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Teacher's Perspective about Digital STEM-PjBL Teaching Material Based on Local Wisdom to Improve Scientific Literacy

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Abstract

Science learning today refers to the STEM approach from both primary education to higher education. Teaching materials are the second important part besides the role of creative and innovative teachers in the learning process. Teaching materials are used as learning resources that can be created and developed by the teacher according to the characteristics and needs of students and integrate other disciplines and values in it. The integration of several disciplines has a significant impact on learning outcomes. This study aims to understand the teacher's perception of the need for STEM-PjBL-based digital teaching materials integrated with local religion and wisdom. This research is the basis of development research conducted to develop digital science teaching materials based on STEM-PjBL integrated with religion and local wisdom. Respondents who participated in this study were 101 teachers from various islands in Indonesia. The technique used is a questionnaire by filling out ten questions on the questionnaire distributed via google form. The results showed that the teaching materials used by teachers in teaching science 55.45% came from the government in the form of teacher-student handbooks. The rest of the teachers use teaching materials sourced from publishers (39.60%) the rest use sources from the internet. There has not been found data on teachers using their own teaching materials or collaborating with the Teacher Working Group. While learning science as a whole without integrating other disciplines is 8.91%. Only 25.74% of teachers integrate technology and machines.

Keywords: digital science teaching materials, STEM-PjBL, religious, local wisdom.

Introduction

Science learning today refers to STEM (Science, Technology, Engineering, Mathematics) education which was known in the 1990s which at that time theNSF (officeNational Science FoundationUnited States)used the term SMET (Science, Mathematics, Engineering, & Technology), but the pronunciation of SMET was almost the same as "Smut" so it was replaced with STEM (Syukri et al., 2013). STEM education has been implemented in Finland, America, and Australia since 10 years ago. After that followed by Vietnam, China, Malaysia, and the Philippines. Meanwhile, in Indonesia, it has only been implemented in the last few years.

STEM-PjBL

The Project Based Learning based STEM is a project-based learning model that emphasizes students to be able to learn independently by solving problems at hand, and students can produce real projects or works(Dywan & Airlanda, 2020; Huang et al., 2020). This model makes learning and activities carried out by students student center by collaborating in groups to complete projects according to design. Project-based learning is defined as teaching that connects technology with familiar everyday life problems for students or school projects.

The Project-Based Learning Model provides a great opportunity to produce an engaging and meaningful learning experience for students.

Project-based learning encourages students to be creative and independent to produce products, so that in the implementation of learning, students will display their creativity, and the results of students' understanding of the material presented will produce maximum learning outcomes. Innovative learning, both Project Based Learning and Problem Based

Learning, improves students' scientific literacy. The advantage of this project-based learning model is that it develops the total involvement of each individual in the process of learning activities (Latifah et al., 2020; Saputro & Rayahu, 2020).

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Scientific Literacy

Based on the results of the PISA (Program for International Student Assessment) in 2018 (Schleicher, 2019) it shows that Indonesia is ranked 71 for science with a score of 396 out of an average of 489 so that Indonesia is at Level 1 which is the lowest level in the world. National data from the Learning Assessment Center (Pusmenjar) through the Research and Development Center for Educational Research (Puspendik) of the Indonesian Ministry of Education and Culture on the percentage of students who lack knowledge of science skills is 73.61. This shows the need for extra efforts in improving scientific literacy through various means. STEM-PjBL education can be applied in learning that is equipped with teaching materials in digital accordance with current developments in the era of the industrial revolution 4.0.

The Digital Science Teaching Materials on Local Wisdom

Teachers need to provide good science learning materials with visualizations that are clearly accepted by students. So it is understandable that teachers need to pour creative and innovative learning into students so that knowledge transfer activities are not limited only to the use of conventional media(Nabilah & Dewina, 2023). This teaching material can be digital teaching materials that can be dissected by students with a combination of text, audio, and video, as well as simulation activities and even experiments. This e-book has several advantages, including being easy to carry, having a small physical size, not being easy to lap, having easy access, being easy to process, being easily understood by people who cannot read because it can be displayed with audio, and being more environmentally friendly (Azalia et al., 2020). The recommended IPA teaching material to improve science literacy is by using the STEM approach with the PjBL model (; Kristiani et al., 2017; Chonkaew et al., 2019 Kusumastuti et al., 2019; Prabawati & Agustika, 2020).

The integration of science learning with other disciplines needs to be developed, which is the basis of STEM education, besides that ethnoscience with local wisdom needs to be strengthened during the science learning process with the STEM-PjBL model (Azalia et al., 2020; Kholifatu et al., 2020; Safitri et al., 2020; Woro Sumarni, 2018). This integration can be applied in the form of textbooks (Azalia et al., 2020), modules (Putra & Aslan, 2020), media (Ahmad Habib, I Made Astra, 2020) and learning tools (Muskania & Wilujeng, 2017; Rogosic et al. ., 2021) so that students become ready to face a future life that demands skills but still has local cultural insight so that they will form a scientific generation that masters 21st century skills and has a nationalist character.

Several previous studies have been carried out regarding the need for science teaching materials that are integrated with ethnoscience with a STEM approach in elementary and junior high schools (Ansyah & Walid, 2021; Muttaqiin et al., 2021), while students have been studied regarding student perspectives on PjBL learning (Barak & Yuan, 2021). Other research also examines the modular support of STEM KIT on science learning in elementary and junior high schools (Rogosic et al., 2021). Furthermore, subsequent research has also implemented STEM in Indonesia regarding the models and media that are integrated in its implementation (Khotimah et al., 2021). STEM turns out to be able to be integrated with models, media, and teaching materials in its application. The STEM-PjBL (Ilmi et al., 2021) model in Indonesia is so varied, ranging from the aid of teaching materials (Yuanita & Kurnia, 2019), to various media (Ahmad Habib, I Made Astra, 2020; Chang & Hwang, 2018; Niswara et al., 2019; Sahin & Yilmaz, 2020; Saputro & Rayahu, 2020; Syawaludin et al., 2019; Titiek Winanti et al., 2019; Wahyu et al., 2020) to integrate with ethnoscience (Damayanti et al., 2017) and ecoliteracy (Rusmana & Akbar, 2017) and Islamic values (Asyhari, 2019; Putra & Aslan, 2020).

The STEM-Project Based Learning model is a model that can improve scientific literacy, motivation, material understanding, creative thinking skills, effectiveness, meaningful learning and support future careers (Jauhariyyah, Suwono, 2017; Prabawati & Agustika, 2020). This STEM-PjBL model should be supported with relevant teaching materials, which were specially developed in accordance with STEM-PjBL education that can be integrated with students' local religion and culture. This is because teaching materials are an important part of student learning success (Nurdyansyah & Widodo, 2017). As an initial step in developing these teaching materials, a needs analysis is needed to determine perceptions of teachers to the need for STEM-PjBL-based digital teaching materials that are integrated with religion and local wisdom.

METHOD

Research Design

This is a quantitative study that analyzes the teacher's perspective on the need for STEM-PjBL-based digital IPA teaching materials that are integrated with local religion and wisdom. This article is a survey research that uses a questionnaire technique. At this stage the questionnaire was given to elementary school (SD)/Madrasah Ibtidaiyah (MI) teachers from various schools/madrasas spread throughout Indonesia. The questionnaire was validated by lecturers from two universities in Indonesia which contained questions related to teaching materials in the form of books used during science learning in schools and also the mastery of science literacy for elementary/MI students. Knowledge of STEM-PjBL integrated with local wisdom, experience learning science in the classroom, and the need for STEM-PjBL-based digital textbooks that are integrated with local wisdom. The questionnaire was administered via the Google Forms platform. The analysis phase in this study consisted of teacher analysis, analysis of the use of teaching materials, analysis of the need for digital teaching materials, and analysis of elementary/MI students' scientific literacy.

Participants

Participants in this study were 101 teachers of grades IV, V, and VI elementary schools from all over Indonesia who were represented by each island, namely Java Island, Sumatra, Kalimantan, Sulawesi, and also Papua. The largest proportion of teacher profiles contributing to this study was for fourth-grade teachers, and the smallest was for sixth-grade teachers.

This is because science learning content is only available in high rankings in accordance with PERMENDICBUD No. 37 of 2018 on Core Competencies and Basic Competencies for Primary and Secondary Schools. The distribution of these teachers will contribute to the research results that will be obtained through ten closed questions given by the researchers.

Data Collection Tools

The questionnaires were filled out by 101 teachers spread across various Indonesian islands. the instrument used is a questionnaire (closed) consisting of 3 dimensions with 10 questions, namely the source and form of teaching materials, integration of teaching materials, and teacher perceptions of the impact of teaching materials on student learning achievement from the cognitive aspect.

The following instruments were used and have been validated by experts as follows.

1. Teaching materials used today? (Q1)
2. The source of the books used? (Q2)
3. Values that are not in the textbook used? (Q3)
4. During teaching science, what has been integrated into learning? (Q4)
5. Do digital science teaching materials need to be in the current era? (Q5)
6. Should science teaching materials be integrated with religious values and local wisdom as an effort to form a better nationalist scientific generation? (Q6)
7. The learning model that has been applied so far in science learning? (Q7)
8. Should digital science teaching materials be integrated with several other fields (technology, mathematics, religion, local wisdom, etc.); which contains (Material, Video, Audio and Worksheet)? (Q8)
9. Can students apply science concepts in everyday life? (Q9)
10. What about students' science learning outcomes from the aspect of knowledge (SL)? (Q10)

Table 1: Participant's characteristics (n=101)

	Frequency	%
Gender		
Female	82	81.19
Male	19	18.81
Teacher of Grades		
IV	55	54.46
V	34	33.66
VI	12	11.88
Working years as a teacher		
1-5 years	57	56.44
5-10 years	38	37.62
10-15 years	6	5.94
Educational background		
Primary Teacher Education	99	98.02
Others	2	1.98
Level of education		
Bachelor's	74	73.27
Master's	27	26.73
Others	0	0

Data Collection

Data collection was carried out from March to April 2021 which was distributed via google form. The data collected were analyzed by calculating the percentage on each item.

Data Analysis

A closed questionnaire is given with four choices of options that refer to the Likert scale so that it is easy to generalize. The data collected for each item was analyzed by calculating the final percentage.

Findings

Sources and Form of Teaching Materials

The results showed that teaching materials used by high grade teachers in elementary schools were Worksheets. Teaching materials in the form of textbooks for teachers and students are books issued by the government in accordance with The 2013 curriculum used in Indonesia. This book must be redeveloped according to the needs and characteristics and potential of each region.

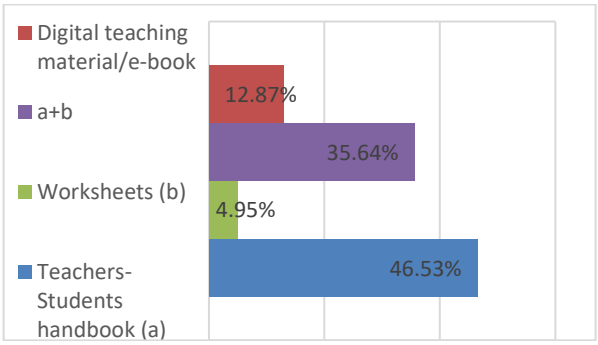

Figure 1: Type of science teaching materials

Based on Figure 1 The results of the question (Q1) as many as 46.53% of teachers only use teacher-student handbooks. The use of digital teaching materials or e-books is still very little used by teachers, which is only 12.87%. There are even teachers who only use worksheets as teaching

materials in the learning process, as many as 4.95%. Meanwhile, the use of combined teaching materials between teacher-student handbooks and student worksheets was 35.64%. The large number of teachers who use teacher-student handbooks makes learning not in accordance with the characteristics of students and the potential of their respective regions. Especially those who only use books published by publishers that are commercial in nature and there has been no due diligence related to material content, language, and graphics specifically for elementary school children. This data shows that almost 50% of the learning that has been implemented has not been contextual and as a whole refers to activities that are still common.

Based on initial data on the use of teacher-student handbooks. In the second question (Q2), it is clarified the source of the teaching materials used by the teacher in learning science in elementary school. Most of the teaching materials used by teachers come from the government. This is shown in Table 2. Total of 55.45% of teaching materials are sourced from the government. Teachers also use books from publishers as much as 39.60%, the remaining 4.95% use the internet as a source of teaching materials. This data is obtained from the questions in Q2 which are shown in Table 2.

Table 2: Source of teaching materials used

	Frequency	%
Government	56	55.45
Publisher	40	39.60
Internet	5	4.95

In Table 2 it is known that the teacher has not used the teaching materials made by themselves. In fact, only about 5% use the internet as teaching material in the learning process. Even though the internet is part of information technology that can be applied by teachers, one of which makes resources on the internet as teaching materials for students in accordance with the latest developments in science and technology (UNESCO, 2019). It was further explained that teacher capacity, infrastructure, and teaching materials need to be developed to prepare students to master 21st century competencies.

Integration of Teaching Materials

Teachers' perceptions of science teaching materials used are related to values teachers who integrate (Q3 and Q4) in learning science and teaching materials used by teachers so far without integrating with other disciplines is 26.2%, while teachers who integrate mathematics and arts (other subjects) are 40.8% because of Science in elementary school is indeed carried out thematically which integrates with other subjects.

Table 3: Integration in science learning

	Frequency	%
Non integrated	26	25.74
Mathematics and art	42	41.58
Islamic and local wisdom	24	23.76
Other disciplines	9	8,91

The data in Table 3 shows that the integration of religious values and local wisdom is still low at 23.76%. Teachers also feel that the integration of technology and machines in science teaching and learning materials is still very minimal, which is only 8.91%. Learning is STEM integrated with some of the values that students need for their future lives. Some of the values contained in STEM learning are curiosity, integrity, objective, open, systematic, cooperative, responsive, decision making. This value makes STEM-based science learning need to be implemented in elementary schools and integrated with local wisdom.

The current need for teaching materials adjusts to the times. The results of the fifth question (Q5) regarding the need for digital science teaching materials for elementary school students show that most teachers feel the need and need for digital teaching materials (Dewi et al., 2018).

The percentage of 66.34% in the strongly agree category and 33.66% in the agree category for the perception of the need for digital science teaching materials provides opportunities for the government and teachers to prepare digital teaching materials.

The need for digital science teaching materials in elementary schools Apart from teachers, the need for teaching materials It is also needed in learning, especially teaching materials designed in accordance with the development of science and technology as well as local wisdom. Studying science through natural phenomena in the local environment makes learning more contextual and meaningful for students and in accordance with the characteristics of elementary school students by making real abstract concepts from phenomena closest to students (Nurcahyono & Novarina, 2016; Rintayati et al., 2022; Suprapto et al., 2021).

The success of learning is not only supported by teaching materials, but also requires the contribution of teachers in preparing better learning models according to the characteristics of elementary school students (Nahdi & Jatisunda, 2020).

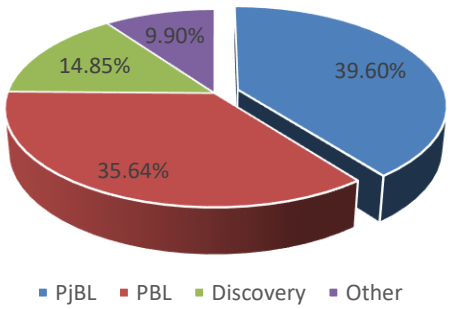

Figure 2: Science Learning Models in Elementary School

The learning models (Figure 2) that according to teachers need to be done for elementary school students in the science learning process (Q7) are project models (39.60%) and problem solving models (35.64%), while other models such as discovery and investigation were 14.85%, and 9.90%, others. This is in line with the recommendation of the Minister of Education and Culture No. 22 of 2016 concerning the standard of the learning process. The project learning model, problem solving, discovery and investigation is a recommended model to train students to have higher order thinking skills.

Teachers also provide perceptions of the need (Q6) for digital teaching materials Technology, Mathematics, Religion, local Wisdom, etc.). Most of the teachers stated that they agree (57.43%) and strongly agree (42.57%) integrated digital science teaching materials for PjBL STEM and local wisdom. Science teaching materials must contains (Material, Video, Audio, and Worksheets) show the perception of teachers is 23.76% for agree and 76.24% strongly agree.

Integration of religion in learning can strengthen the character of students (Suparjo et al., 2021). Integrated STEM-PjBL and local wisdom the need for digital science teaching materials based on STEM-PjBL is integrated with local wisdom because students need adequate competence and skills in accordance with the development of science and technology so that they can catch up with other countries (Muttaqiin et al., 2021; Sari et al., 2018).

Teachers have a arguments the digital STEM-PjBL can improve scientific literacy (SL). Below table 4 mostly of teachers show 60.40% agree and 37.62% agree can improve SL.

Table 4: Level of teacher agreement with Digital STEM-PjBL based on Local Wisdom [N (%)]

	SD	D	A	SA	Total	Mean	SDev
Digital science teaching materials need to be in current era (Q5)	(0)	(0)	(33.66)	(66.34)	(101)	25.25	30.02
Integrated local wisdom effort to form a better nationalist scientific generation (Q6)	(0)	(0)	(58.42)	(41.58)	(101)	25.25	28.31
Digital science teaching materials must be integrated with several other fields (technology, mathematics, religion, local wisdom, etc.) (Q8)	(0)	(0)	(57.43)	(42.57)	(101)	25.25	28.16
Digital science teaching materials must be contains (Material, Video, Audio and Worksheet) (Q8)	(0)	(0)	(23.76)	(76.24)	(101)	25.25	33.41
Digital science teaching materials STEM-Pjbl can improve scientific literacy (Q10)	(0)	(1.98)	(60.40)	(37.62)	(101)	25.25	27.97
Student can apply science concepts in everyday life (Q9)	(0)	(0)	(42.57)	(57.43)	(101)	25.25	28.16
Outcomes student (Aspect of knowledge) (Q10)	(0)	(8.91)	(83.17)	(7.92)	(101)	33.67	39.37

Teachers' Perceptions

The results of this study also show teachers' perceptions of students related to learning outcomes and the implementation of science concepts in students' daily lives. The application of science in everyday life, the essence of science that has been studied is part of natural phenomena that are always experienced in everyday life. The application of science concepts needs to be done so that students' knowledge is implemented and has a high retention rate in the working system of the brain (Lindsey et al., 2014; Conradty & Bogner, 2019; Goff et al., 2020; Martaningsih et al., 2022).

Based on the results of the question (Q9) obtained, as many as 57.43% of teachers strongly agree and 42.57% agree that students can apply science in their lives. The nature of science consists of facts, concepts, principles, laws, and theories. This leads to science as a product, result, and scientific attitude.

The implementation of science in everyday life is part of the SL of students that should be owned by students after studying science with various activities and learning experiences carried out during learning.

In the last question (Q10) the teacher gives the perception that student learning outcomes in the aspect of knowledge are currently in the satisfactory category with a percentage of 83.5%. Meanwhile, for the very satisfactory category, only 7.8% of teachers were selected, and there were even teachers who felt that their students' learning outcomes were not satisfactory with a percentage of 8.7%.

The teacher's perception data shows a very large satisfactory result, which is more than 80% contrary to the data from the PISA results which show that students' scientific literacy is very low and below the world average. This empirical data can be the basis for changes in the learning implementation process related to the models and teaching materials used in learning.

The outcomes students (aspect of knowledge) about SL based on teachers perspective show that agree category 83.17%, strongly category 7.92%, and disagree very low is 8.91%. Referring to the application of the STEM approach in other countries that have higher student SL outcomes, it can be used as a reference regarding the application of STEM education in Indonesia (Cunningham et al., 2020; Kusumastuti et al., 2019). This STEM approach can be combined with a project model that is integrated with local wisdom (Erlinawati et al., 2019; Jauhariyyah, Suwono, 2017; W. Sumarni & Kadarwati, 2020). The combination with the project model because it is a model that is highly recommended by the government to achieve the highest graduation in the aspect of knowledge and skills, namely creating.

Discussion

The ten statements given to teachers, it shows that most teachers have a reasonable knowledge related to STEM approaches and the PjBL model. The STEM-PjBL recommended for primary school (preschool and elementary school) (Chen & Tippett, 2022). Education should be carried out in schools can provide knowledge (Heeg et al., 2022) while instilling students' love for the culture and life around them. On the other hand, digital transformation during the Covid-19 pandemic has a positive impact on the world of education (Fadlelmula et al., 2022)because Indonesia is required to have digital skills, especially in the learning process, so that digital teaching materials are needed that can facilitate students to

learn without being limited by space and time (Andic et al., 2022; Jita, 2022). In line with this, digital teaching materials make a positive contribution to the sustainability of life in the future (Eilks, 2015; Miedijensky & Abramovich, 2019). Keeping trees from being used as the main source of papermaking needed for digital teaching materials. Not to mention the need for water and chemical waste produced from printed teaching materials that can be harmful to the surrounding ecosystem.

The digital teaching materials needed in the 21st century (Jita, 2022) are teaching materials that apply the STEM approach by integrating scientific disciplines between science, technology, engineering and mathematics (Hernandez-martinez et al., 2022; Kurniati et al., 2022; Ilma et al., 2023). Applying the PjBl model so that project activities can be part of the implementation of knowledge that has been built through learning and experimental activities. Digital teaching materials and products from the project are part of SL that can maintain the sustainability of life in the future (Husamah et al., 2022). The findings of this study have limitations in the use of digital teaching materials recommended by teachers as a new transformation in the world of education, namely that they can only be used in schools with adequate internet access. Its use at home must also be with parental assistance, so that parents who are not used to accompanying their children to learn will find it difficult in the process.

Conclusions And Implications

Based on research findings, it is known that digital science teaching materials need to be developed to support STEM-PjBL learning that is integrated with religion and local wisdom for students at the elementary school level. Digital transformation requires the world of education to undergo change, including digital-based teaching material so that it can facilitate students to study without limitation of space or time. This STEM-PjBL teaching material can facilitate the learners having a good science literacy so that it can be useful for their future lives. The development of teaching materials should start at the fourth grade level, as it is the early stage of the science of learning in elementary school.

Science learning is an important part of shaping students into complete scientists. Students have adequate scientific literacy through meaningful learning activities. The meaning of this learning can be obtained by applying the STEM-PjBL integrated with religion and students' local wisdom. With this activity, students will become religious scientists and continue to make culture and local wisdom a part of their identity as Indonesian citizens.

An important part of STEM-PjBL learning based on religion and local wisdom is teaching materials as a source of information. Teaching materials in the 21st century require flexible teaching materials in the form of digital integrated religion and local wisdom consisting of material content in the form of text, video, audio, and equipped with worksheet. The need for digital science teaching materials is shown from the perspective of teachers who feel very necessary in the current era. Moreover, learning is carried out online (in the network) during the pandemic.

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