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ANALYSIS OF THE ATTITUDES AND PERCEPTIONS OF PROSPECTIVE SCIENCE TEACHER STUDENTS TOWARDS STEM LEARNING

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Abstrak

Penelitian ini bertujuan untuk menganalisis sikap dan persepsi siswa calon guru IPA pada pembelajaran STEM (Science, Technology, Engineering and Mathematics). Penelitian ini menggunakan metode survei dan dianalisis secara deskriptif untuk mendapatkan gambaran yang sebenarnya. Sampel pada penelitian ini adalah 62 orang mahasiswa yang terdiri dari program studi Pendidikan fisika, Pendidikan kimia, dan Pendidikan IPA dari 4 Universitas di wilayah Kalimantan Barat. Analisis data dilakukan secara kualitatif atas hasil penyebaran angket sikap dan persepsi siswa calon guru IPA. Berdasarkan hasil analisis data yang diperoleh siswa calon guru sains memiliki sikap dan persepsi yang baik terhadap pembelajaran STEM. Adapun pada setiap aspek sikap dan persepsi siswa terhadap pembelajaran STEM yang dilakukan, siswa memiliki sikap dan persepsi pada kategori yang cukup memahami bahwa mahassiswa calon guru mengakui ketertarikan pembelajaran STEM, memiliki kompetensi dan kinerja yang cukup pada pembelajaran di bidang STEM serta memiliki minat dan rasa kepemilikan itu baik. Rata-rata sikap dan persepsi siswa menunjukkan 2,81 yang maknanya sudah cukup baik.
Kata kunci: STEM Learning, sikap, persepsi, calon guru

Abstract

This research aims to analyze the attitudes and perceptions of prospective science teacher students in STEM (Science, Technology, Engineering and Mathematics) learning. This research uses a survey method and is analyzed descriptively to get a true picture. The sample in this study was 62 students consisting of physics education, chemistry education and science education study programs from 4 universities in the West Kalimantan region. Data analysis was carried out qualitatively based on the results of distributing a questionnaire on attitudes and perceptions of prospective science teacher students. Based on the results of data analysis obtained, prospective science teacher students have good attitudes and perceptions towards STEM learning. As for every aspect of students' attitudes and perceptions towards the STEM learning carried out, students have attitudes and perceptions in the category of sufficient understanding that prospective teacher students recognize an interest in STEM learning, have sufficient competence and performance in learning in the STEM field and have an interest and sense of ownership. it is good. The average attitude and perception of students shows 2.81, which means it is quite good.
Keywords: *STEM Learning, Attitudes, Perceptions*

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INTRODUCTION

In the current era of globalization and the rapid development of communication technology, individuals are required to have varied abilities and skills. 21st Century Skills are seen as being able to strengthen social capital and intellectual capital, which are abbreviated as 4C skills: Critical Thinking and Problem Solving, Creativity and Innovation, Communication, and Collaboration (Meilani et al., 2020). The Ministry of Education and Culture (2014) is seeking to formulate a learning paradigm suitable for the 21st century that emphasizes curiosity and the ability to manage information from various sources, formulate problems, think analytically, and collaborate to solve problems.

In this context, physics learning plays a crucial role in enhancing students' competencies and skills. Atiqoh (2017) adds that effective physics learning occurs when students can master and apply the concepts they have understood to solve physics problems. This approach not only solidifies their grasp of the subject matter but also develops their critical thinking and problem-solving abilities.

Physics is a branch of natural science (IPA). Physics learning is closely related to natural concepts and phenomena in everyday life (Daiani, 2016). So that in the learning process, physics does not emphasize knowledge development but also develops aspects of students' skills (Lestari et al, 2019). Integrating the Science, Technology, Engineering, and Mathematics (STEM) framework can significantly enhance the learning process by supporting students' skills. STEM combines these four disciplines to present contextually relevant problems from daily activities, focusing on creating concrete problems and solutions (Alfika et al., 2019).

The advantages of the STEM approach to science learning in this era of globalization need to be supported by students' attitudes towards learning. Positive attitudes such as curiosity, interest and enjoyment can influence student learning outcomes, especially for middle school students. They are in a transitional period, a period of adolescence, which is neither a child nor an adult. During this period, they experienced rapid changes in attitudes, both in male and female students. Both male and female students have the same portion of learning, and this difference becomes a stereotype for educators.

One study on Indonesian Students' Attitudes and Interest in STEM stated that male students had more positive attitudes and beliefs about technology, engineering, and mathematics than females. Meanwhile, women have more positive beliefs and attitudes towards basic science (Suwono et al., 2019). Research in Texas in 2014 showed differences in attitudes toward STEM careers between first- and second-year college students; first-year students have more favorable attitudes toward STEM Careers (Christensen et al., 2014). Other research explains that science is learning about curiosity and creative thinking skills which greatly influence junior high school students (Hoeruni, 2017). This is confirmed by research analyzing students' attitudes towards science subjects showing positive attitudes towards science subjects (Sukarni et al., 2020).

From PISA 2015, Thailand's student abilities in science, mathematics and reading were ranked 55th, while Indonesia ranked 62nd out of 70 countries (OECD, 2016). However, in the 2018 PISA data, Indonesia has a falling score, occupying 72nd position in 77 OECD Cooperation countries, while Thailand's ranking is 66th, still above Indonesia. Both countries use a curriculum with the same background based on 21st century education (OECD, 2019).

In Indonesia, STEM has been developing since 2013 (Nurazizah et al., 2018). In recent years, STEM education has been considered the gold standard of the Indonesian education system. However, there has not been much research on Indonesian students' attitudes towards STEM. This fact, together with the 2018 PISA data on Indonesian students' competencies, underscores the need to survey Thai students' attitudes towards STEM in terms of grade level and gender.

The higher ranking of Thai students in PISA can serve as a reference to understand the importance of students' attitudes towards STEM. It is crucial for teachers to consider students' interests when applying learning approaches. This is equally important for prospective teachers, as their perceptions of teaching will influence their implementation of lessons.

Understanding and knowledge regarding attitudes and perceptions in certain learning will describe a person's interest in the object being observed. Currently, STEM learning is very popular among prospective science teacher students because they assume that STEM is very close to science learning. Apart from that, based on the results of discussions with PPG students, STEM learning is one of the lessons recommended by the government but it is difficult to understand the integration that teachers must carry out in one lesson. There are still many different perceptions regarding STEM-based learning. Therefore, it is important to carry out this research to obtain an overview of how student teachers have attitudes and perceptions regarding STEM-based learning.

METHODS

This research uses correlational research which aims to determine the profile of attitudes and perceptions of prospective science teachers towards STEM learning and to find out whether there are differences in student teachers' perceptions of this learning. The research method used in this research is correlational research in the form of ex-post facto (to observe natural phenomena to reveal existing facts) with a simple paradigm design.

This research uses a qualitative approach because numerical data or numbers are used to analyze the data. The information obtained is then processed using descriptive methods and after the results are obtained, they are described by drawing conclusions based on numbers. The data collection technique uses a survey method in the form of administering a questionnaire and a data collection tool in the form of a questionnaire. The assessment instruments in this research were designed to obtain an overview of the attitudes and perceptions of prospective science teacher students towards STEM learning. Data analysis was carried out quantitatively. The target or indicator of success is to obtain an overview of the attitudes and perceptions of prospective science teachers and publish the research results in seminars and/or national or international journals.

RESULTS AND DISCUSSION

The aim of the research is to analyze the attitudes and perceptions of student science or physics education teacher candidates towards STEM learning. The teacher candidates referred to in this research are students of the MIPA (Mathematics and Science) education study program in West Kalimantan. The study programs involved are the Physics education study program FKIP Untan, STKIP Singkawang, IKIP PGRI Pontianak. The total number of students involved in this research was 62 students consisting of physics education, chemistry education and science education study programs from Tanjungpura University, IKIP PGRI Pontianak and Muhamadiyah University Pontianak as well as from STKIP Singkawang. Data analysis was carried out qualitatively.

In this research, the instrument for measuring the attitudes and perceptions of prospective teacher students was adapted from research by Jia Liu, Si (2023). The aspects investigated are aspects of recognition of STEM learning, performance and competence, interest and sense of ownership of learning. The statements in the questionnaire can be seen in Table 1.

Tabel 1. Statement of the research instruments used

Indicator	Statements
Recognition	In my opinion, I am good at organizing STEM-related learning at school
	My friends think I am good at managing learning related to STEM
	My lecturers and seniors think I am good at managing STEM-related learning
	My family and friends consider me an expert in STEM-related subjects.

Indicator	Statements
	I was already convinced about STEM learning before starting STEM-related courses
	I think I am talented in STEM-related subjects.
	My classmates would ask about knowledge or exercises related to STEM.
	I can achieve a high level of success in implementing STEM-related learning.
	It took me a long time to understand new knowledge in STEM-related subjects.
	I don't think I'm cut out for STEM-related subjects at all.
	I am confident that I will be able to study STEM-related subjects in high school.
	I am confident that I will be able to teach subjects related to STEM integration
Performance and competency	I can use equipment and supplies well in the classroom or laboratory.
	I can understand the laws and principles of STEM-related subjects well.
	I can use science to explain natural phenomena in everyday life.
	I'm good at designing and fixing things.
	I am able to complete homework in STEM-related subjects well.
	I believe I can learn a lot in classes in STEM-related subjects.
	I believe I can solve complex problems related to STEM.
	I can apply my mathematical knowledge flexibly in science subjects.
	I believe that I can learn even the most difficult science subjects if I work hard.
Interest	I want to learn more about STEM-related sciences through various sources of information.
	I am interested in STEM-related careers.
	I want to teach STEM when I become a teacher
	I love participating in various STEM-related activities.
	I think the STEM knowledge that I learn in class is important in everyday life.
	I like to think actively about STEM issues.
	STEM issues excite me.
	I plan to teach in a STEM learning setting when I become a teacher
	I intend to be more satisfied with my STEM-related major than any other major.
Belonging	I would be proud if I excelled in a STEM-related subject.
	I want to be seen as someone who is involved in mathematics or science and technology.
	I am willing to demonstrate competence in mathematics or engineering in front of others.
	I feel happy when talking with other people about content related to subjects in mathematics or science, engineering or technological engineering.
	I follow the example of STEM-related scientists and engineers.

Indicator	Statements
	I would feel comfortable talking to people who work in STEM-related fields.

Then a questionnaire was given to prospective science teacher students. Following are the results obtained in Table 2.

Table 2. Recapitulation of scores obtained from the questionnaire based on aspects of student attitudes and perceptions

Aspect	Skor	Mean
Recognition	2,62	2,81
Performance	2,84	
Interest	2,93	
Belonging	2,86	

For more clarity, you can see the graph in the Figure 1.

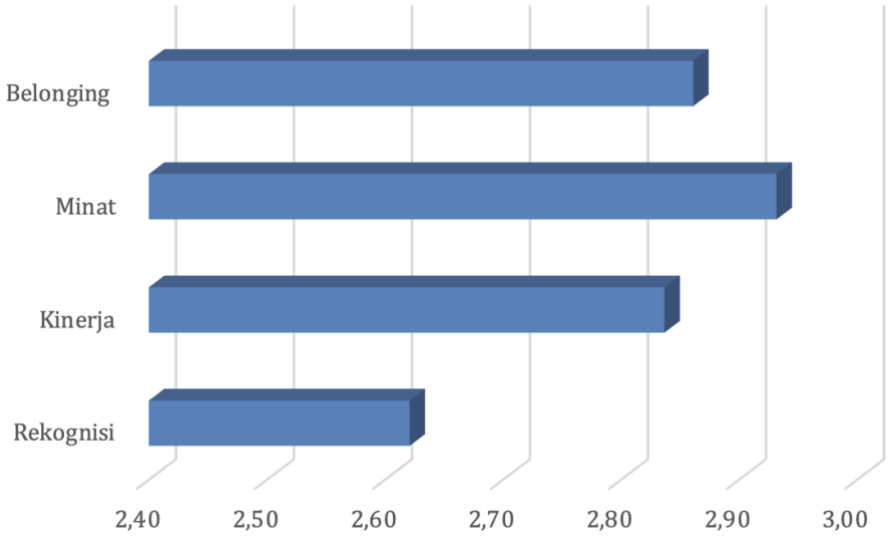

Figure 1. Obtained student attitude and perception scores towards learning and STEM fields

Based on the table and graph above, information is obtained that the average score for students' attitudes and perceptions towards STEM fields and learning is 2.81 out of a maximum score of 4. The score category is in the sufficient category, which means students have an understanding of the fields of science, technology, engineering and mathematics (STEM). The attitudes and perceptions of students are measured in each aspect. The first aspect is the recognition aspect which obtained a score of 2.62. The recognition aspect provides an overview of students' understanding of learning in the STEM field. The second aspect is the performance aspect which obtained a score of 2.84. This score shows that students have a fairly good perception of their ability to carry out and participate in STEM learning. The third aspect is the interest aspect where through this instrument students describe their interest in STEM learning, namely achieving a score of 2.93, which means students have sufficient interest in the STEM field, especially in teaching STEM-based learning. Finally, 2.86 is the score for the sense of belonging aspect of STEM-based learning.

The perception scores obtained by all students are shown in the graph in the Figure 2.

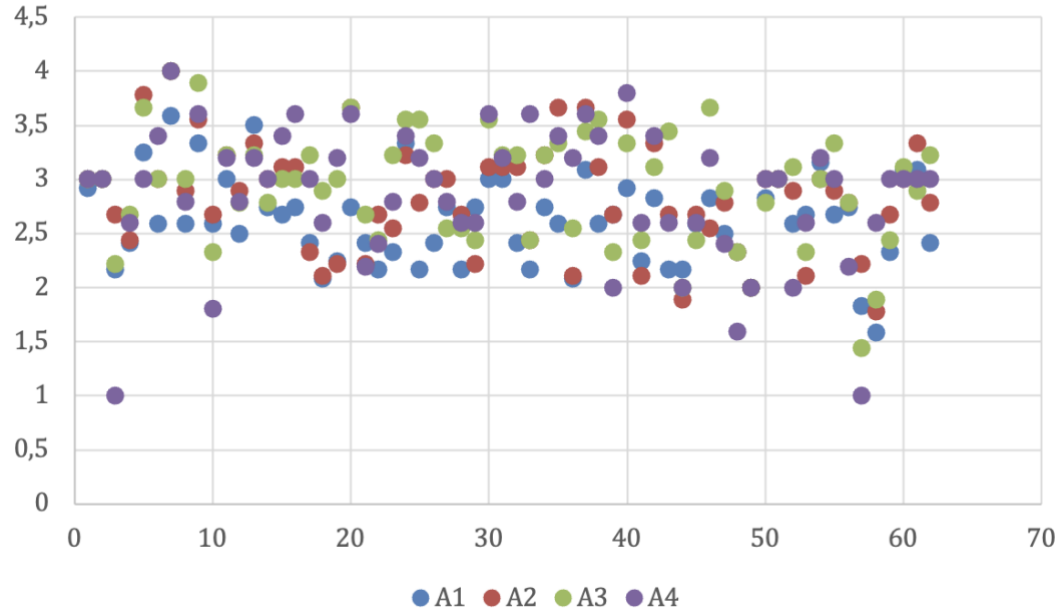

Figure 2. Distribution of student scores for each aspect of student attitudes and perceptions towards STEM learning

In the Figure 2, A1 is a recognition aspect of STEM learning, A2 is an indicator of performance and competency in learning related to science, technology, engineering and mathematics. A3 is an aspect of student interest in learning related to STEM, and A 4 is a sense of ownership of understanding and learning STEM.

Apart from that, an analysis was carried out on gender, the results can be obtained in the Figure 3.

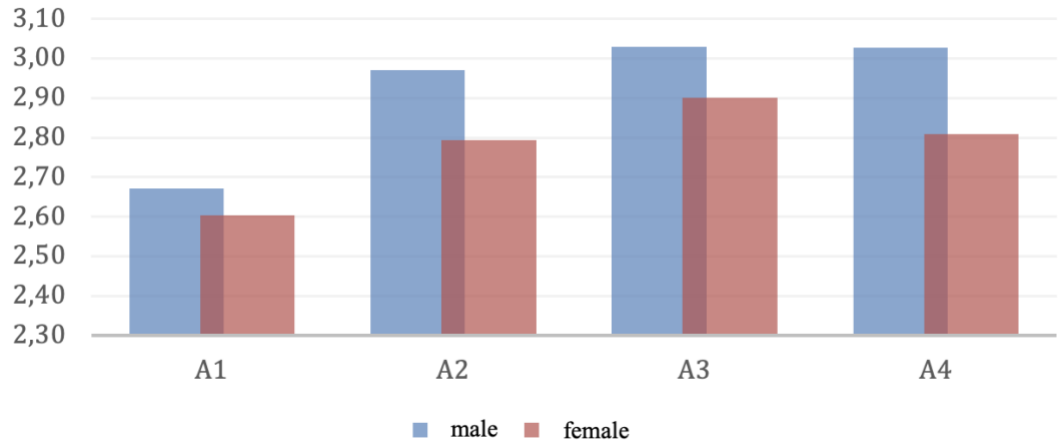

Figure 3. Differences in student perceptions and attitudes towards STEM learning between male and female students.

From the Figure 3, information is obtained that in all aspects male students' perceptions of understanding STEM-based learning are higher than female students' attitude and perception scores. Sequentially, the recognition aspect is 2.67 with 2.60, the performance and competency aspect is 2.97 and 2.79, the interest aspect is 3.03 with 2.90 and the belonging aspect is 3.03 with 2.81. This score indicates the need for further improvement in training programs to increase students' confidence in their performance and competence in STEM This difference may be due to gender stereotypes or a lack of female role models in STEM. Intervention programs targeting females can help reduce this gap. The aim of the STEM approach is to provide opportunities for students to understand learning

related to everyday life in an integrated manner and to practice the concepts learned so that learning is more meaningful. This shows that the goal of STEM in the world of education is in line with the demands of 21st century education, namely so that students have scientific and technological literacy that can be seen from reading, writing, observing and doing science, and are able to develop the competencies they already have to apply them in facing problems in life. everyday life related to STEM fields of science (Bybee, 2013; National STEM Education Center, 2014).

This supports the suitability of the identity framework as a lens of critical analysis for students interested in STEM. Multiple studies have shown that one of the key areas influencing persistence in STEM disciplines is the role of recognition. recognition is essential in STEM education as it enhances motivation, self-efficacy, and a sense of belonging, provides positive reinforcement, encourages perseverance, and serves as inspiration for others. These factors collectively contribute to better student learning outcomes and increased persistence in STEM disciplines. The way others view students is very important in determining how students view themselves and in determining their next choices. Likewise, prospective science teachers are certainly influenced by the perceptions of those closest to them in their lives regarding STEM, which can determine their next academic choices. Many studies have shown that parents' perceptions and expectations regarding their children's STEM abilities influence children's self-perceptions and expectations in STEM disciplines and even have a non-negligible influence on subsequent decisions to pursue STEM careers (L.Sha et al, 2016; Shimpkins et al, 2015). The term perception is closely related to human psychology. According to Sugihartono (2007) perception is human behavior starting with sensing or sensation. Sensing or sensation is a process of entering stimuli into the human sense organs. After the stimulus enters the human sensory organs, the brain will interpret the stimulus. The brain's ability to translate stimuli is what is called perception. Meanwhile, according to Walgito (2003) perception is a process of organizing, interpreting stimuli received by an organism or individual so that it is something meaningful and an integrated activity within the individual. In science learning with a STEM approach, the teacher's role is very important in implementing learning. Teacher behavior which is influenced by individuals, society, the environment and policies has an impact on teachers' decisions about the pedagogical approach to be adopted in learning (Elder, et al., 2007). One measure of the success of a learning program implemented by a teacher is an increase in student learning achievement or student learning outcomes that are above the Minimum Graduation Criteria (KKM). STEM learning is one of the efforts that teachers can make in creating a learning environment that provides opportunities for students to develop 21st century abilities (Wagner, 2008). Apart from that, according to Srikoom, et al. (2017) prospective teachers' perceptions of learning using a STEM approach influence the student learning process. The application of science learning with a STEM approach needs to be implemented in schools because theoretically it can improve 21st century skills. Looking at several research results, it is necessary to carry out research on teachers' and students' perceptions of STEM-oriented science learning.

Integration of the five fields in STEM requires the availability of adequate school facilities. For example, school laboratory facilities are expected to cover five fields of science, namely a science laboratory, a computer laboratory, a mathematics laboratory, a religion laboratory and a library as additional literature in carrying out the integration process between scientific fields. The completeness of school facilities greatly influences the effectiveness of implementing learning using a STEM approach. Science teachers also realize that school facilities are an important factor in supporting the continuity of learning.

Teachers' perceptions can be influenced by the place where they study and learning styles (Srikoom, et al, 2017). Learning with a STEM approach can be viewed differently by each teacher. To improve the quality of implementing learning with a STEM approach, the first step that can be taken is to identify teachers' views about STEM education. Teachers' perceptions of learning are an important component of content knowledge and pedagogy (Park & Oliver, 2008). Teachers who have

negative perceptions and attitudes towards STEM tend to avoid learning with a STEM approach Appleton, 2003).

CONCLUSSION

Based on the research results and discussion, it is concluded that prospective science teacher students have good attitudes and perceptions towards STEM learning. As for every aspect of students' attitudes and perceptions towards STEM learning, students have attitudes and perceptions in the category that are quite understanding, namely that prospective teacher students recognize an interest in STEM learning, have sufficient competence and performance in learning in the STEM field and have an interest and sense of ownership. The average attitude and perception of students shows 2.81, which means it is quite good.

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