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The Development of Science Learning Document Grounded on STEM-Approach Integrated Ethnoscience

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Abstract. This research aimed to develop a science learning documents grounded on STEM-approach integrated ethnoscience for enhancing science concept achievement, environmental care attitude, and creative thinking skills of Junior High Schools Students in the fields of characteristics of substances. The research was conducted into 3 phases: 1) analysing current needs and conditions of need to develop learning documents with the theme of ethnoscience in the batik-manufacturing process 2) developing learning documents, dan 3) validation learning documents. The research revealed the following: 1) science learning documents grounded on STEM-approach integrated ethnoscience has not been widely developed, 2) the science learning documents includes syllabus, lesson plan, teaching materials, and assessment, 3) The results of validation showed that science learning documents are valid and reliable. It can be concluded that research can carried out with a large-scale data

Keywords: integrated science learning, STEM-approach, ethnoscience

I. INTRODUCTION

Recently world development entering the era of disruption. There have been fundamental and uncertain changes in various services, including education service [1]. The era of disruption has entered the second decade of the 21st century. Science learning in the era of disruption should be focus on developing student competencies as a whole attitudes, knowledge, and skills. To achieve success in the 21st century, it takes learning and innovation skills that include 4C namely critical thinking, communication, collaboration, and creativity [2] [3].

The Ministry of Education and Culture of the Republic of Indonesia states that learning must be able to develop culture-based education [4]. Shifting cultural values has led to forgotten local cultural values; therefore cultural preservation is needed through integrating it with school learning [5]. Science learning can be viewed from a multicultural perspective [6]. Indigenous knowledge is related to different body of knowledge, most of which depend on the balanced nature of the natural domains that are rich and inherent in the environment [7]. Thus, the creativity in STEM education could meet the indigenous knowledge or we call it as ethnoscience.

STEM has been actualized in different nations. The previous research revealed that there is an effect of STEM education on the positive attitude of high school students in the STEM field [8]. STEM education also have positive effect on academic success, science process skills, and scientific attitudes [9], [10], problem solving and creative thinking skills [10], [11].

STEM education is perhaps the biggest reform movement in K-12 education in the last decade [12]. The development of STEM Education in Indonesia has not been done much. It is important to develop innovative models of science learning units with the STEM approach and test their effectiveness through scientific research. In this study learning unit that develops material using integrated STEM-approaches and ethnoscience will be developed.

The aim of the study was to develop a science learning documents grounded on STEM-approach integrated ethnoscience for enhancing science concept achievement, environmental care attitude, and creative thinking skills of Junior High Schools Students. The novelty of this research is to integrate the STEM approach with ethnoscience. The benefit of this research is the availability of learning documents based on the STEM approach integrated ethnoscience in junior high school science learning.

II. METHOD

The research was conducted into 3 phases: 1) analysing current needs and conditions of need to develop learning documents with the theme of ethnoscience in the batik-manufacturing process 2) developing learning documents, dan 3) validation learning documents. The focus of this study is the development of science learning document grounded on STEM-approaches integrated ethnoscience. The first stage was conducted by interviewing several middle school science teachers about the

implementation of junior high school science learning in Pekalongan Municipality. Furthermore, qualitative research has been conducted to identify the scientific concepts contained in the batik-manufacturing process.

The second stage is developing learning documents. Learning documents developed are: (1) Development of Syllabus, (2) Lesson Plans, (3) Teaching Materials, (4) Understanding Concept Tests, (5) Tests of Creative Thinking Skills, (6) Environmental Care Attitude Questionnaire (7)) learning implementation questionnaire**.**

The third stage validates learning documents that have been developed. Validation is carried out in the following steps: (1) conducted focus group discussions with junior high school science teachers in Pekalongan Municipality at the Science Teacher Association forum (2) expert validation (3) limited trial.

III. RESULTS AND DISCUSSION

The result of the study are presented in the following discussion.

3.1 Analysing current needs and condition of need to develop learning document

The results of interviews and documentation studies revealed that science teachers in Pekalongan Municipality never taught using the STEM Approach and Integrated Ethnoscience. The development of learning documents was carried out through the Science Teacher Association (*Musyawarah Guru Mata Pelajaran IPA*) forum. Teachers have not used batik as a learning resources related to learning content. This is meet to learning documents developed by most teachers using the scientific approach. Thus, learning documents using the STEM-approach integrated ethnoscience have not been widely developed.

3.2 Developing learning documents

The second stage is developing learning documents. Learning documents developed are: (1) Syllabus, (2) Lesson plans, (3) Teaching materials, (4) Understanding concept tests, (5) Tests of creative thinking skills, (6) Environmental care attitude questionnaire (7)) Learning implementation questionnaire**.**

3.3 Validation learning documents

The third stage is validation. The results of the expert validation of learning document in the form of syllabus are presented in Table 1.

Regulation of Minister of National Education of Republic Indonesia Number 22 of 2016 which stated the syllabus is a reference for preparing the learning framework for each subject [13]. The syllabus that has been developed meets the standards for developing syllabus in government regulations.

Table 1. Validation results of syllabus by science and evaluation expert

No	Validator	∑Score/ ∑instrument	Mean	Category
1	Validator 1 (Science Expert from Postgraduate Studies Universitas Pendidikan Indonesia)	44/13	3.38	Valid
2	Validator 2 (Evaluation Expert from Postgraduate Sudies Universitas Negeri Semarang)	49/13	3.77	Valid
3	Validator 3 (Science Expert from Postgraduate Studies Universitas Negeri Semarang)	47/13	3.62	Valid
	Mean of Score		3.59	

The results of the validation of learning documents in the form of lesson plan are presented in Table 2.

Table 2 Validation results of lesson plan by science and evaluation expert

No	Validator	∑Score/ ∑instrument	Mean	Category
1	Validator 1 (Science Expert from Postgraduate Studies Universitas Pendidikan Indonesia)	138/40	3,45	Valid
2	Validator 2 (Evaluation Expert from Postgraduate Sudies Universitas Negeri Semarang)	142/40	3,55	Valid
3	Validator 3 (Science Expert from Postgraduate Studies Universitas Negeri Semarang)	146/40	3,65	Valid
	Mean of Score		3,55	

Lesson plans are plans for learning activities for one or several meetings. Learning plans are developed from syllabus to direct student learning activities in an effort to achieve basic competencies. Developing lesson plans is needed knowledge to integrate the four STEM disciplines with ethnoscience. STEM education is often called meta-discipline, "the creation of disciplines based on integration from other disciplinary knowledge it becomes a new 'whole' [12]. Thus, in preparing lesson plans need to integrate STEM-Approach and ethnoscience. Our STEM education must design the right way to

explore original knowledge and make creative use of our abundant natural resources.

The results of the validation of learning documents in the form of learning materials are presented in Table 3.

Table 3 Validation results of learning materials by science and evaluation expert

No	Validator	∑Score/ ∑instrument	Mean	Category
1	Validator 1 (Science Expert from Postgraduate Studies Universitas Pendidikan Indonesia)	91/27	3,37	Valid
2	Validator 2 (Evaluation Expert from Postgraduate Sudies Universitas Negeri Semarang)	101/27	3,74	Valid
3	Validator 3 (Science Expert from Postgraduate Studies Universitas Negeri Semarang)	95/27	3,52	Valid
	Mean of Score		3,54	

Teaching module not only provide abundant materials related to scientific subjects, but also makes students appreciate the value and meaning of their own culture [14]. It is suitable with the ethnoscience approach and module theme substance additives based ethnoscience effective improve learning outcomes and the entrepreneurial character of students [6] Learning that connect of local potential with learning materials would help the learner to achieve the learning objectives [15]. Teaching materials are developed to make STEM learning units that are integrated with ethnosains can be directed based on syllabus and lesson plans that have been made.

The results of the validation of learning documents in the form of learning implementation questionnaire are presented in Table 4.

The cultural emphasis in school science provides a broader view of humanistic policies and practices. It considers culture, school science culture, students' cultural identity and understanding of people's culture about the physical world [16]. This emphasizes produces society or culturally responsive school sciences, that are aspects of humanistic school science receiving widespread attention nowadays.

Table 4 Validation results of learning implementation questionnaire by science and evaluation expert

No	Validator	∑Score/ ∑instrument	Mean	Category
1	Validator 1 (Science Expert from Postgraduate Studies Universitas Pendidikan Indonesia)	34/10	3,40	Valid
2	Validator 2 (Evaluation Expert from Postgraduate Sudies Universitas Negeri Semarang)	38/10	3,80	Valid
3	Validator 3 (Science Expert from Postgraduate Studies Universitas Negeri Semarang)	40/10	4,00	Valid
	Mean of Score		3,73	

The results of the validation of learning documents in the form of concept understanding test are presented in Table 5.

Table 5 Validation results of concept understanding test by science and evaluation expert

No	Validator	∑Score/ ∑instrument	Mean	Category
1	Validator 1 (Science Expert from Postgraduate Studies Universitas Pendidikan Indonesia)	51/13	3,92	Valid
2	Validator 2 (Evaluation Expert from Postgraduate Sudies Universitas Negeri Semarang)	46/13	3,54	Valid
3	Validator 3 (Science Expert from Postgraduate Studies Universitas Negeri Semarang)	51/13	3,92	Valid
	Mean of Score		3,79	

Educators have the opportunity to retain students in STEM degrees if instruction focuses on increasing reasoning skills during their freshman year giving students a higher likelihood of success and satisfaction and a lower likelihood of leaving STEM [17]. There is an urgent desire to understand the challenges and obstacles in developing and implementing integrated STEM curricula and instruction. It needs assessment study provide a starting point for better understanding teacher needs in integrated STEM education [18].

The results of the validation of learning documents in the form of creative thinking skills test are presented in Table 6.

Table 6 Validation results of creative thinking skills test by science and evaluation expert

No	Validator	∑Score/ ∑instrument	Mean	Category
1	Validator 1 (Science Expert from Postgraduate Studies Universitas Pendidikan Indonesia)	42/11	3,82	Valid
2	Validator 2 (Evaluation Expert from Postgraduate Sudies Universitas Negeri Semarang)	40/11	3,64	Valid
3	Validator 3 (Science Expert from Postgraduate Studies Universitas Negeri Semarang)	43/11	3,91	Valid
	Mean of Score		3,79	

There is an emphasis on creativity through indigenous knowledge systems of development [16]. STEM which leads to creativity is closer to the development of indigenous science. Setiawan et.al stated science teacher should emphasize on the exploration skills of learning resources which derived from the socio-cultural environment to increase understanding of science concept [19]. Integrated project-based learning model of ethno-technology effectively improves the competency of superior teacher candidates [20].

The results of the validation of learning documents in the form of questionnaire on environmental care attitudes are presented in Table 7.

Table 7 Validation results of questionnaire on environmental care attitudes by science and evaluation expert

No	Validator	∑Score/ ∑instrument	Mean	Category
1	Validator 1 (Science Expert from Postgraduate Studies Universitas Pendidikan Indonesia)	16/6	2,67	Valid
2	Validator 2 (Evaluation Expert from Postgraduate Sudies Universitas Negeri Semarang)	23/6	3,83	Valid
3	Validator 3 (Science Expert from Postgraduate Studies Universitas Negeri Semarang)	23/6	3,83	Valid
	Mean of Score		3,44	

To improve students' skills and attitudes, learning needs to be linked to everyday problems, for example by relating ethnics [20]. STEM education must be designed to ensure a mix of concepts and processes across cultural boundaries [16]. The results of instrument validation indicate that the instrument is valid. This is because the instruments are structured based on the theories that underlie the STEM approach and ethnoscience.

IV. CONCLUSION

Based on the results and discussion, the conclusions are as follows:
Science learning documents grounded on STEM-approach integrated ethnoscience has not been widely developed. The science learning documents developed includes syllabus, lesson plan, teaching materials, and assessment. The results of validation showed that science learning documents developed are feasibility theoretically. Learning documents that have been developed need to be tested empirically.

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