]. A Combination of traditional education and education with good 3D animation trusted nursing students on respiration lessons [5]. Learning methods using blended learning a learning approach that blends harmoniously, structured, and systematically between the advantages of face to face and online learning [6]. Diversifying animation course devices and optimal 3D combinations keep teaching effects in the best condition [7]. 3D animation can present teaching content visually in a three-dimensional and dynamic way. Plus light material delivery and simulation, 3D animation has a very strong sense of reality and breaks the limitations of imagination. Also, fully calling audio-video information channels effectively enhances the teaching effect and reduces the burden of cognition [8].

A Web-Based Interactive Blended Learning model can be implemented as an alternative to face-to-face instruction [9]. The case in Padang State University uses blended learning online and face-to-face [10]. The access and acceptance aspects of the Blended Mobile Instruction (BMI) model are excellent. So the possibility of a BMI model as one of the alternative models in the UNP going forward is very likely

[11]. Learning Management System using Edmodo, in pedagogy Edmodo integrates impact on academic student achievement and improves their achievements, giving students, especially helpful, the opportunity to make friends through messaging [12]. Edmodo developed by Nic Borg and Jeff Ohara in late 2008 argued that the school environment needs to be connected to all activities in the world, to eliminate the gap between students' lives in school and daily life. Edmodo is similar to Facebook's social media. [13].

Joyce [14] plans/patterns that design teaching the purpose of providing learning design direction in helping students achieve competency targets. Project-Based Learning (PjBL) implements project work in the learning process aimed at understanding learning, students use investigative questions and technology that fits the environment of the project they are working on [15]. The PjBL is a key to support students more competitive in an external environment, students produce an educational video based on the topic they are learning [16]. Ganefri [17] PrBL targets students to produce goods/services. Process during lectures or workshops provides quality and meaningful improvement to learn. The Learning experience that fellow students with work practices or work sections are exactly following the standards and specifications. The learning process has an impact on improving entrepreneurial interests students [1]

Research Development is following the opinions of Borg and Gall [18]. Simplified by the Education Policy and Innovation Research Center of the National Department of Education Research [19], as follows:

a. Analyze the products to be developed
b. Develop early products
c. Expert validation and revision
d. Small-scale field trials and product revisions
e. Large-scale field trials and final products

II. METHOD

II. I. Participants

The objects were students of semester IV, Class TK1701 and TK1702, The campus of Polytechnic LP3I Medan Indonesia, numbering 48 students divided into control classes and experiment classes, each 24. Learning was conducted 16 times with 45% face-to-face, and 55% online.

II. II. Research method

Using simplified methods research and development, these stages are implications in table 1, below:

Table 1. Stages of Development Activities

Stages	Activities
Stage I : Analyze the products to be developed	Problem analysis, analysis of learning needs by collecting information used as learning materials [20]. Embedded System Learning Device Research Objects, Software and Hardware Specifications
Stage II : Develop early products	Affiliation with system design in the development of learning devices, designing learning models, and system perspectives [21]. researchers designed system management and built a new model adopting [22] the concept of the project and production-based learning.
Stage III : Expert Validation and Revision	Validation by experts on the products developed, namely: FGD (Focus Group Discussion) to (1) dig into in-depth information about early products developed in the form of IoT-based PBL-3D models and learning devices, (2) develop research hypotheses, (3) collect the data needed to develop products in the form of constructive suggestions and criticisms. Presents several experts related to products developed in the areas of Learning Model, Curriculum, Software Engineering, Electronics, Embedded System, and language. Validation of products produced by both learning models and learning devices. Validation is a content validity perspective, a questionnaire that has been provided to the research object to validate some of the necessary aspects in terms of both the learning model and the learning device.[23]
Stage IV : Small-scale field trials and product revisions	Conduct validity, practicality, and effectiveness tests of new learning models using SPSS. Fix revised products in phase III [24]
Stage V : Large-scale field trials and final products	Evaluation on a large scale and denomination phase. This evaluated product is the result of the research and development of PBL-3D models based on blended learning [25]. This result is valid, practical, and effective, and ready to be in the seminar. The implementation phase of the learning model synergizes with the implementation and maintenance phase of the learning product, learning device development.

II. III. Aiken's V

This study uses Aiken's V, Aiken has formulated Aiken's V formula for mathematics Coefficient Validity Content, namely:

$$V = \frac{\sum s}{n(c-1)}$$

s = r –lo

Lo = lowest validity assessment number (e.g. 1)

C = highest validity rating number (e.g. 5)

R = numbers provided by the assessor

Assessments of Aiken's calculation results range from 0 to 1 and the number 0.6 can be interpreted to have quite high coefficients. For a given value of V, a value of 0.6 and in from a value of 0.6 is stated in a valid category [24,26].

III. RESULT AND DISCUSSION

III.I. Syntax Model

Guidelines for the implementation of PBL-3D model learning for lecturers and students set out in the syntax model which is the collaboration and elaboration of Project and Production Based Learning, as follows:

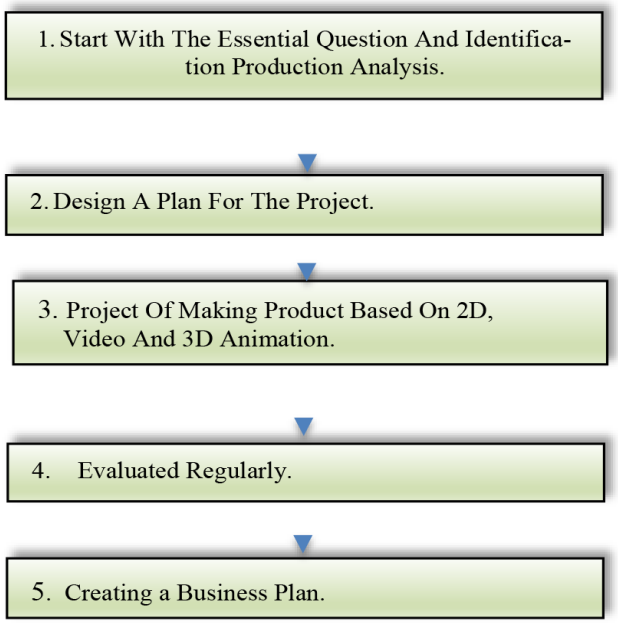

Fig. 1. Syntax PBL-3D Model

Start With The Essential Question And Identification Production Analysis: The lecturer starts the lecture by throwing bombastic questions, what smart tools can be useful in everyday life and sell well, then collaborating with students, identifying the need for everything and analyzing how the product can be realized

Design A Plan For The Project: Lecturers guide students through the process of designing tools, dividing students into work teams, then schedule a schedule of tool work plans that have been designed.

The Project Of Making A Product Based On 2D, Video, And 3D Animation: Product creation based on the design in the form of 2-dimensional images, working videos, and 3-dimensional animations to minimize workmanship errors by all teams.

Evaluated Regularly: Lecturers evaluate the work of each team in carrying out the work, the design of the work schedule, the neatness of the product, and the lecturers evaluate the work of each team in carrying out the work, the design of the work schedule, the neatness of the product, and the quality control of the work, quality control of the work.

Creating The Business Plan: After the product is completed, at the previous stage and has visited the rigorous evaluation phase of product workmanship, lecturers and students schedule a product marketing business plan, by inviting the part of the campus production unit so that the products are made to sell in the market.

III.II. Syntax Model Validation

All instruments have been validated by experts using Aiken's V coefficient with valid results. The practicality of the model is assessed on the Likert scale. Testing the practicality of the PBL-3D Model by conducting a Focus Group Discussion (FGD) by five experts, with the result that the model is very valid. Summary of Aiken's V calculation results of Syntax Validation PBL-3D Model:

Start With The Essential Question And Identification Production Analysis, the result is 0.92, Design A Plan For The Project obtained 0.93, The Project Of Making A Product Based On 2D, Video, And 3D Animation the result is 0.82, Evaluated Regularly the result is 0.91 and Creating a Business Plan the result is 0.94, with average results 0,92 (See Fig. 2):

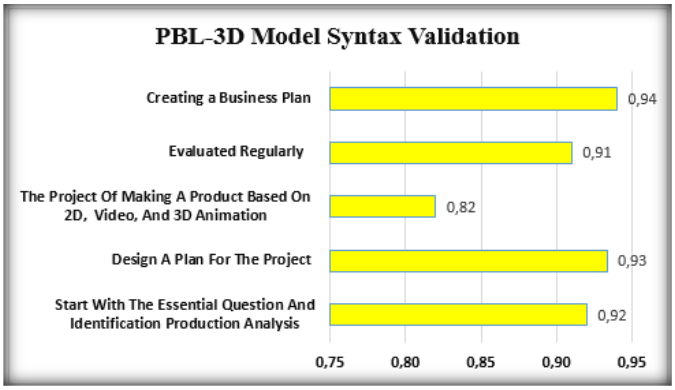

Fig.2. Syntax Validation for PBL-3D Model

III.III. Learning Management System

Edmodo is a software includes activities: [23], Course design by lecturers, Classroom Learning Activities: teaching by lecturers, classroom interaction with students, group activities by students, Access by any device, anywhere by parents, students, and lecturers, Used in personal learning: anytime,

anywhere, Online material: e-book, 2D Picture, and 3D animations.

Here's how the Embedded System Learning screen looks:

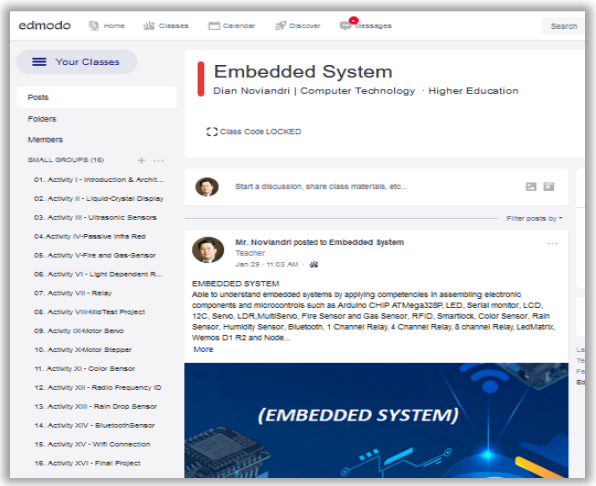

Fig. 3. Embedded System Learning

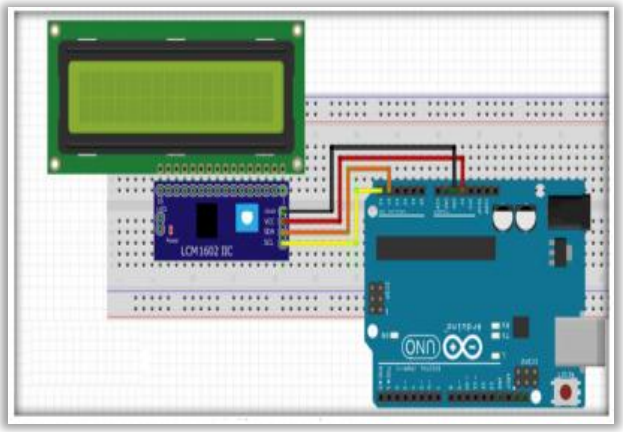

Fig. 4. 2D Picture

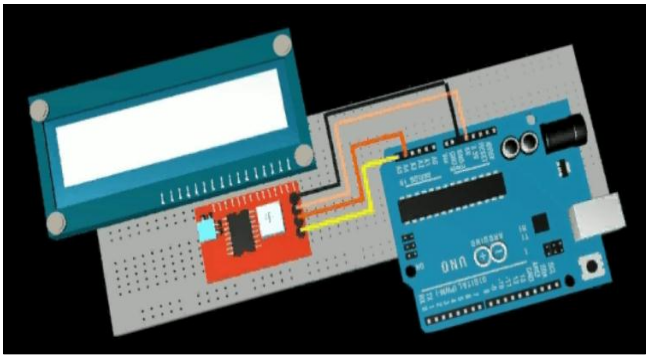

Fig. 5. 3D Animation

Fig. 2 is an interactive online media used for the implementation of PBL-3D model learning, Fig. 3 is an example of LCD material, how to assemble each tool, and Fig. 4 is a 3D animation of learning for LCD material. This applies to every meeting until the last meeting to produce products that are worth selling.

III.IV. Validation of Learning Management System

Validation results by five experts that Learning Management System Structure results in 0.89, Interactivity results in 0.91, Visualization results 0.90 and Navigation and Properties results in 0.93 with average results 0.91, that the LMS is very valid (See Fig. 6):

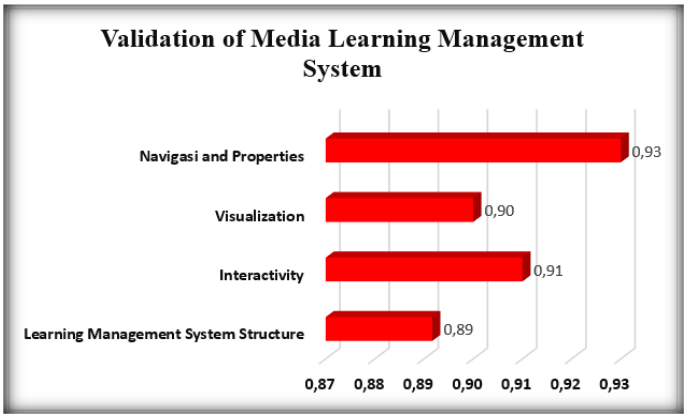

Fig.6. Validation of Media Learning Management System

III.V. Validation of 3D Media

Validation results by five experts that Suitability of study material with SCL results in 0.93, Basic concept of study results 0.98, Completeness of Serving results 0.85, Accuracy results 0.93 and Relevance results 0.88 with average results 0.91, that the LMS is very valid (See Fig. 7):

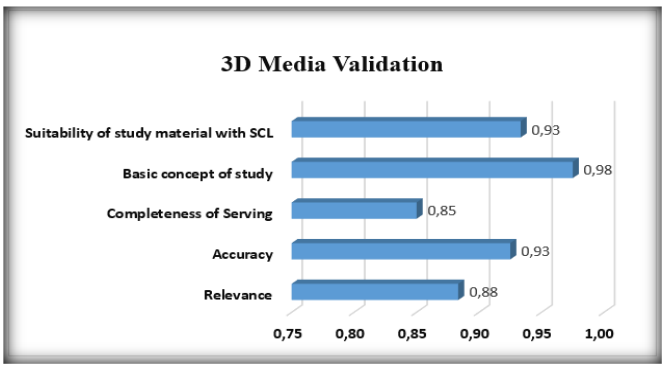

Fig.7. Validation of 3D Media

IV. CONCLUSION

Development of the PBL-3D Model, with the collaboration and elaboration of the Project-Based and Production-Based Learning models, by concluding:

1. PBL-3D model is declared very valid based on the validation results of experts, namely model development experts, animation experts, computer experts, and language experts with average results of

0.92 so that it can be an alternative learning model to develop products.

2. Learning Management System and 3D Media used are also very valid with an average of 0.91
3. By using the PBL-3D Learning Model, it can improve the competence of students in Embedded System courses.

REFERENCES

[1] Ganefri G. The development of production-based learning approach to entrepreneurial spirit for engineering students. Asian Social Science. 2013;9(12):162-7.

[2] Mardin A, Rahmi U, Yulastri A. Production Based Learning: As A Tool To Increase Entrepreneurial Skills Of Students. 2018: 353-360.

[3] Chung H, Long S, Han SC, Sarker S, Ellis L, Kang BH. A comparative study of online and face-to-face embedded systems learning course. InProceedings of the 20th Australasian Computing Education Conference 2018 Jan 30 (pp. 63-72).

[4] Sin NM, Al-Asmari MA. Students' Perception on Blending Instructional 3D Animation in Engineering Courses. International Journal of Information and Education Technology. 2018 May;8(5).

[5] DİNÇER B, SAVCI C, MUTLU H. Effect of 3D Animation-Assisted Education on Knowledge Level of Nursing Students for the Evaluation of Respiration. Journal of Academic Research in Nursing. 2019;5(3):213-8.

[6] Junaidi D. Aris, Panduan Penyusunan Kurikulum Pendidikan Tinggi, Revisi IV. Jakarta: Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan. 2020.

[7] Xia C. Application of Continuous Animation Production Technology in Gymnastics Multimedia Teaching. International Journal of Emerging Technologies in Learning (iJET). 2016 Sep 29;11(09):46-50.

[8] Wang Q. Design of 3D Animation Special Effects in Animation 3D Modeling Teaching Based on QFD Theory. International Journal of Emerging Technologies in Learning (iJET). 2017 Jul 12;12(07):90-100.

[9] Effendi H, Soenarto S, Sofyan H. The effectiveness of web-based interactive blended learning model in electrical engineering courses. REiD (Research and Evaluation in Education). 2015 Dec 31;1(2):175-85.

[10] Effendi ZM, Effendi H, Effendi H. The role of locus control and learning styles in the development of the blended learning model at PSU. Int. J. GEOMATE. 2017 Sep 1;13(37):75-80.

[11] Effendi H, Effendi ZM, Effendi H. Accessibility And Acceptability Of The Bmi Model At Institute Of Teacher Training And Pedagogy. Int. J. Adv. Sci. Technol.2020;29(6):1568–1573.

[12] Ryane I. A Case Study of Using Edmodo to Enhance Computer Science Learning for Engineering Students. International Journal of Emerging Technologies in Learning (iJET). 2020 Feb 18;15(03):62-73.

[13] Hursen C, Fasli FG. The impact of reflective teaching applications supported by Edmodo on prospective teachers' self-directed learning skills. International Journal of Emerging Technologies in Learning (iJET). 2017 Nov 2;12(10):21-34.

[14] Joyce B, Weil M, Calhoun E. Model of Teaching. 2011:p. 637,.

[15] Sababha B, Alqudah Y, Abualbasal A, AlQaralleh E. Project-based learning to enhance teaching embedded systems. Eurasia Journal of Mathematics, Science and Technology Education. 2016 Jun 29;12(9):2575-85.

[16] Hoe LS, Chuan TC, Husin H. A Framework of Project-Based Learning for Enhancing Student Competencies through Digital Video Production. International Journal of Human and Technology Interaction (IJHaTI). 2019 Apr 27;3(1):95-100.

[17] Hidayat H. Production based Learning: An Instructional Design Model in the context of vocational education and training (VET). Procedia-Social and Behavioral Sciences. 2015 Aug 24;204:206-11.

[18] Borg M, Gall WR. Educational Research an Introduction, Third Edit. New York: Longman. 1983.

[19] Puslitjaknov T. Metode Penelitian Pengembangan. Jakarta: Pusat Penelitian Kebijakan Dan Inovasi Pendidikan. 2008.

[20] Parnawati TA, Tribhuwana U, Malang T, Ulinuha A. Premise : Journal of English Education and Applied Linguistics. 2019;8(2): 226–240.

[21] Yulastri A, Hidayat H. Developing an Entrepreneurship Module by Using Product-Based Learning Approach in Vocational Education. International Journal of Environmental and Science Education. 2017;12(5):1097-109.

[22] Maksum H, Purwanto W. Development of a model for automotive vocational education (AVE) learning in technical and vocational education training. Int. J. Innov. Creat. Chang. 2019;9(10):279–294.

[23] Wahyudi W. The Effectiveness of Sharing Blended Project Based Learning (SBPBL) Model Implementation in Operating System Course. International Journal of Emerging Technologies in Learning (iJET). 2020 Mar 13;15(05):202-11.

[24] Azwar S. Reliabilitas dan validitas, Edisi 4. Yogyakarta: Pustaka Pelajar. 2012.

[25] Azidovich Tatuev A, Mikhailovich Kosenok S, Nikolaevna Kiseleva N, Vladimirovna Makar S,

Alexandrovich Sklyarenko S. Institutionalization of the green finance market as an opportunity for the Modernization of the regional economy, and ecosystem preservation. Caspian Journal of Environmental Sciences. 2020 Dec 1;18(5):437-46.

[26] Aho W, Wright E, Marvel J. Evaluating the Influence of Venue on Experiential, Project-Based Learning. International Journal for Business Education. 2020 Apr;160:9-21.