

The Validity Analysis of Learning Kit for Ethnoscience-Oriented Learning Program Operationalization to Improve Teacher Candidates's Technological Pedagogical Content Knowledge (TPACK)

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Abstract: - The task of transferring knowledge to students in educational and training activities lies with the teacher. This study aims to obtain a validation of Learning Kit for Ethnoscience-Oriented Learning Program Operationalization used to improve the Technological Pedagogical Content Knowledge (TPACK) for teacher candidates. Validity data were collected from 5 experts using a validation sheet instrument. The results of expert judgment in this study indicated that the supporting learning kit developed are valid and can be used with minor revisions. Considering the validation results of all aspects assessed are valid and have good reliability, learning kit for Ethnoscience-Oriented Learning Program Operationalization that have been developed can be used but need to be revised first by paying attention to notes/comments and suggestions from experts. The implementation of the use of supporting learning kit in improving Technological Pedagogical Content Knowledge (TPACK) for Teacher Candidates is expected to be able to improve the Technological Pedagogical Content Knowledge (TPACK) of teacher candidates

Key-Words: Ethnoscience, Learning Kit, Technological Pedagogical Content Knowledge

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1 Introduction

At the beginning of its development, teachers are required to master on subject matter and pedagogical aspects, but now teachers also have to keep up with technological developments. Today, information is changing rapidly. Basically, the task of transferring knowledge to students in educational and training activities lies with the teacher. For this reason, teachers should give the opportunity to their students to acquire a number of skills they need throughout their life[1]. So that mastery of technology is not something that can be negotiated [2]–[11]. For this reason, the integration of material, pedagogy, and technology are very much needed. In developed countries, the integration of technology, pedagogy, and content in the form of Technology, Pedagogy, and Content Knowledge (TPACK)-based learning kit pioneered by Misrah as a creative solution developed in learning is very important [12]. TPACK is integration between technology, materials, and pedagogy that interact with each other to produce Information and Communication Technology-based learning [13]. Good teaching with technology requires at least three components of knowledge.

They are Technological Knowledge (TK), Content Knowledge (CK), and Pedagogical Knowledge (PK) as well as the relationship between components [14].

A science that utilizes local culture and wisdom is called ethnoscience. Along with developments in education and technology in the twenty-first century, literacy standards for various subjects or disciplines are being set. Kress 2003 defines the concept of literacy as "the ability to effectively use communicative symbols given meaning by society [15]. The development Ethnoscience-Oriented Learning Programs is carried out to teach students to be able to improve Technological Pedagogical Content Knowledge (TPACK) through Ethnoscience-Oriented Learning Program with a technology-assisted flipped classroom approach in the form of Ethnoscience LMS. Ethnoscience is an activity of transforming original science which consists of all knowledge about people's facts derived from hereditary beliefs and contains myths. the application of science learning with an ethnoscience approach requires the teacher's ability to combine original knowledge with scientific knowledge [16], [17]. TPACK improvement is a process to acquire the knowledge and skills needed to form a professional teacher. Consequently, the student who will be a teacher candidates must be able to design online

learning kit based on the knowledge gained (including ethnoscience) by utilizing technology, including Learning Implementation Plans (RPP), Teaching Materials, Student Worksheets (LKS), learning media, and assessment instruments.

Many ethnoscience research that have been carried out by many researchers. The function of ethnoscience would ease students to explore the facts and phenomenon existing in society and be integrated with scientific knowledge [18]. Based on the facts, considering teachers are essential in the learning process, there should be an innovation in the learning process of the teaching institution. Following the suggestions of scientific literacy can be increased through learning chemistry charge ethnoscience [19]. Perwitasari 2016, showed result that learning application from concept of energy and its amendments charge ethnoscience fish curing used to improve the scientific literacy of students [20]. The learning process also combines community science and scientific science. They can increase students' understanding of scientific science concepts and experience to be more meaningful. Local culture in learning can improve student science literacy skills [21]. Students learn more effectively if they utilize the environment or equipment around them. It can stimulate their curiosity to do the observations and trigger them to ask questions so that they can conclude and gain experience through scientific processes [22].

But it seems that there are not many ethno-science studies that have been used to improve the preparation needs of Technological Pedagogical Content Knowledge (TPACK) for teacher candidates. To see the accuracy of the Learning Kit for Ethnoscience-Oriented Learning Program Operationalization that was developed to carry out its functions, expert judgment was carried out by experts who were capable in their fields. Therefore, this article will discuss expert judgment on the Learning Kit for Ethnoscience-Oriented Learning Program Operationalization that will be developed to be valid for use to increase the TPACK for teacher candidate. The relationship between components in TPACK is shown in Figure 1.

Based on Figure 1, the three components of TPACK: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) seem to intersect with each other. The intersection of the three is an integral part that describes the relationship between TK, PK, and CK. TPACK was introduced as a conceptual framework as the basic knowledge needed to teach more effectively accompanied by the application of technology [23]. TPACK is a thinking strategy that includes knowledge of how, where, and what methods are used based on knowledge strategies that guide students to accept learning accompanied by the

application of technology [24].

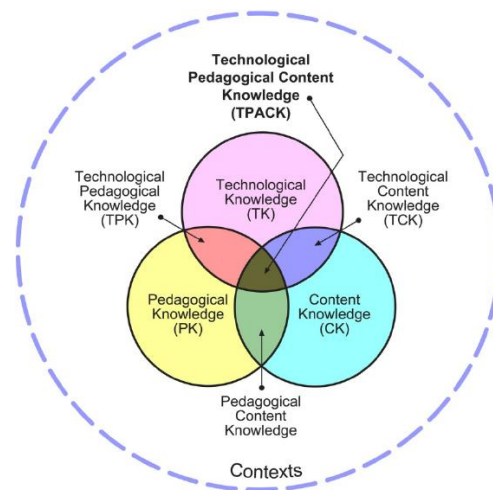


Figure 1. The TPACK Framework and its Knowledge Components[25]

2 Methods

The subject of this study is a learning device for the operationalization in the Ethnoscience-Oriented Learning Program which was validated by five (5) experts. The collection of validity data uses an expert validation sheet that contains the assessment components of the expert validator which contains the value to be given to the program that has been developed [20]. The expert validation sheet consists of several aspects of the assessment that have been developed by the researcher. To find out the validator agreement (Expert Judgment), the validity index proposed by Aiken was used [26]. The content validity coefficient and the homogeneity coefficient reliability were proposed by Aiken (1980, 1985), which can be used to measure the validity rating of each item (V value). Two techniques used in this analysis are through Aiken's V . content validity coefficient. Aiken (1985) formulated the Aiken's V formula to calculate the content-validity coefficient based on the results of the assessment of the expert panel of n people on an item in terms of the extent to which the item represents the construct being measured [27].

The following is the formula for the Aiken index

$$V = \sum S/[n(c - 1)]$$

where:

V is the index of expert agreement regarding the validity of the item content;

s is the score determined by the expert minus the lowest score in the category used ($s = - 1$);

r is the expert choice category score

1 is the lowest score in the assessment category;

n is the number of validators,

c is the highest score in the assessment category (score 4).

The criteria for an instrument item are said to be valid if V number minimum is 0.75 [28]. An item with that

criteria means that it has good content validity and supports the overall validity of the instrument content [29]. Then each component of the learning device is analyzed and interpreted in a qualitative form. That component was to determine the validity and feasibility of the Learning Kit for Ethnoscience-Oriented Learning Program Operationalization developed. To measure the strength of agreement between raters, the Intraclass Correlation Coefficient (ICC) method was used. The assessment is carried out by several raters, so the meaning of the reliability of the rating results is more consistent among raters. Taking into account the guidelines and criteria for the reliability coefficient provided by the experts, an instrument is said to be reliable if it has a reliability coefficient of 0.75.

3 Results and Discussion

Learning kit are produced through the process of design, construction, and evaluation. At the design stage, the learning kit were designed. They include learning objectives, teaching materials, student assignment plans, and assessment instruments. The follow-up to the design stage is the construction stage. At this stage, the preparation of learning kit was carried out. The results of the realization stage were in the form of learning kit for the operationalization of learning programs, including learning objectives, teaching materials, student assignment plans, and assessment instruments. The results of the construction in the form of learning kit were submitted to the experts to be validated. The achieved goal was to obtain validity of learning kit. The results of expert validation were then analyzed and product revisions were made based on the results of the analysis. The validation of Learning Kit for the operationalization of Ethnoscience-Oriented Learning Program was carried out through the assessment of five (5) experts (expert judgment). The product assessment was carried out by each expert so that it could be seen whether the product developed

was valid or not. The collection of validity data used an expert validation sheet that contained the assessment components of the expert validator. Validation activities were performed by competent experts to assess the learning kit [30].

The expert validation sheet consisted of several aspects of the assessment that have been developed by the researcher. It includes the validation sheet for teaching materials, the student assignment plan validation sheet, the validation sheet for the observation sheet for the implementation of the learning program, the RPP assessment sheet validation sheet, validation sheet for the TPACK component assessment sheet based on the lesson plans prepared by students, and validation sheet for learning practice observation sheets. The validity analysis was followed by a reliability analysis of the Ethnoscience-Oriented Learning Program which aims to determine the reliability of the developed learning program so it can be used. The calculation of the reliability coefficient was based on the results of the assessment of five expert judgment. The aspects of the expert validation test are presented in tables 1, 2, 3, 4, and 5.

In its development, TPACK has become a framework that can be used to analyze teacher knowledge related to technology integration in learning [31]. The learning process related to educational technology provide the ability to design, develop, utilize, use, manage, and evaluate learning using various technologies as processes, learning kit, and resources in learning. The use of learning strategies that are part of the lecture is an effort to integrate the development of TPACK in a lecture related to content. The selection of the TPACK development method is tailored to the needs, objectives, and context of each. TPACK development is usually carried out in a continuous research and development, starting with measuring TPACK first, then developing it [32]. TPACK is considered as a potential framework that can provide new directions for teachers in solving problems related to integrating ICT into teaching and learning activities in the classroom [33].

Table 1. Aspects of Teaching Material Validation Test

No.	Aspects
1	The filling of teaching materials is in accordance with the learning objectives and the expected competencies.
2	The filling of teaching materials content including TPACK, ethnoscience, and compiling ethno-science-oriented learning kit within the TPACK framework.
3	Presentation of topics in teaching materials has been arranged coherently and systematically.
4	The presenting topics in the teaching materials already reflect the integration of ethno-science and technology.
5	The making of guidelines for the use of ethno-science and technology-oriented learning teaching materials has been conveyed clearly.
6	Completing ethnoscience-oriented learning teaching materials can help students understand and find physics concepts that can be integrated into ethnoscience.
7	Making teaching materials oriented to ethnoscience can help the role of lecturers as

	facilitators.
8	The use of ethnosciencetech-oriented lecture teaching materials can help students to develop TPACK.
9	Making teaching materials oriented to ethnosciencetech can be studied independently by students.
10	Completing Ethnosciencetech-Oriented Learning Program for teaching materials is able to stimulate student curiosity to seek more information.
11	Filling in teaching materials can facilitate students to develop Learning Kit for Operationalization of Ethnosciencetech-Oriented Learning Program within the TPACK framework.
12	Filling in teaching materials makes it easier for students to understand the conceptual relationship of content aspects (ethnoscience), pedagogy, and technology.

Table 2. Aspects of Student Assignment Plan Validation Test (RTM)

No.	Aspect
1	Assignment of tasks in RTM in accordance with CPMK and expected competencies.
2	Filling in the RTM includes TPACK, ethnoscience, and compiling ethno-science-oriented learning kit within the TPACK framework.
3	The assignment of tasks in RTM has been arranged in a coherent and systematic manner.
4	The assignment of tasks in RTM has reflected the integration of ethno-science and technology.
5	The description of the assignment in the RTM has been conveyed clearly.
6	Giving assignments in RTM can help students understand and find physics/science concepts that can be integrated into ethnoscience.
7	Giving assignments in RTM can help students to develop TPACK.
8	Giving assignments in RTM can facilitate students to develop ethno-science and technology-oriented learning kit within the TPACK framework.
9	Giving assignments in RTM makes it easier for students to understand the conceptual relationship of content aspects (ethnoscience), pedagogy, and technology.
10	Use of RTM with good and correct Indonesian rules, communicative language and easy for students to understand.
11	The use of RTM as an instrument to measure the achievement of CPMK.

Table 3. Aspects of Validation of the Ethnosciencetech-Oriented or lesson plan Assessment Sheet

No.	Aspect
1	Instructions for using the lesson plan assessment sheet are clearly stated.
2	Completeness of the lesson plan assessment sheet (containing lesson plan components, namely identity, learning objectives, materials, methods, learning activities, learning resources, and assessments).
3	Compatibility of the lesson plan components with the indicators.
4	The indicators on the lesson plan assessment sheet are clearly described and include ethno-science-oriented learning steps.
5	Correct use of Indonesian, simple, communicative.
6	The use of sentences that are easy to understand, and do not cause double interpretation.

Table 4. Aspects of Validation Test of TPACK Component Assessment Sheet Based on the lesson plan Prepared by Students

No.	Aspect
1	Instructions for using the assessment sheet are clearly stated
2	The statement item of the assessment sheet includes the TPACK component

3	Compatibility of TPACK components with categories and indicators
4	The categories and indicators on the assessment sheet are clearly stated and ethno-science and technology oriented
5	Using correct, simple, communicative Indonesian
6	Using sentences that are easy to understand, and do not cause double interpretation

Table 5. Aspects of Validation Test of Learning Practice Observation Sheets

No.	Aspect
1	Instructions for using the observation sheet are clearly stated.
2	The statement item on the observation sheet includes components of teaching skills and TPACK.
3	The suitability of the components of teaching skills and TPACK with the indicators.
4	The categories and indicators on the assessment sheet are clearly stated and ethno-science and technology oriented.
5	Correct use of Indonesian language that is simple and communicative.
6	The use of sentences that are easy to understand and not cause double interpretation.

The data obtained from the instrument in the form of a validation sheet, were analyzed quantitatively to determine the validity of the learning kit for the operationalization of the lecture program. After being analyzed and interpreted theoretically according to the Aiken V Index, the lecture program developed is classified into the valid category (V 0.75) based on the value of the

expert agreement. The assessment is carried out by several raters, so the meaning of the reliability of the rating results is more consistent among raters. Taking into account the guidelines and criteria for the reliability coefficient provided by the experts, an instrument is said to be reliable if it has a reliability coefficient of 0.75. The results of expert validation are presented in tables 6, 7, 8, 9, and 10.

Table 6. The Validation of Teaching Materials Results for Ethnoscience-Oriented Learning Program

NO	Rated Aspect	Validator					V	Note
		I	II	III	IV	V		
1	The contents of the teaching materials are in accordance with the learning objectives and the expected competencies	4	4	4	4	4	1,000	Valid
2	The content of teaching materials includes TPACK, ethnoscience, and compiling Learning Kit for Ethnoscience-Oriented Learning Program Operationalization within the TPACK framework	4	4	4	4	4	1,000	Valid
3	Presentation of topics in teaching materials has been arranged coherently and systematically	4	4	4	4	4	1,000	Valid
4	The topics presented in the teaching materials already reflect the integration of ethno-science and technology	3	4	3	3	4	0,800	Valid
5	Guidelines for the use of Ethnoscience-Oriented Learning materials have been clearly conveyed	4	4	3	3	3	0,800	Valid
6	The content of Ethnoscience-Oriented Learning materials is able to help students understand and find physics concepts that can be integrated into ethnoscience	4	4	4	4	4	1,000	Valid
7	Ethnoscience-Oriented Learning materials can help the role of lecturers as facilitators	4	4	4	4	4	1,000	Valid
8	The use of Ethnoscience-Oriented Learning materials can help students to	4	4	4	4	4	1,000	Valid

develop TPACK								
9	Ethnoscience-Oriented Learning materials can be studied independently by students	3	4	3	3	4	0,800	Valid
10	The content of Ethnoscience-Oriented Learning Program is able to stimulate student curiosity to seek more information	4	3	3	4	3	0,800	Valid
11	The content of teaching materials can facilitate students to develop Learning Kit for Ethnoscience-Oriented Learning Program Operationalization within the TPACK framework	4	4	4	4	4	1,000	Valid
12	The content of teaching materials makes it easier for students to understand the conceptual relationship of content aspects (ethnoscience), pedagogy, and technology	4	4	4	4	4	1,000	Valid
The V Average							0,933	Valid

Table 7. Student's Assignment Plan of Ethnoscience-Oriented Learning Program

No.	Rated Aspect	Validator					V	Note
		I	II	III	IV	V		
1	Assignment of tasks in RTM in accordance with CPMK and expected competencies.	4	4	4	4	4	1,000	Valid
2	Learning objectives content includes TPACK, ethnoscience, and compiling ethnoscience technology-oriented learning kit within the TPACK framework.	4	4	4	4	4	1,000	Valid
3	The assignment of tasks in learning objectives has been arranged in a coherent and systematic manner.	4	4	3	3	3	0,800	Valid
4	The assignment of tasks in learning objectives has reflected the integration of ethno-science and technology.	4	4	4	3	3	0,867	Valid
5	The description of the assignment in the learning objectives has been conveyed clearly.	4	4	4	4	4	1,000	Valid
6	Giving assignments in learning objectives can help students understand and find physics/science concepts that can be integrated into ethnoscience.	4	4	4	4	4	1,000	Valid
7	Giving assignments in learning objectives can help students to develop TPACK.	4	4	4	4	4	1,000	Valid
8	Giving assignments in learning objectives can facilitate students to develop Learning Kit for Ethnoscience-Oriented Learning Program Operationalization within the TPACK framework.	4	4	4	4	4	1,000	Valid
9	Giving assignments in learning objectives makes it easier for students to understand the conceptual relationship of content aspects. (ethnoscience), pedagogy, and technology	4	4	4	4	4	1,000	Valid
10	Learning objectives uses good and correct Indonesian rules, communicative language and easy for students to understand.	4	4	4	4	4	1,000	Valid
11	Learning objectives can be used as an instrument to measure the achievement of	4	4	4	4	4	1,000	Valid

student's assignment

The V Average

0,970 Valid

Table 8. Assessment Sheet for Ethnoscience-Oriented Learning Program Implementation Plans

No.	Rated Aspect	Validator					V	Note
		I	II	III	IV	V		
1	Instructions for using the Learning Implementation Plans assessment sheet are clearly stated.	4	4	4	4	4	1,000	Valid
2	Completeness of the Learning Implementation Plans assessment sheet (containing lesson plan components, namely identity, learning objectives, materials, methods, learning activities, learning resources, and assessments).	4	4	4	4	4	1,000	Valid
3	Compatibility of the Learning Implementation Plans components with the indicators.	4	4	4	4	4	1,000	Valid
4	The indicators on the Learning Implementation Plans assessment sheet are clearly described and include ethnoscience-oriented learning steps.	4	4	3	3	3	0,800	Valid
5	The use of Correct, simple, communicative Indonesian.	4	4	4	4	4	1,000	Valid
6	The use of sentences that are easy to understand, and do not cause double interpretation.	4	4	3	3	3	0,800	Valid
The V Average							0,933	Valid

Table 9. TPACK Component Assessment Sheet Based on Learning Implementation Plans Prepared by Students

No.	Rated Aspect	Validator					V	Note
		I	II	III	IV	V		
1	Instructions for using the assessment sheet are clearly stated.	4	4	4	4	4	1,000	Valid
2	The statement item of the assessment sheet includes the TPACK component.	4	4	4	4	4	1,000	Valid
3	Compatibility of TPACK components with categories and indicators.	4	4	4	3	3	0,867	Valid
4	The categories and indicators on the assessment sheet are clearly stated and ethnoscience and technology oriented.	4	4	3	3	3	0,800	Valid
5	Using correct, simple, communicative Indonesian.	4	4	4	4	4	1,000	Valid
6	Using sentences that are easy to understand, and do not cause double interpretation.	4	4	4	4	4	1,000	Valid
The V Average							0,944	Valid

Table 10. Learning Practice Observation Sheet

No.	Rated Aspect	Validator					V	Note
		I	II	III	IV	V		
1	Instructions for using the observation sheet are clearly stated.	4	4	4	4	4	1,000	Valid
2	The statement item on the observation sheet includes components of teaching skills and TPACK.	4	4	4	4	4	1,000	Valid

3	The suitability of the components of teaching skills and TPACK with the indicators.	4	4	3	3	3	0,800	Valid
4	The categories and indicators on the assessment sheet are clearly stated and ethno-science and technology oriented.	4	4	3	3	3	0,800	Valid
5	Using correct, simple, communicative Indonesian.	4	4	4	4	4	1,000	Valid
6	Using sentences that are easy to understand, and do not cause double interpretation.	4	4	4	4	4	1,000	Valid
The V Average							0,933	Valid

Table 11. The Summary of Validity and Reliability Analysis

No.	Learning Media	V	Validator	ICC	Reliability
1	Teaching Materials Ethnoscience-Oriented Learning Program to Develop Student TPACK.	0,933	Valid	0,773	Reliable
2	Student Assignment Plan Ethnoscience-Oriented Learning Program To Develop Student TPACK.	0,970	Valid	0,763	Reliable
3	Ethnoscience-Oriented Learning Program Assessment Sheet.	0,933	Valid	0,833	Reliable
4	TPACK Component Assessment Sheet Based on the Learning Implementation Plans Compiled by Students.	0,944	Valid	0,755	Reliable
5	Learning Practice Observation Sheet	0,933	Valid	0,833	Reliable

From the Table 11, it can be seen that each type of Learning Implementation Plans is categorized as valid. The calculation of the reliability coefficient based on the results of the assessment of five experts was also declared reliable with an ICC of 0.773 for teaching materials, 0.763 for student assignment plans, 0.833 for assessment sheets, 0.755 for TPACK component assessment sheets based on RPP prepared by students, and obtained 0.833 for the learning practice observation sheet. According to Koo and Li (2016), the reliability is

included in the good category, meaning that the level of agreement (reliability) of expert assessment for learning devices is 0.75. Considering the validation results of all aspects assessed are valid and have good reliability, the Learning Kit for Ethnoscience-Oriented Learning Program Operationalization that have been developed can be used but need to be revised first by paying attention to notes/comments and suggestions from experts. The notes/comments given are summarized in table 12.

Table 12. Summary of Validator Comments

No	Learning Media	Validator's Comments
1	Teaching Materials for Ethnoscience-Oriented Learning Program to Develop Student TPACK	<ol style="list-style-type: none"> 1. There is a paragraph that only consists of 1 sentence, the paragraph should have more than one idea, and consists of several sentences 2. The comparison of the number of pages for the three Learning Activities is not balanced

		Suggestions for improvement: adding sentences and the number of pages in the three learning activities are made proportional
2	Student Assignment Plan (SAP) Ethnoscience-Oriented Learning Program To Develop Student TPACK	There are six Student Assignment Plans from SAP 1 to SAP 6, only SAP 1-SAP 4 for Intern 3, also SAP 6, but SAP 5 for Intern 2? Suggestions for improvement: Focus the course on internship 2 or internship 3
3	Ethnoscience-Oriented Learning Program Implementation Plan (RPP) Assessment Sheet	1. In the attachment of the Learning media section, the provisions are not clear 2. The scoring guideline on the assessment instrument is not yet clear, the pass limit is $N < 70$ Enough (what is the passing grade) Improvement suggestions: a. The provisions of the designed learning media must be very clear/strict because of TPACK, and ethnoscience and technology b. Should be $60-69 = C$ or $N < 70$ is enough
4	TPACK Component Assessment Sheet Based on the RPP Compiled by Students	Scoring guidelines on assessment instruments are not yet clear the pass limit $N < 70$ Enough (what is the passing grade) Suggestion for improvement: Should be $60-69 = C$ or is $N < 70$ is enough
5	Learning Practice Observation Sheet	To clarify more about the rubric

4 Conclusion

Based on the results of the research and data analysis, it can be concluded Learning Kit for Ethnoscience-Oriented Learning Program Operationalization that were developed are included in the valid and reliable category so that they can be implemented to improve the Technological Pedagogical Content Knowledge (TPACK) of teacher candidate. Considering the validation results of all aspects assessed are valid and have good reliability, Learning Kit for Ethnoscience-Oriented Learning Program Operationalization that have been developed can be used but need to be revised first by paying attention to notes/comments and suggestions from experts

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