Development of Early Childhood Education Textbooks Based on the STEAM Learning Model (Science, Technology, Engineering, Art, and Mathematics) in Improving 4C Skills of Early Childhood Education Students

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Abstract. This study aims to develop a STEAM-based early childhood curriculum textbook. The main purpose of developing this coursebook is to strengthen students' skills,such as Critical Thinking, Communication, Creative Thinking, and Collaboration (4C) which are needed today. The research method use an R&D approach which is carried out in three stages : (1) preliminary study through literature study and field study; (2) development study with experts; and (3) trial of steam-based textbooks (experimental study). The research population involved: (1) students who took the course of Pre-curriculum at UNIMED; (2) lecturers who taught the course of Pre-K curriculum; and (3) three experts in learning in pre-school. The instruments used are textbook validation questionnaires which are analyzed using the Percentage Average Score (PRS), and test instruments and performance assessments measuring student behavior after learning by using Steam-based textbooks. This research is expected to produce the following outcomes (1) scientific articles indexed by Scopus or Web of Science; (2) Copyright Certificate (IPR); (3) international proceedings; (4) Simple Patent; (5) ISBN (International Standard Book Number) of book. This research is included in the Technology Readiness Level (TRL) 4, which produces Steam-Based Textbooks that can be implemented in the Early Childhood Education curriculum course.

Keywords: Early Childhood Education Curriculum,Steam,4C Skills.

1 Introduction

Everyone must learn to face new things that continue to happen because the education system continues to experience changes and progress. The positive impact that occurs from these changes and progress makes humans more educated and forms a more knowledgeable personality. The use of learning methods that we use will also be influenced by the increasingly

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rapid development of the current era. As time progresses, there are more and more demands that prospective educators must have, especially in early childhood education.

To achieve this, one of the elements is through teaching materials. An educator/instructor in carrying out teaching and learning activities in class requires teaching materials because teaching materials are all forms of materials that can be used by someone to help with their work. One form of teaching material, namely books, which can be interpreted as teaching materials, are books that contain knowledge from curriculum analysis results in written form. Textbooks are written materials that present knowledge from the thoughts of the author (Mawardi et al, 2013)

In planning and reviewing the implementation of learning, an educator needs teaching materials as a guide regarding the information, tools and texts used. In accordance with the statement above, teaching materials must have a clear point of view, principles, approaches, methods and teaching techniques. In 21st century learning, the Steam approach is very relevant to use. Through the Steam approach, students can develop the 4C skills (creativity, critical thinking, collaboration and communication) so that students can solve the real problems they face and can convey them well through innovative solutions (Lestari et al, 2018).

An academic education program is a series of teaching materials and activities whose function is to develop and integrate various existing scientific and technological substances directed at academic mastery and insight into the existence and conditions in the field, especially those related to pathways, types and levels of early childhood education. As prospective early childhood educators, students need to have skills in designing a curriculum as a scientific basis to face current developments and the increasingly complex learning process today. The skills in question are 4C skills which stands for creativity, critical thinking, collaboration and communication. The four elements aim to form intelligent and qualified students.

In the Early Childhood Education curriculum course, students are not only able to study the curriculum theoretically but must be able to analyze education and learning programs to the point of preparing learning activity programs in Early Childhood Education. Another problem is the attitude of students depending on lecturers' lectures, students' weak ability to explain and argue and students are not motivated to answer lecturers' questions if their names are not mentioned/called.

The problems above are caused by various things, such as the lack of information received by students. Most of the information only comes from lectures given by lecturers. Students are less motivated to search for information from various online and offline media. Lectures are dominated by lecturers and the availability of learning resources in the form of lecture modules is still theoretical. Therefore, students must have the 4c skills to be skilled at finding solutions to solving problems, wisely making decisions, thinking creatively, deliberating fairly, and being able to communicate their ideas effectively in designing the future preschool curriculum. To support this, textbooks are needed that students can use as a reference in learning. The existing book references so far are still general in nature and are not fully able to answer existing problems, especially regarding curriculum changes that have occurred to date. In at least the last ten years, Indonesia has made curriculum changes four times, namely the 2013 curriculum, the revised 2013 curriculum, the emergency curriculum and currently the most recent is the independent curriculum (Sugiri and Priatmoko, 2020). This curriculum change is based on very rapid developments in the times and science, making the abilities and skills required by industry

increasingly numerous and complex. Thus, human resources (HR) must always be ready to adapt and process the very rapid and massive changes in the 21st century.

2 Method

The research approach used is a mix method using the Research and Development method (Borg and Gall, 2006). Users of this method are an effort to carry out research as well as product development which can ultimately improve the goals they want to achieve.

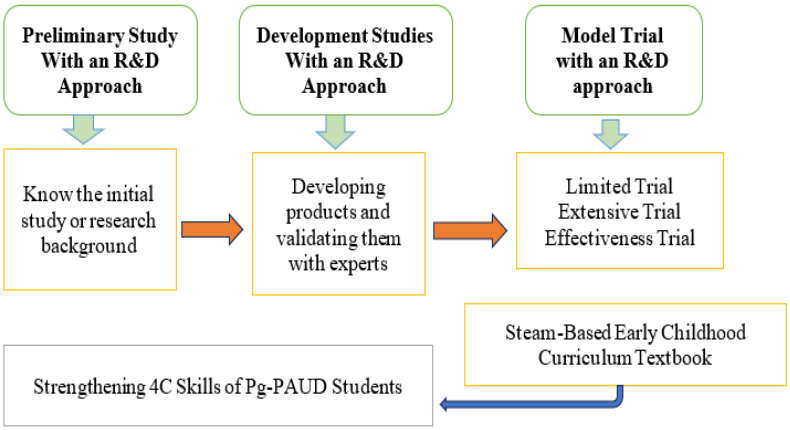

Fig. 1. Research Design

All 115 PG-PAUD students attending lectures consisting of 5 classes in the PAUD Curriculum courses will be the population in this research and the sample will be determined based on random sampling techniques. Data collection techniques are the methods that researchers use to collect data (Mukrima et al., 2016). Interviews, literature studies, and distributing questionnaires were carried out to collect data later. As a basis for developing PAUD curriculum textbooks, literature studies, experts are needed to validate the design and practical tests based on questionnaires distributed to students. To find out more detailed information regarding the use of textbooks, interviews were conducted with students (Mita, 2016).

The use of regression and the Kolmogorov-Smirnov test was carried out to see how effective the development model was. The data analyzed is based on the results of the items in the instrument used using SPSS 20. The data collection instrument becomes a reference in determining initial data in developing a model that is appropriate to needs in the field as well as being used to see the level of feasibility and effectiveness of the development of the model being developed. Using a Likert scale will result in an affirmative answer, namely a scale value of 1-4.

3 Results

Based on the results of research related to textbooks that will be used in early childhood education curriculum courses, it can be seen that the textbooks used so far are still general in

nature and still cannot facilitate student activity and reasoning. The availability of textbooks for students can provide relevant learning material that will help students achieve learning goals and basic competencies and for teachers can become a reference for relevant learning resources to use. Textbooks are an important component in achieving learning success. Apart from helping educators, the use of textbooks also makes it easier for students to understand the material and is able to provide interesting learning material (Prastowo, 2014). This textbook not only plays a role in the success of learning at the primary and secondary education levels, but also at the tertiary level. The use of this textbook is designed using the STEAM learning method. STEAM integrates the five elements, namely concepts, technology, engineering, art and mathematics in a comprehensive manner so as to help students develop skills in learning and be able to face future challenges (Mursyid, 2018). Through STEAM students try to understand real problems by appreciating art and science simultaneously using various forms of critical thinking skills, creativity and imagination (Wilson & Hawkins, 2019).

This research will start from the preliminary research stage, then continue with the planning stage until obtaining an initial product which will later be tested in the field. Furthermore, if the initial product requires product revision, it will be carried out to the trial stage so that finally the product can be disseminated.

1. Preliminary Research

A preliminary study was carried out in order to analyze the needs in the field for the availability of Steam-based PAUD curriculum books. This analysis was also carried out to see the availability in terms of human resources and implementation time in working on the book. Next, research was carried out through literature studies and literature studies to find out several things that were considered important regarding the product being developed through analysis of Semester Learning Plans (RPS) in PAUD curriculum courses, data studies and conducting interviews with students and lecturers in this course.

2. Planning

The planning stage in this research is determining the research objectives, estimating funds, time and energy from the research team, which is then followed by distributing tasks to the research team according to the qualifications of each member. Product design from the results of the analysis in the previous stage will be carried out at this stage, namely in the form of a textbook based on the STEAM approach. The planning steps are as follows:

a) Determine the title of the textbook to be developed.

b) Prepare references from various sources, including the internet, journals, books or other references.

c) Identify CPL & CPMK courses based on the current curriculum.

d) Identify indicators of competency achievement to be developed.

e) Designing the format for making textbooks.

3. Initial Product Development

This research was continued with initial product development which included determining the design of the product being developed, the material in the textbook being developed included;

(1) the nature of the curriculum, (2) the foundations and principles of PAUD curriculum development, (3) components of PAUD curriculum development, (4) curriculum development models, and 5) History of PAUD curriculum development in Indonesia.

4. Initial Product Trial

The initial product trial aims to see the opinions of experts regarding the development of the initial textbook design that the researchers have prepared. Content validity testing based on expert assessments was carried out using the Aiken V formula, the test results can be seen in the following table:

Table 1. Expert Trial Assessment

No	Observed Aspects	Rating Score		Average	Information
		Expert 1	**Expert 2**		
1	Content Eligibility	2,75	2,85	2,8	Enough
2	Eligibility of Presentation	2,70	2,80	2,75	Enough
3	Language Aspect	2,90	2,95	2,93	Enough
	Amount	8,35	8,60	8,48	
	Average	2,78	2,87	2,83	Enough

The initial product trial results obtained a score of 2.83 in the sufficient category. Through expert assessments, recommendations for improvement were obtained, namely that improvements were needed in the presentation of cases and adding questions at the end of each material.

5. Major Product Revisions

After getting the results of the initial product trial, the researcher will carry out revisions according to the aspects that received low marks from the experts by improving the suitability of the content, presentation and language to make it even better. Addition of theoretical sources that refer to concepts and consistent use of terms in the curriculum so that readers can easily understand them.

6. Product Trial

Textbooks that had undergone improvements were given to 6 students who had taken the Early Childhood Education curriculum courses to carry out limited trials. The results of the limited trial can be seen in the following table:

Table 2. Product Trial Results

No	Observed Aspects	Subject Assessment						Average
		1	2	3	4	5	6	
1	Content Eligibility	3,66	3,71	3,76	3,72	3,69	3,67	3,68
2	Eligibility of Presentation	3,61	3,64	3,59	3,85	3,64	3,66	3,59

3	Language Aspect	3,79	3,74	3,82	3,74	3,74	3,80	3,73
	Amount	11,06	11,09	11,17	11,26	11,07	11,23	11,00
	Average	3,68	3,69	3,72	3,75	3,69	3,74	3,71

The results of the limited trial resulted in a score of 3.71, which means a good category for all, so that the textbook can be tested on a larger group. The research team also continues to check the book to minimize errors in typing words or sentences and also in image design. This is done to improve the quality of the preschool curriculum books.

7. Trial Use

Usage trials were carried out on 20 students as a sample who focused on assessing textbooks on the aspects of appropriateness of presentation, appropriateness of content and appropriateness of language. The results of the use trial can be observed in the table below:

Table 3. Large Group Trial Results

Aspect	Aspect Description	Score	Average
Content Eligibility	Compatibility of the material with CPL/CMK	90,0	3,53
	Material accuracy	89,0	3,56
	Supporting learning materials	91,5	3,66
	Material update	88,8	3,55
Appropriateness	Serving technique	93,0	3,73
Presentation	Serving support	92,5	3,70
	Presentation of learning	93,0	3,72
	Presentation equipment	93,5	3,74
Language Assessment	Straightforward	95,5	3,82
	Communicative	95,3	3,81
	Dialogic and interactive	93,0	3,72
	Suitability with the level of development of students	92,0	3,68
	Consistency and integration of thought flow	95,5	3,82
	Use of terms, symbols or icons	91,0	3,64
	Average		3,69

Information	Good

8. Final Product Revision

After testing the product on a large group, the results obtained showed a score of 3.69, which means it is in the good category. With these results, the research team does not need to carry out further revisions. Textbooks that are suitable for use by students will then be registered to obtain copyright.

9. Dissemination and Implementation

At this stage, dissemination and outreach is carried out to lecturers who teach courses and also to students who have taken early childhood curriculum courses. Meanwhile, students who have not yet attended the lecture will be socialized at the start of learning in Block 2, odd semester this year. This stage was carried out to disseminate the results carried out by researchers.

4 Conclusion

Based on the results of trials carried out on 20 students, the average result of the final product developed reached 3.69 in the good category, so that final product revisions do not need to be carried out and can be continued with the dissemination and implementation stages for students who have taken or will take the course. PAUD curriculum. The product resulting from this research, namely textbooks, can be one of the references used by lecturers in PAUD curriculum courses.

References

[1] Gall, M. D., Gall, J. P., & Borg, W. R. (2006). Educational Research: An Introduction, 8th Edition. Educational An Introduction

[2] Lestari, D.A.B., Budi, A. dan Darsono, T. (2018). Implementasi LKS dengan Pendekatan STEM (Science, Technology,Engineering, and Mathematics) untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. Jurnal Pendidikan Fisika dan teknologi, Volume 4(2), 202.

[3] Mawardi., M, Duskri., Setianingsih, Y., Ninoersy, T., Umar, M.. dan Mashuri. (2013). Pembelajaran Mikro. Banda Aceh, Al-Mumtaz Institute dan Instructional Development Center (IDC) LPTK Fakultas Tarbiyah IAIN Ar-Raniry.

[4] Mita Rosaliza. (2016). wawancara sebuah interaksu komunikasi dalam penelitian kualitatif.

[5] Mukrimaa, S. S., Nurdyansyah, Fahyuni, E. F., Yulia Citra, A., Schulz, N. D., د, غسان ., Taniredja, T., Faridli, E. M., & Harmianto, S. (2016). metode penelitian kuantitatif. In Jurnal Penelitian Pendidikan Guru Sekolah Dasar (Vol. 6, Issue August).

[6] Mursyid M. (2018). Pendekatan pembelajaran STEAM menjadi prioritas di MTsN 3 Wonogiri (Internet). Available from: https://jateng.kemenag.go.id/2018/10/pendekatan-pembelajaran-steam-menjadi-prioritas-di-mtsn-3-wonogiri/.

[7] Prastowo, Andi. (2014). Panduan Kreatif Membuat Bahan Ajar Inovatif. Yogyakarta: Diva Press.
[8] Sugiri,W.A & Priatmoko, S. (2020). Persprektif Asesmen Autentik Sebagai Alat Evaluasi Dalam Merdeka Belajar. At-Thullab: Jurnal Pendidikan Guru Madrasah Ibtidaiyah.
[9] Wilson, B. & Hawkins, B. (2019). Art and science in a transdisciplinary curriculum. In Judson, G. & Lima, J. (Eds). CIRCE Magazine: Steam Edition.CIRCE: The Centre for Imagination in Research, Culture & Education http://www.circesfu.ca