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Research Article

Technopreneurship Based Learning Model with Project Based Learning Approach in Higher Education

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Abstract: The goal of this development research is to create a valid, practical, and effective technopreneurship-based entrepreneurship learning model with a Project Based Learning approach for use in Higher Education. Students from Makassar State University's Electronics Engineering Education Faculty of Engineering served as test subjects in this study. The data is analyzed using a combination of descriptive and qualitative data. The final products are learning model books and learning support tools that include semester learning plans, learning modules, and evaluation tools. The study's findings are as follows: (1) preliminary testing to determine the validity of the learning model in terms of all components; (2) theoretically and empirically, the learning model is feasible for use in the classroom; and (3) this learning model is stated to meet practical and effective criteria for use in Higher Education.

Keywords: learning model, technopreneurship, Project Based Learning.

INTRODUCTION

University education is one of the educational institutions in Indonesia that is required to produce graduates who are competent, skilled, and knowledgeable enough to compete in the global marketplace. Because technological developments have an impact on global competition in the current era, appropriate and sustainable technological innovations must be enhanced further by increasing mastery of competencies for technology implementation.

According to Higher Education: Article 16 (1) of Law No. 12 of 2012, Vocational Education is a Higher Education Diploma Program that prepares students to work with specific applied skills up to an applied undergraduate program. Paragraph 2 of Article 35: In Tertiary Education Institutions, a Higher Education Curriculum is developed that refers to the National Higher Education Standards for each Study Program, including the development of intellectual intelligence, noble character, and skills. Permendikbud No. 3 of 2020 on National Higher Education Standards backs this up. The Ministry of Education and Culture is revitalizing the curriculum by focusing more on curriculum based on industry needs, so that graduates are superior to market/industry needs.

The development of technopreneurship in university education is a major concern for the government in the current global era. It is hoped that students will be technologically competent as well as entrepreneurial in nature. As a result, universities in Indonesia are emphasizing the inclusion of entrepreneurial activities in courses and curricula, as well as Information Technology (IT) as a forum for developing innovations and inventions to prepare students to become competent staff in that field.

In addition to understanding the theory and practice of entrepreneurship in modern business, mastery of technology is required (Kurniullah, et al. 2021:78). Entrepreneurs are challenged to develop themselves independently through education and/or training. Technology mastery will be more valuable. Entrepreneurs who master technology outperform entrepreneurs who stick to the old ways. According to Isdarmini (2020: 141), the concept of technopreneurship combines technological and entrepreneurial skills. Dan Wijoyo and colleagues (2020: 34) Technopreneurship is the combination of an entrepreneur's entrepreneurial skills and technological mastery. Similarly, Nelloh (2018) asserts that technopreneurship incorporates elements of technology for innovation and appropriate innovation strategies, and that it is a factor in developing the national economy for the process of establishing new businesses.

Project Based Learning (PBL) is a learning model that places the project at the center of learning. This learning is deemed effective in a contextual learning process that emphasizes the concept of student involvement in problem-solving investigations for the development of creativity.

Based on preliminary observations and research studies, learning tools in the form of lesson plans and learning modules must still be developed, as well as a technopreneurship-based learning model and method with a Project Based Learning approach that can foster an entrepreneurial spirit in students and increase entrepreneurial motivation. The process of carrying out activities in order for them to be used in entrepreneurship courses serves as a model for the development of project-based learning tools for fostering technopreneurship behavior.

This study aims to develop a techno-preneurshipbased entrepreneurship learning model in Higher Education that is valid, effective, and practical in terms of quality standards in order to increase student entrepreneurship motivation.

METHODS

The research is of the R&D variety, with the goal of creating a technopreneurship-based entrepreneurship learning model using a Project Based Learning (PjBL) approach. Plomp (2007:9) developed the learning model, which includes the following stages: (1) preliminary investigation; (2) design; (3) initial product; (4) test, evaluation, and revision; and (5) implementation. According to Dick and Carey (2009: 3), the criteria for developing learning tools as supporting models (RPS, Learning Modules, and Evaluation Tools) for the development of learning instructional systems are as follows.

Students from Makassar State University's Electronics Engineering Education Faculty of Engineering participated in this study. The instruments were developed as a result of focus group discussions (FGD). FGD participants are experts and practitioners with expertise and focus in the field being studied. Each participant was given an instrument feasibility assessment sheet during the FGD activities. The results of the FGD were then discussed. (1) instrument validation sheet; (2) learning device validation sheet; (3) model validation sheet; (4) learning model book validation sheet; (5) model implementation observation sheet; (6) student activity observation sheets; and (7) student response questionnaires to learning comprise the instrument.

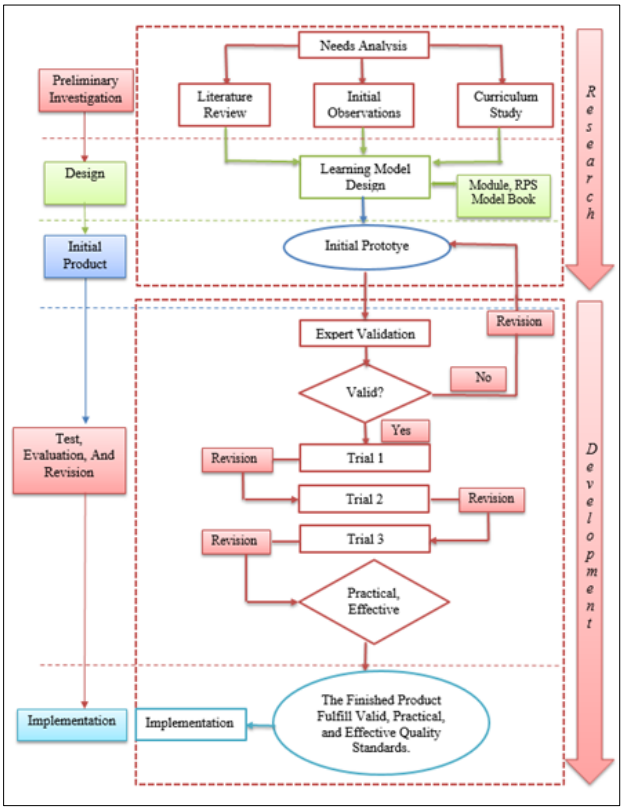

Figure 1. Flowchart of Research Implementation Stages

This study includes both quantitative and qualitative data. The implementation of the model, student activities in learning, and student responses to the implementation of learning are examples of quantitative data. The qualitative data is the result of lecturer and student interviews on learning implementation, activities, and student responses to learning implementation. The resulting data is then analyzed to determine the validity, practicability, and efficacy of the developed learning model. The model's validity criteria employ the category of learning quality (Prahani &

Yuanita, 2016) to determine the model's level of validity, namely:
$3.25 < P \leq 4.0$ means very valid
$2.50 < P \leq 3.25$ means valid
$1.75 < P \leq 2.50$ means less valid
$1.00 < P \leq 1.75$ means not valid
P is the average validation score for each assessment aspect.

According to expert and practitioner evaluations, the criteria for the validity of models, learning tools, and learning model books are in the minimal valid category. This process is repeated until the ideal models, learning tools, and model books that meet the valid or very valid categories are obtained based on content validity and constructive validity.

The model implementation criteria are in the form of learning quality categories (Prahani & Yuanita, 2016) to determine the level of implementation of the developed learning model, namely:
$3.25 < T \leq 4.0$ means everything is finished
$2.50 < T \leq 3.25$ means most are finished
$1.75 < T \leq 2.50$ means only a fraction are finished
$1.00 < T \leq 1.75$ means nothing is finished
T is the feasibility

The T value, which has the categories of being fully implemented or mostly implemented, is the criterion for determining the learning model's level of implementation. If the T value falls into a different category, it will be revised again based on the aspects with the lowest value.

During the learning process, student activity data is analyzed by determining the average frequency and average percentage of time students spend on learning activities. Criteria for student activity will be effective if a percentage of all observed aspects is carried out in each meeting. If student activities do not meet the criteria for effectiveness, a review is conducted to complete the implementation of the next lesson by revising the learning model guidelines and learning tools. In addition, a re-trial was conducted in order to meet the criteria for effective learning models based on student activities during the learning process.

The number of students who responded positively or negatively to each category of questions was determined by analyzing student response data. A positive response indicates that students respond to the categories of happy, new, interested, clear, and interested in each aspect of learning that is addressed, whereas a negative response indicates the inverse.

Positive criteria for student responses to learning are met when more than 80% of students respond to the following questions: (1) happy with learning, (2) learning is something new, (3) interested in learning, (4) can clearly understand the language used in learning, and (5) interested in the appearance of learning devices (writing, illustrations/pictures, and image layout). Meanwhile, constructive student responses are taken into account when revising the guidelines and learning tools. If the student's response does not meet the effective criteria, the researcher revises the aspects with less value based on the student's response results. To obtain effective results for the learning model based on indicators of student responses to learning, repeat trials were conducted.

The analysis of the data from the learning achievement test in question is an examination of the completeness of student learning outcomes. The test is administered at the conclusion of the sub-discussion to assess the level of student mastery of the teaching material. Criteria for the completeness of student learning outcomes in learning are met if the test results obtained are at least 80% of all students scoring at least 75 on a scale of 0-100.

RESULTS AND DISCUSSION

Project Based Learning (PBL) is a form of entrepreneurship based on technopreneurship in the form of a theoretical study of learning theory that is a supporting theory of the developed model, the factual conditions of learning, and the current state of students. The study's findings are the preliminary design of the model components, which are as follows.

Syntax

The syntax of the learning model is shown in Table 1 below,

Table 1. Learning Phases

Learning Phase	Student Activities
Fundamental question (**Inquire**)	. Students create basic questions about the problem-solving topic . Students ask questions about the topic . Students look for appropriate steps to solve the problem
Designing Product Planning (**planning**)	Students discuss the project creation plan in groups. . Students divide tasks. Students prepare the necessary tools, materials, media, and learning resources.
Arranging Production Schedule (**Scheduling**)	Students create a project completion schedule. . Students agree on a project completion deadline.
Monitoring the Activity and Progress of the Project (**Monitoring**)	Students complete projects in accordance with a mutually agreed-upon timeline; . Students document each stage; Students discuss problems that arise during project completion with lecturers.
Test Results (**Assessing Results**)	Students discuss the feasibility of completed projects. . Students create product/work reports to be presented or presented to other groups.
Evaluation of Learning Experiences (**evaluate**)	Students present or present product reports created in groups . Students from other groups responded Students and lecturers reflect on and summarize the outcomes of learning activities.

Social System

The Technopreneurship-Based Entre- preneurship Learning Model with Project-Based Learning (PKbT-PjBL) Approach facilitates learning by allowing students to interact with one another, with lecturers, and with learning materials. The lecturer acts as a facilitator and motivator during the learning process in the technopreneurship based entrepreneurship learning model. The lecturer prepares learning as a facilitator by starting with the RPS, syllabus, lecture contracts, Learning Modules, and Assessment Rubrics. Furthermore, the lecturer introduces phenomena at the start of the learning process, and students then observe them in groups.

When the lecturer conveys topics and asks questions about how to solve problems, students and lecturers form groups, and students interact with learning material. The lecturer assists students in defining learning tasks related to the problem at this stage, after which the students discuss and review the learning topics assigned by the lecturer.

Reaction Principle

Models based on constructivist theory will emphasize student-centered learning, with lecturers serving as motivators and facilitators. Learning modules, which contain material, test questions, and assignments, are provided by lecturers as learning resources. Furthermore, the lecturer presents learning materials that are integrated with entrepreneurship learning materials based on technopreneurship. Lecturers assist and provide feedback to groups of students/individuals.

Support System

The lecturer creates a learning plan that is accompanied by other support systems to ensure that the model is implemented practically and effectively, such as semester learning plans (RPS), learning modules, final learning achievement tests, individual/group assignments, assessment rubrics, and other supporting materials.

Impact on Instruction and Accompaniment

The impact of using the learning model is (1) increased mastery of technopreneurship-based entrepreneurship material. The development of entrepreneurship material based on technopreneurship has an impact on students' technopreneurship knowledge and skills. The material presented is in line with current business, industry, and workplace developments and needs (DUDIKA); (2) Technopreneurshipbased entre- preneurship learning materials have an impact on increasing entrepreneurial motivation; the material presented is capable of instilling an entrepreneurial spirit in students. (3) Development of hard and soft skills Technopreneurship-based entrepreneurship learning materials using a Project Based Learning approach can improve hard and soft skills, allowing students to develop skills that are appropriate for their competencies.

The Learning Model's Accompanying Impact is Independence, Activeness, and Meaningfulness in Learning.

Model Quality Test Results

The model quality test results include valid test results, practical test results, and effective test results, as shown below.

- Table 2 shows the model's and instrument's validity and reliability. The table results show that the model and instrument meet the criteria for validity and reliability, indicating that they are usable. The results of the evaluation of experts/lecturers and education practitioners from all aspects, model components, and instruments show that conceptually, the model/instrument meets the practical and effective criteria for application.
- The model quality/practical test results show that each model/syntax component's implementation falls into the well-implemented category.
- Quality test results/effective model test results, specifically as follows: **First**, the activity component demonstrates that (1) introduction (100%); (2) core activities (93%); (3) student behavior (87%); and (4) cover (100%). The percentage of student activities demonstrates that, in general, students follow the learning stages that correspond to the syntax of the technopreneurship-based entrepreneurship learning model with a Project Based Learning approach. There were additional discussion activities, both individually and in groups, as well as assignments and the use of learning resources. **Second**, student responses to the implementation of learning show that: (1) interest in the learning process (92%); (2) ease in the learning process (94%); (3) the quality of teachers during learning (92%); and (4) lecture activities (92%). The percentage of students' responses to the learning process shows that students respond positively to learning. **Third**, 90 % of student learning outcomes obtain a score of 75. This indicates that student learning outcomes have met the criteria, namely at least 75 % of students obtain a criterion score of completeness of learning outcomes.

Table 2. Results Validation and Reliability Instruments

Validation Component the Validity of the Reliability Conclusion					
	Index	***Description***	***Index***	***Description***	
Learning model validation sheet	0,89	*Valid*	0,92	*Reliable*	LD
Learning model book validation sheet	0,87	*Valid*	0,92	*Reliable*	LD
Semester Learning Plan validation sheet	0,89	*Valid*	0,92	*Reliable*	LD
Learning module validation sheet	0,89	*Valid*	0,92	*Reliable*	LD
Validation sheet observation of the implementation of the learning model	0,87	*Valid*	0,92	*Reliable*	LD
Questionnaire validation sheet student response to learning	0,81	*Valid*	0,89	*Reliable*	LD
Instrument validation sheet for observing student activities	0,89	*Valid*	0,92	*Reliabel*	LD

Information: LD (Appropriate Used)

Learning Model Revision

The model was then updated based on the results of the model quality test, which included, The model changes are as follows:

1) Syntax with separated sub-components of student activities that were originally combined.
2) Combining initial or preliminary activities with core and final activities in previously separated phases

The model guideline adjustments are as follows:

1) The feasibility of the model book's contents is described in each section, beginning with the introduction, the model's contents, the model's implementation, and the closing; previously, only the main points were taken.
2) The syntax of the PKbT-PjBL model is described entirely in terms of students, whereas previously it was described in terms of both lecturers and students.
3) Learning steps are not mandatory.
4) Instructions for implementing learning using the PKbT-PjBL model are provided for one semester (16 meetings), which was previously not presented.

Learning device tweaks are including:

1) The Semester Learning Plan (RPS) includes an assessment rubric as well as the task of creating a lean canvas for a website creation business based on real-life cases/problems.
2) The appropriateness of the learning material provided in relation to the expected final ability.
3) The main objective of learning is added.
4) The method of instruction has been included.
5) The additional module's content is tailored to the learning objectives.
6) Adaptive formative tests and assignments to learning objectives

Findings from the Research

Valid, practical, and effective learning models are linked to the achievement of research objectives. During the process of testing the learning model, specific findings were obtained, specifically related to the students' condition.

Firstly, the model's initial testing process was declared valid in all aspects and components, but the learning theory used to support the model was insufficient. According to the validator, the seven model elements must be explained in detail in order to be implemented in the field.

Secondly, the results of expert and practitioner assessments are theoretically used to determine the viability of implementing the model in class. While the model trials' empirical results met the criteria of practicability and effectiveness.

Thirdly, in this study, students actively participate in the PKbT-PjBL model syntax learning stages. Individual and group discussion activities, assignment collection, and application of learning resources have all been enhanced. When the PKbT-PjB model is used, student learning becomes more active. When the desired goals are met in accordance with the learning objectives and student learning outcomes, learning is said to be effective.

CLOSING

The validity, practicability, and effectiveness criteria are met by the technopreneurship-based entrepreneurship learning model with the Project Based Learning (PjBL) approach. The learning model includes the following aspects/components: syntax, reaction principles, social systems, support systems, and instructional and accompanying influences. The research product is a learning model book with accompanying tools such as semester learning plans, learning modules, and evaluation tools.

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