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Development of a Natural Science Module with a STEM Approach on Liquid Substance Pressure for Class VIII SMP/MTs

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Abstrak

This study aims to describe the validity and responses of students to the natural science module with the STEM approach in the sub-material of liquid pressure. The research model uses a 4D model developed by Thiagarajan (define, design, develop and disseminate) but this study only reached the development stage. The development of the science module was validated by material expert validators, media experts, and user experts (teachers) with an average percentage of 93.63% with a very valid category. The results of the small-scale student response test of 86.1% to determine the readability of the media, then the large-scale test obtained 86.74 %, thus this science module is categorized as very interesting. This module contains sub-materials of fluid pressure consisting of hydrostatic pressure, Archimedes' law, and Pascal's law. In each material, there are illustrations to support the depth of the material

Keywords: Natural science module, STEM, Liquid Pressure

INTRODUCTION

Education has the meaning of a planned effort that aims to maximize the learning process and situation so that students can develop in terms of their potential and skills needed for themselves, society, nation, and state. (RI, 2003). Education has a close relationship between educators and students contained in learning activities, namely in the school area. Education in the school area will determine the success of an education that can make students excel to create the best graduates and have a big role in the future. (Lalupanda, 2019). The success of education is in the learning process in schools, learning in schools is regulated in the 2013 curriculum. The 2013 curriculum focuses on strengthening the learning process by encouraging students to think critically when solving problems, the ability to balance attitudes, knowledge, and skills (Ailangga Kusuman, 2016).

To maximize the use of the 2013 curriculum, during the learning process it is necessary to have a learning approach that can support the learning process. The approach that is by the 2013 curriculum is the STEM (Science, Technology, Engineering, Mathematics) approach. STEM is an interdisciplinary learning approach. The STEM approach has similarities with the 2013 curriculum, which is that it has a goal that does not only focus on knowledge (cognitive) but also on attitudes (affective) and skills (psychomotor) of students so that

students can actively participate in learning collaboratively, disciplined and help each other in learning. integration of various experiences in their lives (Sartika, 2019). The STEM approach combines STEM subjects with problem-based learning in daily activities so that it can form students who can relate the knowledge learned at school with events that occur in real life. Independent learning and learning based on current problems that occur in the community is a must in applying STEM in learning (Huzaifah, 2017).

This requires a teacher to be more creative in teaching. Teachers are expected to be able to design and prepare teaching materials that can increase the success of the learning process (Ailangga Kusuman, 2016). Teaching materials made by adjusting the needs of teachers and students will improve the quality of learning (Kurnia Y. d., 2019). Teachers are accustomed to using teaching materials in the form of textbooks, LKPD, modules, photos/pictures, and others. One of the teaching materials that can be developed is the learning module. This is because the module can make it easier for students during the learning process in class and independent learning outside the classroom (Zaeninur, 2016). Teaching materials in the form of modules can be used in all types of subjects, for example, in science subjects.

Science subjects are lessons that learn about natural phenomena or phenomena that are produced through a series of scientific processes based on a scientific attitude that gives results in the form of scientific products. (Vita Ria Mustikasari, 2017). In science learning, there are scopes of physics, chemistry, and biology. In studying science (physics) they not only understand concepts, but they also participate directly in the knowledge discovery process. Therefore, in the learning process, the teacher not only conveys information but also provides skills in the problem-solving process (Mellya Dewi, 2018).

Based on the results of observations that have been made in junior high schools (SMP). In fact, in studying science subjects, students tend to have difficulty learning science subjects in the physics branch. Physics is considered difficult for students because it requires understanding concepts, too many memorization formulas, and ga lot of mathematical calculations. This makes students think that the natural science of physics is more difficult than the science of chemistry and biology. In science learning at school, the teaching materials that are always used are limited to BSE and LKPD books, there are no learning support books such as modules used by teachers and students during the learning process.

Based on these problems, the objectives of this study are 1) to describe the validity of the science module with a STEM approach on the sub-material of fluid pressure for class VIII SMP/MTs students. 2) describe students' responses to the science module with a STEM approach on the sub-material of liquid pressure for class VIII SMP/MTs students.

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METHOD

In research development and product feasibility testing in the form of a science module with a STEM approach, this type of research and development (R and D) refers to a 4-D research model with several stages, namely Define, Design, Develop, and Disseminate. (Sugiyono, 2015). In this research, the modified 4-D model is Define, Design, and Develop. This is due to the limited time and cost of research.

This study involved three experts, namely material experts, media experts, and user experts to assess the validity of the module based on aspects of graphics, content, presentation, language, and small-scale response tests as many as 6 students while large-scale response tests as many as 30 students. The research instrument uses a validation sheet of material experts, media experts, and user experts) and student response questionnaires. The data analysis technique used is a quantitative descriptive analysis technique from the results of the validity and attractiveness tests by experts and student responses.

The data collection instrument used a validation questionnaire and student response questionnaires on each aspect using a 1-5 Likert scale in table 1.

Tabel 1. Criteria for Rating Scale

Criteria	Score
Very Good (SB)	5
Good (B)	4
Enough (C)	3
Less (K)	2
Very Poor (SK)	1

(Sahlan, 2015)

The percentage calculation technique and qualitative descriptive technique to analyze the data from the validation results and convert it into qualitative data, with the following formula:

$$Vah = \frac{Tse}{Tsh} x100\%$$

Information:
Vah = expert validation
Tse = total empirical score obtained from expert assessment
Tsh = total expected score

Table 2. Validity Interpretation Criteria

Validity Criteria	Level Validity
85,01%-100%	Very valid or can be used without revision
70,01%-85,00%	Valid or usable but need minor revision
50,01%-70,00%	Not valid, it is recomended not to use because it needs a major revision
01,00%-50,00%	Invalid or cannot be used

(Akbar, 2013)

This data analysis of student responses aims to determine student responses to the developed module. The percentage calculation technique and qualitative descriptive technique to analyze the data from the validation results, with the following formula:

$$Vah = \frac{Tse}{Tsh} x100\%$$

Information:
Vah = percentage value (audience validation)
Tse = total empirical score obtained from student responses
Tsh = total expected score

Table 3. Criteria for Student Respons Result

Validity Criteria	Level Validity
81%-100%	Very interesting
61%-80%	Interesting
41%-60%	Quite interesting
21%-40%	Not attractive
0%-40%	Very unattacttive

RESULT AND DISCUSSION

This research and development only use 3 stages, namely define, design, and develop, the dissemination stage is not carried out due to time and cost constraints. The first stage is the definition stage, this stage consists of front-end analysis with a study of the 2013 curriculum, student analysis examines the characteristics of students by the design and development of learning modules, task analysis examines the tasks required by students, Concept analysis is carried out on the material to be developed so that it is by KI, KD, and indicators, the last is the formulation of learning objectives, namely setting learning objectives so that they do not deviate from the initial goals.

The planning stage (design) is carried out by determining the format for the development of the science module to be developed. The planning stage starts from compiling learning materials that are by KI, KD, and the formulation of learning objectives according to the 2013 curriculum. Then the second chooses the media to be developed by the researcher, namely teaching materials in the form of a science module with a STEM approach which is made using two applications, namely Adobe Illustrator and Microsoft Word. The third is the initial design by preparing the format of the IPA module such as the beginning, the content section, and the closing section. And the last is the instrument design in the form of guidelines for making expert validation instruments and student response questionnaires that refer to the BSNP and the Ministry of National Education, guidelines for developing modified and adapted teaching materials to the product to be developed.

The development stage (Develop) is the improvement of the science module with a STEM approach on the liquid pressure sub-material through a revision process that has been tested for validation by a team of material experts, media experts, and user experts as well as limited trials on students so that the product produced better. Improvements made to the module based on input from material expert validators include: 1) the word "god" in the foreword is replaced by "Allah"; 2) in the module description section 11 and 12 there are the spelling of some wrong words; 3) writing the formula for physical quantities using italics format; 4) the multiplication symbol in the formula uses the symbol “×” instead of the letter “x”; 5) writing indexes like A1 and A2 using subscript.

Improvements made by media expert validators include: 1) the front cover, namely the campus logo, must be made clearer and more proportional. Meanwhile, the improvements made by expert user validators include; 1) on page 28 module lines 1-11 the sentence must justify; 2) on page 31 module lines 1-12 sentence writing must justify; 3) on page 45 line 6 module the sentence must justify; 4) on page 46 module lines 1-14 the sentence must be justified; 5) on page 46 line 5 the word effect should be replaced with influencing; 6) on page 46 modules, lines 12-14 are quoted in quotation marks; 7) on

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page 49 of the module, the bibliography is referenced with images from the internet for illustrations of images used in the module.

Based on the analysis of the validation results for the development of the IPA module with the STEM approach on the sub-material of liquid pressure, the validation value from material experts is 95.15%, media experts are 92%, and users are 93.75%. This states that the development of the natural science module with the STEM approach is included in the very valid category according to the validity criteria proposed by Sadun Akbar that the interval value of 85.01% - 100% is included in the very valid criteria. Modul which is in the very valid criteria can be applied to student. Susanti, Hasanah and Khirzin (2018) said that modul with STEM Approach can give the differences in cognitive and affective learning outcomes.

The limited trial aims to determine the response of students to the developed module. The data collection method was carried out by distributing student response questionnaires that asked students to fill in a checklist in each row and column containing questions. The limited trial was carried out with two tests, namely a small-scale test on 6 students and a large-scale test on 30 students.

Based on the data from the small-scale and large-scale trials obtained with percentages of 86.1% and 86.74%, it can be said that the science module developed is in the very attractive category with the percentage criteria for product development that have been set by Sa'dun Akbar (Akbar, 2013) So that in research (Riyani, 2020) said that the STEM-based module could be a practical reference book used in learning to improve student learning outcomes.

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that 1) the validation results from material expert validators, media, and users on the development of the science module with the STEM approach on the liquid pressure sub-material obtained an average of 93.63%, with these results the module Science with a STEM approach on the sub-material of liquid pressure is included in the very valid category. 2) the results of the student response test to the development of the science module with the STEM approach on the sub-material of liquid pressure on the small-scale test obtained an average of 86.1% and the large-scale test obtained an average of 86.74% which could indicate that the module Science with a STEM approach on the sub-material of liquid pressure is included in the very interesting category so that the IPA module with a STEM approach on the sub-material of liquid pressure can be used by teachers and students during the learning process.

DAFTAR PUSTAKA

Ailangga Kusuman, M. B. (2016). Pengembangan Bahan Ajar Mata Pelajaran Dasar dan Pengukuran Listrik untuk Sekolah Menengah Kejuruan. Vol 23, No 1. . Jurnal Pendidikan teknologi dan Kejuruan, 28-29.

Akbar, S. (2013). Instrumen Perangkat Pembelajaran. Bandung: Remaja Rosdakarya.

Huzaifah, F. I. (2017). Implementasi STEM dalam Pembelajaran IPA di Sekolah Menengah Pertama. Prosiding Seminar Nasional Pendidikan IPA 2017.

Jamilah, d. (2017). Pengembangan Modul pembelajaran Berbasis Discovery Mata Pelajaran IPA Siswa SD No 1 Baktiseraga kelas IV. Jurnal EDUTECH. Vol.02 No.2, 191.

Kurnia, D. (2017). Pengembangan Modul Biologi Berbasis Jelajah Alam Sekitar (JAS) pada Materi Pencemaran Lingkungan Peserta Didik Kelas X SMA Negeri 2 Sungguminasa. Skripsi, Universitas Alauddin Makassar.

Kurnia, Y. d. (2019). Pengembangan Bahan Ajar Berbasis STEM (Science, Technology, Engineering, and Mathematics) Materi Kelistrikan untuk Sekolah Dasar. JPPD. Vol. 6 No.2 , 200.

Lalupanda, E. M. (2019). Implementasi Supervise Akademik untuk Meningkatkan Mutu Guru. Jurnal Akuntatibilitas Manajemen Pendidikan. Vol 7 No 1, 62-67.

Mellya Dewi, I. K. (2018). Penerapan Pembelajaran Fisika Menggunakan Pendekatan STEM untuk Meningkatkan Kemampuan Memecahkan Masalah Siswa pada Materi Listrik Dinamis. Prosiding Seminar Nasional Quantum , 381.

RI, S. N. (2003). Undang-Undang Republik Indonesia No.20 Tahun 2003 tentang Sistem Pendidikan Nasional. Jakarta: Sekretariat Negara.

Riyani, W. (2020). Pengembangan Modul Berbasis STEM pada Materi Perubahan Lingkungan untuk Siswa SMA. Universitas Negeri Semarang, 27.

Susanti, L. Y., Hasanah, R., & Khirzin, M. H. (2018). Penerapan media pembelajaran kimia berbasis science, technology, engineering, and mathematics (STEM) untuk meningkatkan hasil belajar siswa SMA/SMK pada materi reaksi redoks. Jurnal Pendidikan Sains (JPS), 6(2), 32-40.

Sahlan. (2015). Evaluasi Pembelajaran Praktis Bagi Pendidik dan Calon Pendidik. Jember: STAIN Press.

Sartika, D. (2019). Pentingnya Pendidikan Berbasis STEM dalam Kurikulum 2013. Vol.3, No.3. Jurnal Ilmu Sosial dan Pendidikan, 90.

Siregar, L. L. (2020). Modul Pembelajaran Berbasis Science, Technology, Engineering, Mathematics (STEM) untuk meningkatkan Hasil Belajar dan Keterampilan proses Peserta Didik pada Materi Redoks dan Sel Elektrolisis. Jurnal Ilmu Pendidikan Indonesia. Vol.8 No.2 , 85.

Sugiyono. (2015). Metode Penelitian dan Pengembangan. Bandung: Alfabeta.

Vita Ria Mustikasari, M. A. (2017). Identifikasi Miskonsepsi Konsep Tekanan Zat Siswa Kelas VIII-C SMPN 1 Karangploso Semester Genap Tahun Pelajaran 2017-2018. Vol.1 No.2 . Jurnal Pembelajaran Sains .

Zaeninur, A. L. (2016). Pengembangan Modul IPA Berbasis Integrasi-Interkoneksi pada Materi Cahaya untuk Siswa SMP/MTs Kelas VIII. Skripsi, Universitas Islam Negeri Sunan Kalijaga Yogyakarta.

BRIEF PROFILE

The author named Frisci Windavi Riri Agitha was born in Sidoarjo on 7 June 1998. Currently, the author is registered as a student of UIN Kiai Haji Achmad Siddiq Jember Study Program Tadris IPA class of 2017 and graduated in 2021.

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