Needs Analysis of STEM-Based Teaching Materials on Integrated Pest Management as a Sustainable Agriculture Solution in The Green Lifestyle Practice Course

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ABSTRACT

Agricultural issues in the modern world, particularly the negative environmental impacts of pesticides use, demand innovation in education. This study aims to analyse the need for integrated pest management (IPM) learning materials as a solution for sustainable agriculture to support learning in the Green Lifestyle Practice course. The research employed a descriptive qualitative method using purposive sampling through structured interviews distributed via Google Forms to 20 students who had taken the Green Lifestyle Practice Course during the even semester of the 2024/2025 academic year. The analysis results indicate that the importance of developing STEM-Based IPM teaching Materials. The findings of this study serve a crucial foundation for subsequent research focused on developing the STEM-Based IPM learning materials to enhance the learning process.

Keywords: IPM, STEM, Learning Material, Sustainable Agriculture, Green Lifestyle.

INTRODUCTION

Indonesia is an agrarian country where a large portion of the population works in the agricultural sector. One of the main challenges in agriculture is the presence pf pests, which can significantly reduce the productivity of the agriculture. Pest outbreaks represent a very serious threat if not addressed promptly. There are 226 species of insects, 42 of which are classified as pests (Alam et al., 2016). In Indonesia, pest control is predominantly carried out using certain types of pesticides due to their perceived effectiveness and practicality. However, pesticides contain active ingredients that can bring negative impacts, such as environmental pollution, due to their persistent chemical compounds (Arif, 2015). The use of pesticides in agriculture is a common practice that poses various risks, including health concerns (Jamin et al., 2022). According to Jayanti and Suprapta (2009), pesticides can severely disrupt agricultural ecosystems by

causing pest resistance and killing off natural enemies of the pests themselves. Residues from consumed pesticides may also affect human health. This highlights the need for environmentally friendly pest control systems to support sustainable agriculture.

Integrated pest management (IPM) is one alternative for sustainable agriculture that enable safer pest population control. The optimal implementation of IPM is closely tied to the role of STEM (Science, Technology, Education, and Mathematics), which now serves as a foundational pillar in developing sustainable agricultural systems. STEM-Based learning can foster innovation among students (Suwardi, 2021).

There is a growing need to instill environmental values rooted in STEM within the educational framework-particularly through Green Lifestyle Practice Course. This course emphasizes human concern for the planet by promoting a lifestyle that treats the earth as a partner in life. This can begin with everyday actions (Irmawati, 2012). The integration of sustainable agriculture issues can serve as one of the core themes in the Green Lifestyle practice course. However, currently there is no supporting teaching material used in the Green Lifestyle practice course in UIN Sunan Kudus. The teaching materials being developed will include content on integrated pest management and several related practical activities. Therefore, this research aims to analyse the need for STEM-Based teaching materials on IPM as a sustainable agriculture solution. This study serves an initial step toward the development of such materials based on the need analysis conducted.

METHOD

This study employed a qualitative research design using purposive sampling. Qualitative research aims to understand specific contextual conditions by describing the natural setting and capturing what truly occurs in the field (Fadli, 2021). The research was conducted from March to June 2025 within the Science Education (Tadris IPA) program at UIN Sunan Kudus, specifically involving students enrolled in the Green Lifestyle Practice Course.

Research data were obtained through observation during the learning process and interviews at the end of semester. The interviews were conducted in a structured question by distributing questionnaires via Google Forms. The data analysis technique employed was descriptive, in which the data were organized into specific patterns and then concluded narratively (Rasmi, 2022).

FINDINGS AND DISCUSSION

The needs analysis study on STEM-Based IPM teaching materials as a sustainable agriculture solution was conducted with 20 students who had enrolled in the Green Lifestyle Practice course during the even semester of 2024/2025 academic year. Based on observations made throughout the course, it was found that students required teaching materials addressing current and

relevant topics related to environmentally friendly practices-one of which is STEM based IPM. Student participation was generally low, as learning activities were limited to in-class sessions. In response, the lecture introduced field study activities to enhance engagement.

The intended output of the field study was a student report on green lifestyle efforts in addressing a specific environmental issue. Hower=ver, not all students participated in the scheduled field study guidance sessions. Based on the collected data, there are only 45% of the 20 students received supervision for their field study assignments.

This condition prompted the development of a teaching material that could serve a reference in the learning process by focusing on a specific subject area. Teaching materials can support students in learning more systematically. This aligns with Hidayat (2019), who stated that teaching materials are part of learning resources that are organized in a comprehensive and systematic manner based on instructional principles. Therefore lecturer conducted a need analysis to identify the relevance of STEM-Based learning materials in addressing one of the current environmental issues.

The needs analysis was conducted through structured interviews using a questionnaire distributed via Google Forms. The questionnaire consists of 10 items, combining both open-closed questions, to explore the need of the teaching material. The results indicates that the availability of teaching materials was considered "adequate" by 60% of respondents and "very adequate" by 40% (Figure 1). However, these findings did not specify the types of teaching materials currently in use during the course.

The first question was then expanded by asking which learning media were most frequently used during the course. The needs analysis revealed that 85% of the media used were PowerPoint presentations, followed by 10% instructional videos, and 5% using e-modules (Figure 2). These results indicate that printed module-based teaching materials have not been widely utilized in the learning process. Printed modules are one of several types of teaching materials. According to Arsanti (2018), as cited in Yulandari (2021), there are four types of teaching materials: printed materials, audio-based materials, video-based materials, and interactive materials.

Figure 1: 1st Question

Figure 2: 2nd Question

The results of the needs analysis related to the third question indicated that the topic of IPM had been discussed in general terms by 65% of respondents, while 35% reported it had been covered in depth (Figure 3). These findings suggest that IPM has not been a primary focus within the Green Lifestyle practice course. To explore this further, the subsequent question asked students' opinions regarding the inclusion of IPM as one of the core topics in the course. The responses showed that 45% of students agreed and 55% strongly agreed (Figure 4). IPM is a relevant practice within the framework of green lifestyle education. Its implementation can improve agricultural productivity in a sustainable manner by controlling pests through environmentally friendly and integrated methods (Wati, 2022).
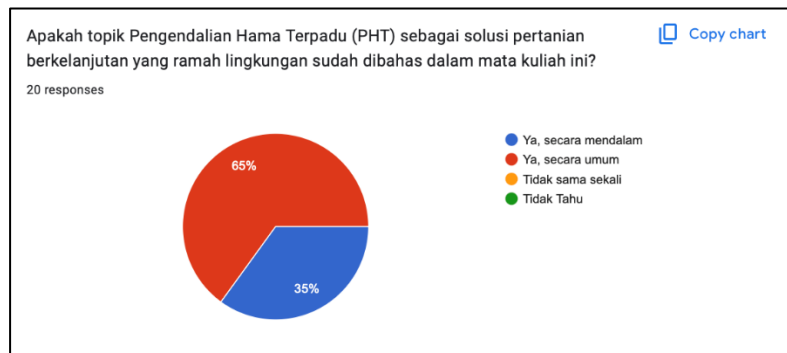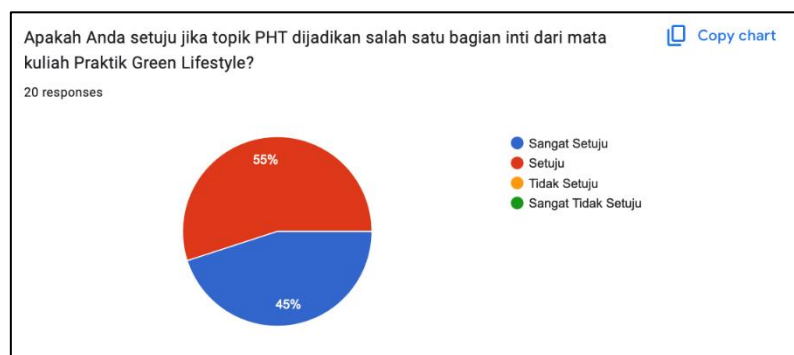
Figure 3: 3rd Question

Figure 4: 4th Question

The next question focused on the implementation of STEM in the learning process. The results showed that 35% students perceived STEM as being highly applied, 55% considered it moderately applied, and 10% viewed it as poorly applied (Figure 5). These findings indicate that STEM-Based learning has yet to be optimally implemented. To further explore students' perspectives on the importance of STEM in education, the subsequent question addressed the significance of STEM within the Green Lifestyle practice. Results revealed that 70% if respondents considered STEM application very important, 25% important, and 5% moderately important (Figure 6). This suggests that STEM is a crucial approach that should be integrated into the learning process. This aligns with Lestari and Rahmawati (2020), who stated that the STEM approach is designed to utilize technology and systematic experimentation to support scientific concepts through data processing, According to Sartika (2019), STEM education has been developed in both developing and developed countries by integrating Science, Technology, Engineering, and Mathematics.
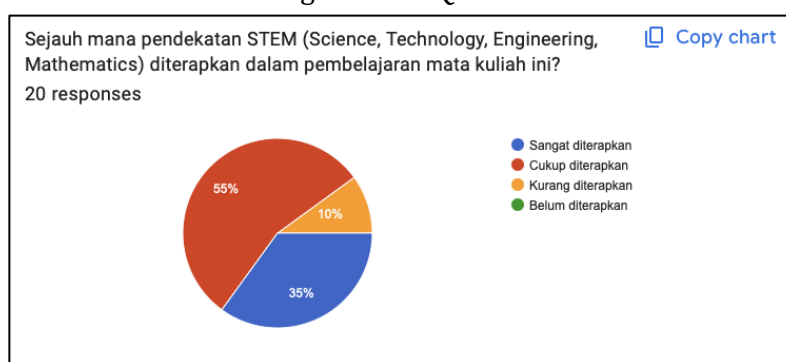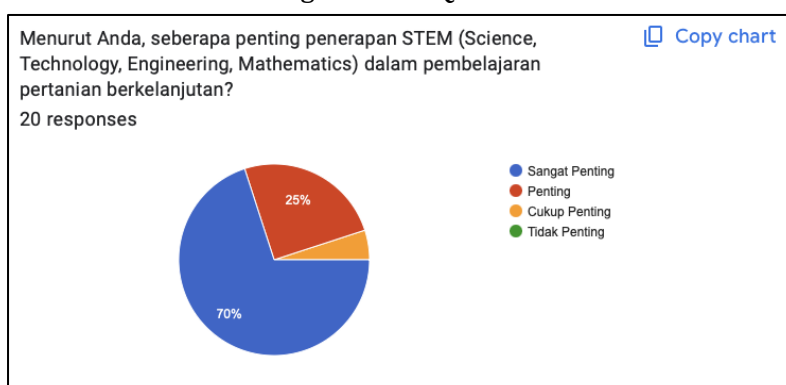
Figure 5: 5th Question

Figure 6: 6th Question

The subsequent question focused on which STEM aspects should be emphasized in integrated pest management (IPM) as a solution for environmentally friendly agriculture. The results indicated that Science and Technology aspects each received 70% emphasis, Engineering 45%, and

Mathematics 30% (Figure 7). STEM-Based IPM requires a focused topics to be effectively developed. Analysis of the topics that will be included in teaching materials showed that 55% of respondents selected the basic concepts of IPM, 30% chose identification techniques, 65% preferred technological innovation, and 35% opted for case studies on sustainable agricultural practices (Figure 8). These findings suggest that the most prioritized topic is technological innovation within IPM. The application of technology in IPM can enhance the capacity to manage agroecosystems and implement integrated pest control efforts to improve agricultural productivity (Sholeh et al., 2019).

Figure 7: 7th Question

Figure 8: 8th Question
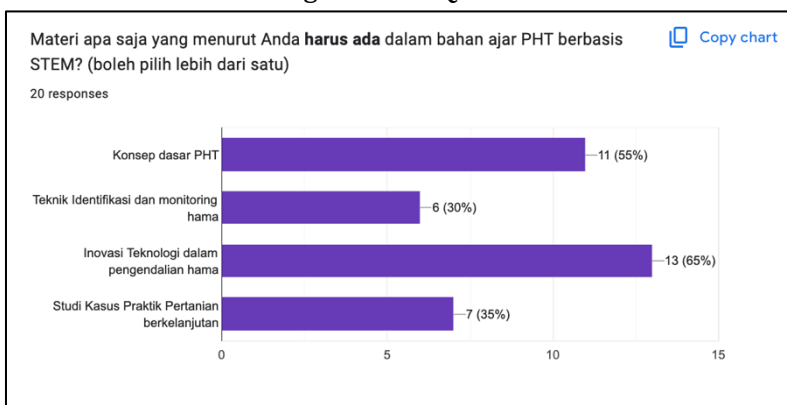
The next question involved a structured interview with open questionnaire item, aiming to gather students' expectations regarding the competencies they hope to acquire once STEM-Based IPM teaching materials become available. The results showed that the majority of students whised to understand the fundamental concepts of IPM and to apply environmentally friendly STEM-Based IPM practices, enabling them to implement a real green lifestyle (Figure 9).

Figure 9: 9th Question
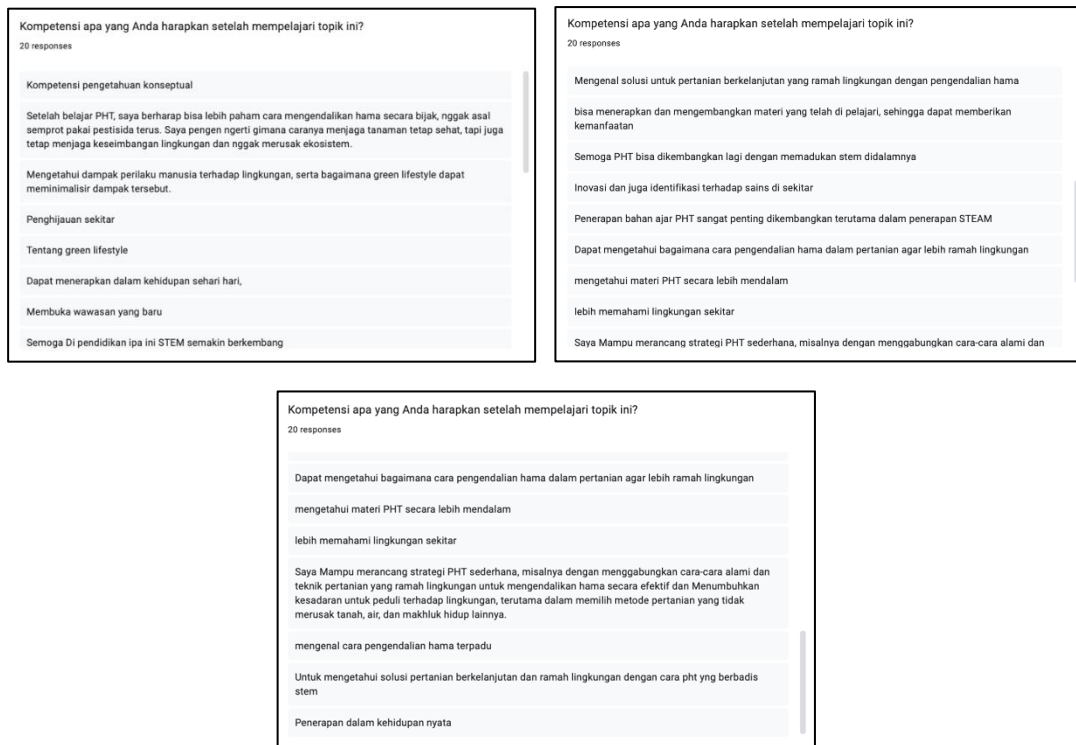
The final question addressed students' opinions regarding the development of STEM-Based Integrated Pest Management (IPM) teaching materials. The results showed that 45% of students strongly agreed and 55% agreed with this development (Figure 10). This supports the concepts of IPM combined with technological engineering as a strategy to enhance plant diversity through natural and environmentally friendly biological control (Widhayasa et al., 2013). According to Salam et al (2021), the availability of STEM-Based teaching materials can improve students' creative thinking skills. Therefore, incorporating STEM-Based teaching materials into the learning process is highly necessary.

Figure 10: 10th Question
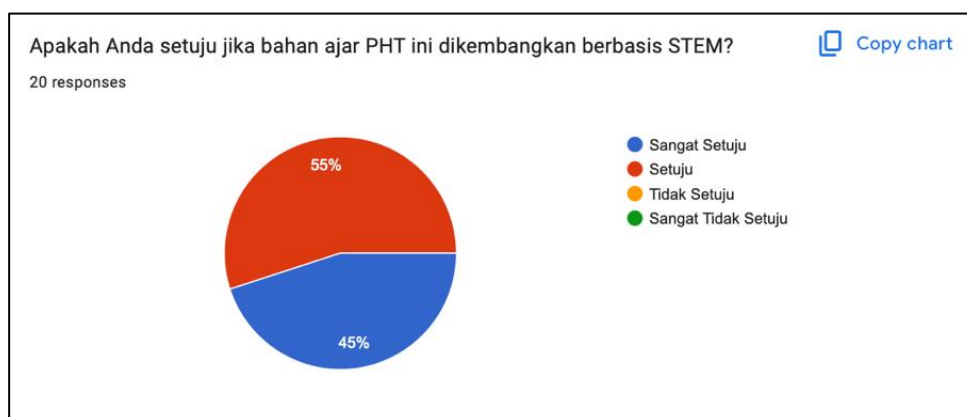
CONCLUSION

Based on the analysis conducted with 20 students who had completed the Green Lifestyle practice cource, regarding for developing STEM-Based IPM teaching materials as a solution for sustainable agiriculture within the course, it can be concluded that the IPM topic is important to be included as one of the core subjects in the course. Furtheremore, the development of STEM-Based teaching materials is necessary to support the learning process.

ACKNOWLEDGEMENT

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