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Innovation in The Development of an Electronic Practicum Book of IT-Based Learning Media Oriented to The Team-Based Project

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Abstrak

Belum terdapat buku praktikum yang memenuhi standar kualitas tinggi (valid, praktis dan efektif) yang dapat digunakan sebagai panduan belajar untuk mengembangkan media IT. Penelitian ini bertujuan untuk menghasilkan satu buku praktikum media IT yang terintegrasi dengan prinsip-prinsip pembelajaran Team-Based Project yang memenuhi standar. Untuk menghasilkan produk yang diinginkan, maka dilakukan penelitian R&D dengan model 4D yang terdiri dari empat fase: pendefinisian, desain, pengembangan dan penyebarluasan. Subjek penelitian ini adalah mahasiswa calon guru pada matakuliah media pembelajaran berbasis IT yang terdiri dari 63 orang (kelas A dan B). Untuk memperoleh data yang diperlukan, maka digunakan beberapa instrumen: lembar observasi, lembar validasi, lembar kepraktisan, dan lembar keefektifan berupa essay test dan lembar respon mahasiswa, kemudian data dianalisis secara kualitatif dan kuantitatif. Berdasarkan hasil penelitian, buku tersebut memenuhi 3 standar kualitas yang ditentukan, dan terbukti adanya peningkatan kemampuan mahasiswa dalam menghasilkan produk media IT yang relevan dengan kebutuhan siswa sebagai yang termasuk pada warga digital.
Kata Kunci: Buku Elektronik; Praktikum; Media Pembelajaran Berbasis IT; Projek Berbasis Tim.

Abstract

There are no practicum books that are valid, practical, and of good quality that can be utilized as study aids for creating IT media. This study aims to create an IT media practicum book that is integrated with team-based project principles that meet quality standards. R&D research is conducted using a 4D model, which consists of four processes, to produce the desired product: (1) define, (2) design, (3) develop and (4) disseminate. The subjects of this research are students who are prospective mathematics teachers and are taking IT-based learning media courses consisting of 63 people (classes A and B). The research data was obtained through several instruments: (1) observation sheets, (2) validation sheets, (3) practicality sheets, and (4) effectiveness sheets in the form of essay tests and student response sheets, then the data were analyzed qualitatively and quantitatively. Based on the research findings, the book has met the three specified quality standards, and it is proven that there is an increase in students' ability to understand development concepts and create IT media that are relevant to the needs of native digital learners.
Keywords: Electronic Books; Practicum; IT-Based Learning Media; Project Based Team.

I. INTRODUCTION

Technological developments and advances are currently moving rapidly (Günbaş, 2022), so humans are required to be able to master information and knowledge (Corinne Martinez, 2022), especially for prospective teachers (Instefjord & Munthe, 2017) to become professional teachers. (Günbaş, 2022; Siregar, 2021). It is undeniable that these technological developments and advances affect many lines of life, including the learning process (Siregar, 2019; 2021; Sulaiman & Ismail, 2020). Teachers and learners are required to use technology wisely to improve the quality of learning because it can increase the efficiency and effectiveness of learning (Koehler & Mishra, 2009; Sarji & Mampouw, 2022; Sadiah & Afriansyah, 2023).

The use of technology to create IT-based learning media is one of the mandatory competencies for a professional teacher in the 21st century (González-Pérez,; Ramírez-Montoya, 2022). However, based on preliminary research this ability is still relatively low. Therefore, it is necessary to provide creative and innovative solutions by improving the quality of learning and its support system, for instance, employing team-based projects and integrated practicum books with multimedia that are appropriate for the requirements and qualities of future teachers.

Human dependence on technology is increasing, especially in improving the quality of learning (Design-Based Research Collective, 2003; Diva & Purwaningrum, 2023). The use of information technology in the learning process is one of the learning innovations needed in the era of the industrial revolution 4.0. Where, information technology plays an important role in improving the quality of learning (Widyawati & Sujatmika, 2020; Septia & Wahyu, 2023).

The learning objectives are to improve: (1) intellectual abilities, (2) the ability to solve a problem, (3) high learning outcomes, (4) communication skills, and (5) character quality (Kemendikbud, 2013). In line with that, there are 4 competencies that must be possessed by a professional teacher: (1) personality, (2) professionalism, (3) pedagogic and (4) social (Mandal, 2018; Permendikbud RI number 16 of 2017; Linda & Afriansyah, 2022). Thus, to achieve national learning goals, it is necessary to improve the quality of prospective teachers so that they are able to achieve these 4 competencies through a quality lecture process (Mandal, 2018; Putra, Hermita, & Alim, 2021).

One of the competencies of professional teachers is to be able to create IT-based learning media (Günbaş, 2022; Siregar, et al., 2021; Sulaiman, Ismail, 2020) in accordance with theory, material characteristics, and needs. student learning, so that they deserve to be teachers for digital-native students (Corinne Martinez, 2022; Sulaiman, & Ismail, 2020); Bell, 2010; Schleicher, 2012). However, in reality, based on the results of preliminary research, the ability of prospective teacher students to develop IT-based learning media is still in the low category. This is evident from the media they produce was still as a source of information and cannot be used to stimulate students to learn actively and

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then be able to construct their own knowledge.

The low competence of students to develop IT-based learning media is caused by several factors: (1) activities in the learning flow have not stimulated them to create learning media (2) the contents of the practicum book only focus on theory and tutorials, (3) the book does not contain up-to-date technology, (4) the book has not adopted the principles of outcome-based learning, and (5) the book has not studied the pedagogic aspects in depth. Thus, it is necessary to develop an IT-based learning media practicum book that is relevant to theory, learning objectives and the needs of students as digital-native learners (Siregar, 2021; Martin, 2018).

The integration of technological aspects (Munday, 1991; Mayer, 2017) and team-based projects is very important to consider in developing an IT media practicum book. Where aspects of technology can be utilized to support the effectiveness of the learning process (Siregar 2019; Susanto, & Lestari, 2020; Munday, 1991; Bringula, 2017) and can help simplify complex matters (Cam & Kiyici, 2022; Siregar, 2021; Mayer, 2017; Chien et al., 2012). Furthermore, integrating project aspects with real and contemporary cases can help the learning process become more creative, innovative, collaborative, communicative and constructivist so that it can achieve learning goals (Corinne Martinez, 2022; Abidin, 2014:264). Thus, it is necessary to develop a learning media practicum book that integrates technological aspects (Siregar, 2019; 2021) and team-based projects that meet the criteria for high quality standards: validity, practicality and effectiveness (Nieveen, 2013; Nieveen & Folmer, 2013).

It cites multiple related studies to demonstrate that generation Z can benefit from the use of interactive TPACK, team-based projects, and electronic publications that use case approaches (Yudiandari & Aufelia Cita, 2018). Implementation of an Android-based e-textbook in the learning process of learning media courses can enhance student learning outcomes (Batubara, Sumantri, & Marini, 2022). In addition, there is a positive influence between learning achievement and prospective teacher perceptions of the use of electronic books (Almekhlafi, 2021). Based on these facts, it is believed that books developed on a digital basis can improve learning outcomes. On the other hand, there has been no previous research that has developed electronic practicum books in integrated with team-based projects to improve the ability of prospective teachers to develop constructivist-based learning media that are relevant to today's needs.

II. METHOD

The electronic practicum book is oriented towards a team-based project approach with high quality standards, so researchers have implemented research and development (R&D) based on Four-D Models (define, design, develop and disseminate) (Thiagarajan, 1974). This concept is in line with the traits of the creation of an electronic book that is the result of a collaborative initiative. The flow

of development of the IT media practicum book is shown in the Figure 1 below.

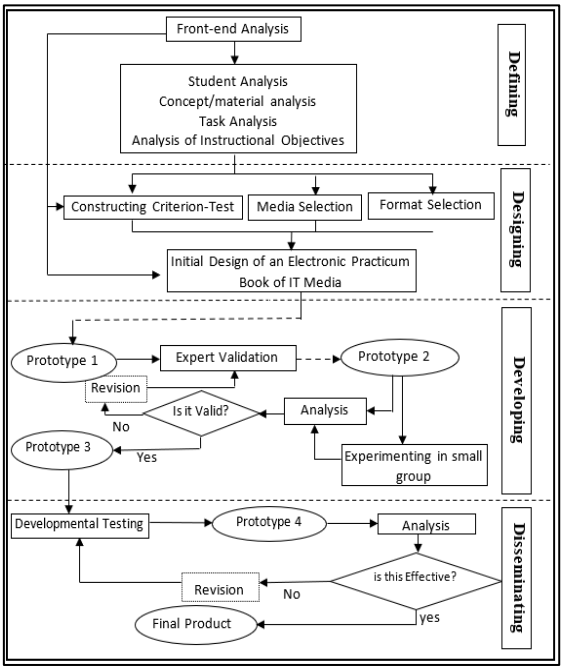

Figure 1. Operational scheme of 4-D model (Thiagarajan, 1974)

This study has implemented several instruments: (1) validation sheets of learning plans, tests, and team-based project-based practicum e-books, (2) test instruments, (3) practicality questionnaires, (4) practicality response questionnaires by teachers (5) questionnaires student responses to measure effectiveness. Where this questionnaire was developed based on indicators that are relevant to the components of the electronic book practicum of IT-based learning media (Bozkurt & Bozkaya, 2015).

In this study, qualitative data were obtained from interviews, observations and suggestions from media experts, material experts, lecturers, and students after using the practical electronic book (Donald et al., 2010). While quantitative data were obtained from the results of pretest-posttest and response questionnaires (Blaikie, 2003). Then the two types of data were analyzed using the mix-method. The qualitative analysis technique was carried out by analyzing descriptive data, while the quantitative analysis technique was applied to analyze the results of the pretest-posttest and response questionnaires.

To find out the improvement of the competence of prospective teachers in creating IT-based learning media, pre-test, and post-test were carried out. Then the results were analyzed using the formula for calculating the gain index according to Meltzer (2002:1260) as follows: $\mathbf{g} = \frac{X\ postest - X\ pretest}{X\ ideal - X\ pretest}$. Where: g: gain index; and X: scores obtained. Furthermore, the value of g is interpreted based on Hake's criteria in Table 1 (Hake, 1998:65).

Table 1.
Gain Index Interpretation

Gain Score	Interpretation Category
g > 0,7	High
0,3 < g ≤ 0,7	Moderate
g ≤ 0,3	Low

The quality of an IT-based learning media oriented electronic practicum book on a team-based project is declared eligible for use if it meets the indicators of validity, practicality and effectiveness (Nieveen, N., 2007). A book is valid if it is included in the valid or very valid category. Then the product is practical if it meets two indicators: (1) the expert states that the book can be used with little or no revision, (2) the lecturer who uses the book states that the book is easy to use and meets the good or very good category. Furthermore, the final product is effective if it fulfills three conditions: (1) there is an increase in the competence of prospective teacher students in developing IT-based learning media, and (2) at least 80% of students give

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a good response, (3) get a score of 80 (an A or B), and (4) produce IT-based learning media.

III. RESULT AND DISCUSSION

The process of developing an electronic practicum book of IT-based learning media is carried out through four phases. The research findings of each phase are described as follows.

A. Defining Phase

A competency that instructors must grasp is the capacity to create IT-based instructional materials. Because, IT-based media is needed to support a quality learning process. But in reality, prospective mathematics teachers have not been able to create IT media that are relevant to pedagogical aspects, student characteristics, material characteristics, and the selection of the right type of media (video, audio, infographic, image). The root of the problem and alternative solutions designed, then used to develop this book. The explanation is described as follows

Based on the preliminary study, there are several root problems found: (1) Inappropriate learning flow to be able to produce quality learning media, (2) The practicum book only reviews theories and tutorials on making explanatory videos, motion graphics, images, audio, and infographics, (3) The practical book has not been developed based on electronics, which is a digital native learner's need, (4) The practicum book has not yet adopted the principles of outcome-based learning, such as team-based-project, (5) The practical book has not integrated the pedagogic and practical aspects. Then, alternative solutions designed to solve the problem are: (1) The learning flow is designed starting from the introduction, core activities, and final activities. Activities consist of identifying the problem, determining alternative solutions, analyzing the required media, creating media, experimenting with the product with a small group, and evaluating it, (2) the book describes the theory and practice related to developing components of IT-based learning media, then the content of the book is also equipped with relevant cases experienced by students when learning mathematics. Based on this case, students were asked to create media as an alternative solution to the case, (3) an IT-based learning media practicum book developed in digital form. The development process is based on the following aspects: (a) student analysis (b) concept/material analysis (c) task analysis (d) analysis of instructional objectives, (e), (4) the IT-based learning media practicum book is designed through team-based-project principles. Thus, users will be led to be able to produce high-quality IT-based learning media, (5) the practicum book describes pedagogic aspects in the form of psychological aspects, characteristics of prospective teachers, material characteristics, competencies, curriculum, and student needs. Then integrate it into a practical order.

B. Designing Phase

After the definition process, the design process for the electronic book practicum of IT-based learning media is carried out according to the needs, concepts, and characteristics of prospective teacher

students and learning objectives. The design process is outlined in the following Figure 2.

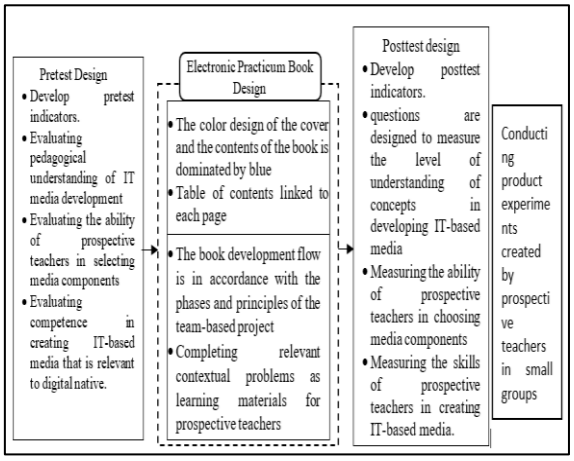

Figure 2. Design chart on pretest, posttest, and electronic practicum book

C. Developing Phase

At this stage, the development of an IT-based learning media electronic practicum book is carried out by following the results at the design stage. After creating all the components of the book such as material descriptions, images, videos, audio, animations, infographics, and hyperlinks, they are then put together in the form of an electronic book, look Figure 3, 4, and 5.

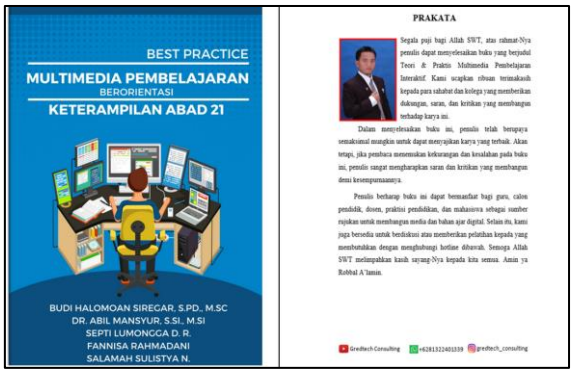

Figure 3. Cover and preface to the electronic practicum book

Figure 4. Components of book content consisting of images, infographics, hyperlinks.

Figure 5. Components of book content consisting of audio, motion graphics and videos.

After developing the initial design of the lesson plans, pretest, posttest, and electronic practicum books, then the device was validated by education experts, material experts, and media experts.

Table 2.
Learning device validation results

No.	Instrument	Validator	Average each validator	Average	Category
1.	Material expert	MatExp 1	3,3	3,20	very Feasible
		MatExp 2	3,1		
2.	Media expert	Media Exp 1	3,4	3,4	very Feasible
		Media Exp 2	3,4		
3.	Questionnaire of lecturer's response	LecRes	3,1	3,10	very Feasible

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4.	Questionnaire of Learners' responses	ProsTeac	3,3	3,4	very Feasible

Based on the description in the Table 2, all devices are in the very feasible category. Prototype 1 was revised based on the suggestions contained in the validation instrument, then readability was tested by 6 prospective teachers. Then the product was revised again and became a prototype 2.

D. Disseminating Phase

At this stage the e-book is implemented in the real class to determine the level of effectiveness. The test results are shown as follows.

Table 3.
Student learning outcomes of prospective teachers

Interval	Grade in Letter	*Pre-test*		*Post-test*	
		Number of Learner	Perc. of Learner	Number of Learner	Perc. of Learner
85 - 100	A	7	11%	23	37%
75 - 84	B	9	14%	29	46%
65 - 74	C	25	40%	8	13%
00 - 64	E	22	35%	3	5%
Total of		63	100%	63	100%

Table 3 reveals that the number of prospective teachers who are able to develop IT-based learning media has increased sharply. But there are still prospective teachers who have not developed it properly. The table shows that there are 83% of prospective teachers who score at least B. Then there are 13% and 5% who get C and E scores, respectively.

Table 4.
Pretest and posttest results

Interval	Category	*Pretest*		*Posttest*	
		Learner	%	Learner	%
90-100	very high	6	10%	24	38%
80-89	high	8	13%	27	43%
65-79	moderate	24	38%	9	14%
55-64	low	19	30%	3	5%
0-54	very low	6	10%	0	0%
Total of		63	100 %	63	100 %

Table 4 describes an increase in the number of prospective teachers who are able to develop IT media in the very high and high categories. However, there are still those who have not been able to develop media properly. Based on the table, it can be stated that the prospective teachers who achieved the very high, high, and moderate categories respectively were 38%, 43%, and 14%, then only 5% were included in the low category.

Table 5.
Improving the learning outcomes of prospective teachers

N-Gain	Category	Numb.	Perc.	Average of gain
g>0,7	high	48	76%	0.75
0,3≤g ≤0,7	moderate	14	22%	
g<0,3	low	1	2%	
Total		63	100%	

Table 5 indicates that there are 76%, 14% and 1% who achieve learning outcomes in the high, moderate, and low categories, respectively. Where the average N-gain reaches 0.75, where this

score indicates that the average learning outcomes are included in the high category.

The results above show that the use of an electronic practicum book oriented to the team-based project is effective in increasing the ability of prospective teachers to develop constructivist-based digital media. Where these findings are relevant to several similar studies conducted by Yudiandari and Aufelia Cita (2018), Lin and Wang (2019), Batubara, Sumantri, and Marini (2022), Almekhlafi (2021), Siregar (2021), Anita et al. (2021), Battaglia, Paolucci, and Ughetto (2021), and Marthani and Ratu (2022), etc.

IV. CONCLUSION

After conducting an in-depth analysis, it can be stated that an electronic practicum book of IT media oriented to the Team Based Project meets 3 criteria of high-quality standards. Practicality satisfies the condition of being very practical, and product validity is included in the feasible category. Furthermore, student learning outcomes increased sharply. Where all students can create IT-based learning media with different qualities. Thus, this product is recommended for use in IT-based learning media practicum courses. The new finding in this study is that prospective teachers have not been able to create effective learning media, especially on the topic of geometric transformation. After testing the media in small groups, in fact there was only a slight increase in students' conceptual understanding of the material. It may be inferred from the findings of the triangulation approach study that the prospective teacher's media products did not enable students to comprehend translation, dilation, rotation, and reflection in great depth. Thus, it is recommended for researchers to continue this research in order to overcome the difficulties of prospective teachers in developing IT-based learning media, especially in geometry transformation material.

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