

NEEDS ANALYSIS FOR THE DEVELOPMENT OF TPACK-BASED MULTIMODAL DIGITAL TEACHING MATERIALS AND 21St CENTURY SKILLS

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Abstract

TPACK and 21st-century skills (critical thinking, creative thinking, collaboration, and creative thinking) must be integrated with teaching materials used in learning, especially in mathematics learning. 21st-century skills are a fundamental need to be mastered by prospective teacher students as a provision in teaching their students later after becoming a teacher. This research is development research with the ASSURE model but is limited to the needs analysis stage only. Hence, the purpose of this research is to describe the review results related to the need for developing TPACK-based multimodal digital teaching materials and 21st-century skills in learning analytical geometry courses that will be used as a foundation in developing teaching materials. This research is descriptive qualitative research with research subjects consisting of 48 students and 12 lecturers of mathematics education at Universitas Muhammadiyah Sorong in the 2021/2022 academic year. The research data were collected with a needs analysis questionnaire using learner analysis indicators at the ASSURE development stage and analyzed descriptively. The results of the study concluded that multimodal digital teaching materials for TPACK-oriented analytical geometry courses and 21st-century skills need to be developed for students of the mathematics education study program at the Faculty of Teacher Training and Education, Universitas Muhammadiyah Sorong.

Keywords: Needs analysis, Multimodal digital teaching materials 2; 21st-century skills

1. INTRODUCTION (BOLD 12PT)

The integration of technological advances in digital era learning needs to be maximized in the implementation of the learning process [1] as an effort to improve learning outcomes and the achievement of 21st-century skills of students [2], [3]. 21st-century skills consisting of four skills, among others, critical thinking skills, creative thinking, communication, and collaboration (4C), are essential skills to be developed in students at the primary or tertiary education level because it dramatically affects the ability to produce students who can be ready for various challenges and problems faced in everyday life at this or in the future [4], [5], [6], [7], [8].

Learning in the digital era cannot be separated from the utilization of technological advances, pedagogy, and even material content in every lesson, commonly referred to as TPACK (Technological, Pedagogical, And Content Knowledge) [3], and becomes mandatory knowledge that must be mastered by lecturers, teachers, or prospective educators who prepare their students' 21st-century skills [10]. For the learning process by utilizing TPACK and oriented towards improving 21st-century skills to be maximally implemented, it must be

presented in multimodal digital teaching materials. Teaching materials contain various materials that follow the competencies that are the learning objectives and are used by educators to carry out the learning process to achieve maximum learning outcomes [8], [11]. Teaching materials can also be interpreted as something fundamental in implementing the learning process, which contains various knowledge, attitudes, and skills, that must be mastered by learners or students by the curriculum set by the government or the college itself [12]. At the same time, multimodal is communicating by utilizing one semiotic source but can be oral, written, or text others [9]. Multimodal itself can be interpreted as interacting by using various means, in the form of text, images, info graphics, or other means that can assist in conveying the expected information [13].

Multimodal digital teaching materials are learning materials that contain materials and competencies that follow the learning objectives in the curriculum with those developed by utilizing TPACK and oriented towards 21st-century skills in digital form, which contain knowledge presented in the form of text or writing and clarified with images and audio, as well as maximizing the use of video or material links in the form of links and are interactive [14], [15]. TPACK in teaching materials is structured by maximizing the environment and collaboration between technology and pedagogy to deliver content or material following learning objectives and skills that students must master [16], [17], [18], [19].

Multimodal digital teaching materials are expected to improve the various skills needed by students for life in the 21st century. The study results of the research can be seen that teaching materials presented digitally in electronic form affect streamlining the implementation of the learning process and improving student learning outcomes, and being able to develop the creativity of lecturers in preparing media that will be used in the implementation of learning [15], [14], [20]. It is a necessity for educators, both teachers, lecturers, and prospective educators, to have the knowledge and skills in critical and creative thinking to continually develop the learning process through the development of innovative teaching materials by utilizing TPACK and 21st-century skills [2], [21], [22]. Not only that, teachers or lecturers are also expected to be able to apply and integrate TPACK in every lesson that is carried out by consistently producing innovation by utilizing effective technology to improve the learning process and results [20], [23].

The review of relevant research shows that only some studies still develop TPACK-oriented multimodal digital teaching materials and 21st-century skills in analytical geometry courses. However, this paper only presents the analysis results of the need for developing multimodal digital teaching materials developed with TPACK-oriented and 21st-century skills.

This study aims to describe the results of the review of data on the needs analysis of teaching material development which will be used as a consideration or initial data in the development of multimodal digital teaching materials for analytical geometry courses oriented to TPACK and century skills in students of mathematics education study program, Faculty of Teacher Training and Education, Universitas Muhammadiyah Sorong.

2. METHODS

This research is development research with ASSURE design but is limited to the learner analysis stage at the ASSURE development stage. This research was conducted on students of the mathematics education study program and the Faculty of Teacher Training and Education, Universitas Muhammadiyah Sorong, consisting of 48 students and 12 lecturers, with the implementation time in the even semester of the 2021/2022 academic year from February 2022 to March 2022.

Data in the study were collected with a needs analysis questionnaire for lecturers and students consisting of 8 questions: 1. (Apakah saudara sudah mengambil mata kuliah geometri analitik) Have you taken analytic geometry courses; 2. (Apa bahan ajar yang biasa digunakan dalam pembelajaran di kelas) What teaching materials are commonly used in classroom learning; 3. (Apa bahan ajar yang digunakan dalam pembelajaran mata kuliah geometri analitik?) What teaching materials are used in learning analytic geometry courses? “Jika jawaban nomor 1 Anda sudah” (If the answer to number 1 you have); 4. (Apakah Anda pernah melakukan pembelajaran dengan memanfaatkan bahan ajar digital multimodal (berupa teks, gambar, audio, video, berbasis web/interaktif) dengan memanfaatkan TPACK (Technological, Pedagogical, Content Knowledge) Have you ever done learning by utilizing multimodal digital teaching materials (text, images, audio, video, web-based / interactive) by utilizing TPACK (Technological, Pedagogical, Content Knowledge); 5. (Menurut Anda, apakah bahan ajar yang digunakan dalam proses pembelajaran belum mengakomodir peningkatan keterampilan ABAD 21 berupa (Berfikir Kritis, Berfikir Kreatif, kolaborasi dan Komunikasi) In your opinion, do the teaching materials used in the learning process not accommodate the improvement of 21st Century skills in the form of (Critical Thinking, Creative Thinking, Collaboration, and Communication); 6. (Menurut saudara, perlukah dalam setiap pembelajaran dikembangkan bahan ajar yang dapat meningkatkan keterampilan ABAD 21 mahasiswa berupa (Berfikir Kritis, Berfikir Kreatif, kolaborasi dan Komunikasi) According to you, is it necessary in every lesson to develop teaching materials to improve students' ABAD 21 skills (Critical Thinking, Creative Thinking, Collaboration, and Communication); 7. (Perlukah dikembangkan bahan ajar digital multimodal pada mata kuliah geometri analitik berorientasi TPACK dan keterampilan ABAD 21) Should multimodal digital teaching materials be developed in TPACK-oriented analytical geometry courses and ABAD 21 skills; 8. (Perlukah dikembangkan bahan ajar digital multimodal pada mata kuliah lainnya pada program studi pendidikan matematika yang berorientasi TPACK dan keterampilan ABAD 21) Should multimodal digital teaching materials be developed in other courses in mathematics education study programs oriented to TPACK and 21st-century skills, The validity of the instrument is measured using experts consisting of people, namely Dr. Ismail Djakaria, M.Si from Universitas Negeri Gorontalo and Dr. Haryanto, M.Pd from the Universitas Papua. The research data were analyzed qualitatively and descriptively.

3. RESULTS AND DISCUSSION

1. Results of needs analysis by Students

The research data were collected in writing by giving a needs analysis questionnaire to the research subjects consisting of 48 students of the mathematics education study program at Universitas Muhammadiyah Sorong. The data collected was then analyzed and presented in a table to make it easier to conclude. The data on the results of the needs analysis by students can be seen in Table 1.

Table 1: Result of needs analysis by Students

Responded Indicators	Frequency (F) and Percentages (%) of each score									
	0		1		2		3		4	
	F	%	F	%	F	%	F	%	F	%
Statement 1	29	60,42	19	39,58						
Statement 2	48	100,00								
Statement 3	48	100,00								
Statement 4			16	33,33	30	62,50	2	4,17		
Statement 5			11	22,92	2	4,17	35	72,92		
Statement 6							21	43,75	27	56,25
Statement 7							17	35,42	31	64,58
Statement 8							22	45,83	26	54,17

Table 1. describes that of the 48 respondents who have taken analytic geometry courses, as many as 19 people (39.58%), while 29 people (60.42) still have not contracted the course. Data The results of the needs analysis by students also show that all respondents answered that they had never carried out learning by utilizing multimodal teaching materials either in analytical geometry courses or other courses. Related to teaching materials commonly used in classroom learning shows that. The utilization of multimodal digital teaching materials (in the form of text, images, audio, video, web-based / interactive) oriented TPACK (Technological, Pedagogical, Content Knowledge) in learning shows that 33.33% of respondents answered that they had never been, 62.50% stated that sometimes, and the remaining 4.17% stated that they often had. That 11 people (22.92%) answered that they had, 4.17% or two respondents answered rarely, and the remaining 72.92% stated that they had yet to be accommodated.

The analysis data also shows that statements 6, 7, and 8, related to the importance of developing teaching materials in every lesson that can improve students' 21st-century skills in the form of (Critical Thinking, Creative Thinking, Collaboration, and Communication), should multimodal digital teaching materials be developed in TPACK-oriented analytical geometry courses and 21st-century skills, and should multimodal digital teaching materials be developed in other courses in mathematics education study programs oriented to TPACK and 21st-century skills, show that more than 50% or 56.25%, 64.58% and 54.17 respondents strongly agreed.

The analysis shows that the needs analysis data by students can be concluded that the implementation of learning carried out by mathematics education lecturers at the Faculty of

Teacher Training and Education, Universitas Muhammadiyah Sorong, has not maximally used multimodal digital teaching materials oriented to TPACK and 21st-century skills and more than 50% of students responded strongly agree to develop multimodal digital teaching materials for TPACK-oriented analytical geometry courses and 21st-century skills.

2. Results of needs analysis by Lecturers

In addition to being collected through needs analysis data by students, in this study also collected needs analysis data by mathematics education lecturers totaling 12 people, with indicators of questions in the needs analysis questionnaire, among others: 1. (Apakah Bapak/Ibu pernah mengampu mata kuliah geometri analitik) Have you ever taught analytic geometry courses; 2. (Bahan ajar apa yang biasa Bapak/Ibu gunakan dalam pembelajaran di kelas) What teaching materials do you usually use in classroom learning; 3. (Bahan ajar apa yang Bapak/Ibu gunakan dalam pembelajaran mata kuliah geometri analitik) What teaching materials do you use in learning analytic geometry courses (If the answer to number 1 you already have); 4. (Seberapa sering Bapak/Ibu melakukan pembelajaran dengan memanfaatkan bahan ajar yang terintegrasi dan berbasis digital multimodal (berupa teks, gambar, audio, video, berupa web/interaktif) dengan memanfaatkan TPACK (Technological, Pedagogical, Content Knowledge) How often do you do learning by utilizing teaching materials that are integrated and multimodal digital-based (in the form of text, images, audio, video, in the form of web / interactive) by utilizing TPACK (Technological, Pedagogical, Content Knowledge); 5. (Menurut Bapak/Ibu, perlukah dalam setiap pembelajaran dikembangkan bahan ajar yang dapat meningkatkan keterampilan ABAD 21 mahasiswa berupa (Berfikir Kritis, Berfikir Kreatif, kolaborasi dan Komunikasi) According to you, do the teaching materials used in the learning process currently accommodate the improvement of 21st Century skills in the form of (Critical Thinking, Creative Thinking, collaboration and Communication); 6. (Menurut Bapak/Ibu, perlukah dalam setiap pembelajaran dikembangkan bahan ajar yang dapat meningkatkan keterampilan ABAD 21 mahasiswa berupa (Berfikir Kritis, Berfikir Kreatif, kolaborasi dan Komunikasi) According to you, should teaching materials be developed in every lesson that can improve students' 21st century skills in the form of (Critical Thinking, Creative Thinking, collaboration and Communication); 7. (Menurut Bapak/Ibu, perlukah dikembangkan bahan ajar digital multimodal pada mata kuliah geometri analitik berorientasi TPACK dan keterampilan ABAD 21) According to you, should multimodal digital teaching materials be developed in TPACK-oriented analytical geometry courses and 21st century skills; 8. (Menurut Bapak/Ibu, perlukah dikembangkan bahan ajar digital multimodal pada mata kuliah lainnya pada program studi pendidikan matematika yang berorientasi TPACK dan keterampilan ABAD 21) According to you, should multimodal digital teaching materials be developed in other courses in mathematics education study programs that are oriented towards TPACK and 21st century skills.

Table 2: Result of needs analysis by Lecturers

Responded Indicators	Frequency (F) and Percentages (%) of each score									
	0		1		2		3		4	
	F	%	F	%	F	%	F	%	F	%
Statement 1	7	58,33	5	41,67						
Statement 2	11	91,67	1	8,33						
Statement 3	12	100,00								
Statement 4			1	8,33	10	83,33	1	8,33		
Statement 5							12	100,00		
Statement 6									12	100,00
Statement 7							3	25,00	9	75,00
Statement 8							3	25,00	9	75,00

(Source: Researcher data, 2022)

Table 2 shows that of the 12 respondents, 5 people (41.67%) have taught and 7 people (58%) have never taught analytic geometry courses. In statements 1 and 2 it can be examined that only one lecturer who carries out learning utilizing multimodal oriented teaching materials, the rest use books, the internet, pdf teaching materials or PowerPoint but not yet integrated. Regarding how often learning is carried out that utilizes learning using teaching materials that are integrated multimodal and TPACK (statement 4), the data shows that only one lecturer or 8.33% answered often, the rest said 91.67% answered never and only sometimes.

The data in table 2 also describes that the average lecturer answers statements 6, 7, and 8 with an average score of 3 and 4 which means responding to the need and very need for the development of TPACK-oriented multimodal teaching materials and 21st century skills (4Cs) both in analytical geometry courses or other courses in the mathematics education study program.

Based on the results of the data analysis of the needs analysis of mathematics education lecturers at the Faculty of Teacher Training and Education, Universitas Muhammadiyah Sorong, it can be concluded that it is necessary to develop a multimodal digital teaching material in the analytical geometry course of the mathematics education study program oriented to TPACK and 21st century skills, this is in line with the results of research [24], [25] which states that it is necessary to develop digital-based teaching materials and utilize multimodality. [26] Also added that learning by utilizing multimodal digital teaching materials needs to be developed to streamline the learning process.

4. CONCLUSION

The results of this study concluded that in general, students of the mathematics education study program at Universitas Muhammadiyah Sorong strongly agreed to develop multimodal digital teaching materials for analytical geometry courses oriented to TPACK and 21st-century skills which were also corroborated by the responses of mathematics education lecturers at the Faculty of Teacher Training and Education, Muhammadiyah University of Sorong who stated

that multimodal digital teaching materials for analytical geometry courses need to be developed for students of the mathematics education study program at Universitas Muhamadiyah Sorong oriented to TPACK and 21st-century skills.

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