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RESPONSE OF PROSPECTIVE MATHEMATICS TEACHER STUDENTS TO LEARNING DIFFICULTIES IN CALCULUS COURSE

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ABSTRACT

This study was motivated by the learning difficulties faced by prospective mathematics teacher students in calculus courses, while calculus courses studied at the college level equip prospective teacher students to teach mathematics subjects at the secondary school level. This study aims to determine students' responses to learning difficulties in calculus courses. This research used descriptive quantitative method by involving 25 students of Tadris Mathematics IAIN Kerinci as the research sample. The sampling technique used in this study was convenience sampling, which is when a researcher chooses his sample only by including people who are available. This study uses a closed questionnaire as a data collection tool that is reviewed from 7 aspects of difficulty, namely interest, motivation, talent, intelligence, facilities and infrastructure, quality, and teaching methods. The results of descriptive analysis showed that students have a high level of difficulty in learning calculus. The conclusion of this study shows that students' learning difficulties, especially in calculus courses, are strongly influenced by external factors, especially related to learning facilities and infrastructure. The results also show that prospective math teacher students at IAIN Kerinci have an unfavorable response to learning difficulties in calculus courses.

Keywords: Learning Difficulties, Calculus, Response, Prospective Teachers

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PRELIMINARY

Calculus is a course that must be taken by students majoring in mathematics in college. This course is often full of problems, one of which is the way students perceive the difficulties in the course. According to Nurhikmayanti (2017), most students have difficulty in understanding complex concepts related to calculus. As stated by Chusna (2016) and Yuliana & Fajriah (2013), learning mathematics at the elementary school level has a significant impact on the learning process of further mathematics at the next level because it is related to the basic concepts of mathematics

that help students learn it. A good understanding of the basics in math lessons is important to overcome difficulties in learning calculus.It is not only a matter of understanding the material, but also the previous mathematical foundations play a role in students' abilities. As mentioned by (Piddin, 2016), a strong Understanding of basic math materials is an important foundation for students to overcome obstacles in calculus courses Understanding basic math material is a very important foundation for students to over come obstacles in calculus courses.

Calculus is one of the important courses in higher education that prepares prospective teachers to teach mathematics in secondary schools, including the material of Function, Limit, Differential, and Integral. Instead, students still face difficulties due to the lack of connection between theory and practical applications in calculus (Mahayukti et al., 2022). Mathematics is often avoided, feared, and even hated by students, which may be due to the perception that math is scary (Maharani & Bernard, 2018). Novitasari (2016) said that students think that math is complicated and difficult to understand because of its abstract nature. Another study by Ma, Ailly and Arth in Khatoon & Mahmood (2010) emphasized that mathematics difficulty can be defined as a feeling of discomfort when facing mathematical problems such as in Calculus courses. It is also related to the fear and anxiety that arise in certain situations related to mathematics. The success or failure of learning depends on how students are able to deal with difficulties in learning mathematics (Maharani & Bernard, 2018). Suardi in research by Zivana et al. (2023) said that learning difficulties include learning disabilities and inability to master material.

Overcoming learning difficulties in calculus courses creates challenges that can potentially have a long-term impact on academic development. If these issues are not addressed effectively, students may experience a loss of confidence and interest in areas of study involving higher-level mathematics due to their learning difficulties. Thus, lecturers play a very important role in determining the problem and providing appropriate solutions (Hidayah et al., 2021).

Based on several opinions regarding the criteria for learning difficulties, researchers use aspects of learning difficulties according to (Piddin, 2016), namely interest, motivation, talent, intelligence, facilities and infrastructure, quality and learning methods used in learning. Interest is defined as a person's interest in something or a particular activity (Casuarina et al., 2017). Interest has a fairly

simultaneous impact on one's learning outcomes because without interest, individuals will not learn well and tend to be forced to learn, which ultimately has an impact on the achievement of learning outcomes.

In addition to interest, intelligence and talent also affect a person's learning outcomes (Novitasari et al., 2015). Researchers view these two terms as two different things, but some other researchers classify intelligence and aptitude as two things that have the same meaning. Carol Dweck's Theories of Intelligence asserts that when people believe that intelligence and aptitude are dynamic and possible to improve, they will have better outcomes than those who believe that intelligence and aptitude are fixed and cannot change (Jonsson & Beach, 2017).have the same meaning. Carol Dweck's Theories of Intelligence asserts that when people believe that intelligence and talent are dynamic and possible to improve, they will have better results than those who believe that intelligence and talent are fixed andcannot change (Jonsson & Beach, 2017).

In addition to interest and talent, motivation is one of the things that affects learning difficulties. Motivation is seen as a need to perform an action or deed by seeing motivation as an interrelationship between beliefs, perceptions, values and interests. Seeing needs as the main motivation in learning, it is important to identify the needs that encourage someone to learn (Grajcevci & Shala, 2017).

Supporting facilities play an important role in achieving optimal learning achievement. At various levels of education, from elementary schools to universities, these facilities have a significant impact in facilitating the teaching and learning process. Research by (Akomolafe & Adesua, 2016) showed a positive correlation between the quality of learning facilities and student learning outcomes. Therefore, the procurement and maintenance of adequate learning facilities is a very important investment in supporting the achievement of optimal learning achievement. Thus, the provision of good learning facilities is a strategic step in improving the quality of education and learning outcomes.

Student responses about difficulties in calculus courses are a major subject of concern, and understanding the fundamentals behind these issues can guide educational improvement efforts. These responses refer to how students perceive and experience the challenges they face in understanding complex mathematical concepts

in the context of calculus. By understanding students' responses about calculus learning difficulties, educators can identify ways to improve learning and help students overcome the barriers they face.

Previous research that has been conducted by previous researchers such as Mutakin (2015), the results of this study are the factors that cause Informatics Engineering students to experience difficulties in taking Calculus courses. Then other research by Hidayah et al. (2021), the research describes student learning difficulties in calculus II courses on indefinite integral and definite integral material and efforts made to overcome student learning difficulties in calculus II courses on indefinite integral and definite integral material. Furthermore, research conducted by Monariska (2019) found that student learning difficulties exist in the mathematical abilities possessed when facing integral challenges, errors in understanding problems, as well as expertise in workmanship and lack of accuracy and proper utilization of time, which causes the problem cannot be resolved, so that an in-depth learning approach and psychological support are needed to help students overcome difficulties in calculus courses. From previous research, there has been no research conducted with descriptive quantitative methods that examine how students' responses of learning difficulties experienced in calculus courses and no one has examined the level of student difficulties in each indicator of learning difficulties. This is a research gap so that the author conducts research related to this matter.

Understanding prospective mathematics teachers' responses to calculus course difficulties is an important step in identifying academic difficulties faced by students. The main purpose of understanding this response is to know the perceptions or views of prospective mathematics teachers towards calculus learning difficulties and to be able to develop learning strategies that are more effective and responsive to student needs. In addition, research aimed at optimizing students' calculus understanding and proficiency should be based on recognizing the challenges faced by students. Thus, involving student responses in the process of curriculum design and teaching methods can have a positive impact on the quality of learning at the university level.

METHODS

This study aims to determine student responses to Calculus courses in the Tadris Mathematics Study Program at the Kerinci State Islamic Institute. The method used is descriptive quantitative adapted from (Cresswell, 2019). The research participants

consisted of 25 students majoring in Tadris Mathematics IAIN Kerinci who were taking Calculus courses. Using this method is expected to provide a clear picture of the learning difficulties faced by students in Calculus courses and the level of difficulty they experience.

Students' learning difficulties were identified through observation and closed questionnaires. The data collection method used a closed questionnaire which was first analyzed for validity and reliability by experts in the field of mathematics education then continued with analysis using SPSS software. The questionnaire contains seven aspects of learning difficulties containing 14 positive and negative statements with 1 positive statement and 1 negative statement for each indicator. This study used a questionnaire with four Likert scale options that included choices involving levels of agreement, ranging from strongly agree, agree, disagree to strongly disagree.

An analytical questionnaire study was conducted to assess the proportion of knowledge on each aspect that causes students' difficulties in understanding mathematics. The percentage of knowledge for each aspect was done using the following formula:

$$PP = \frac{A}{B} \times 100\% \quad (1)$$

Specifications:

PP : The percentage of each aspect

A : Total score from the questionnaire for each factor obtained

B : Sum of the highest scores

(Sudijono, 2009)

The criteria for learning difficulties are analyzed based on the results of the questionnaire with the categories of learning difficulties according to (Arikunto, 2006) which are presented in Table 1 below :

Table 1. Criteria for Learning Difficulty Factors

Level	Criteria
$80 \leq PP \leq 100$	Very High
$60 \leq PP < 80$	High
$40 \leq PP < 60$	Enough
$20 \leq PP < 40$	Low
$0 \leq PP < 20$	Very Low

Observation was carried conducted by the researchers to cross check the results of the difficulty questionnaire. This step allows researchers to directly observe and analyze

the learning difficulties of prospective mathematics teachers when studying Calculus courses by the lecturers.

After the perception questionnaire was distributed to students who became research subjects, the response score data obtained was then categorized by referring to the categories compiled by (Azwar, 2012) and can be seen in Table 2 below:

Tabel 2. Response Category

Score Range	Category
$x < 34$	Very Low
$34 \leq x < 46$	Low
$46 \leq x < 59$	Medium
$59 \leq x < 71$	High
$x \geq 71$	Very High

The results of data processing were then interpreted. The interpretation is used to determine the response of prospective mathematics teacher students to learning difficulties in calculus courses.

RESULTS AND DISCUSSION

Based on the results of the questionnaire distributed to 25 respondents regarding the response to the importance of interest in dealing with calculus course questions, three students showed the level of agreeing and strongly agreeing, nine students showed the level of disagreeing, and eleven students showed the opposite opinion of disagreeing and strongly disagreeing, the other two students had a supportive view and strongly supported the statement. More details can be seen in Figure 1 below:

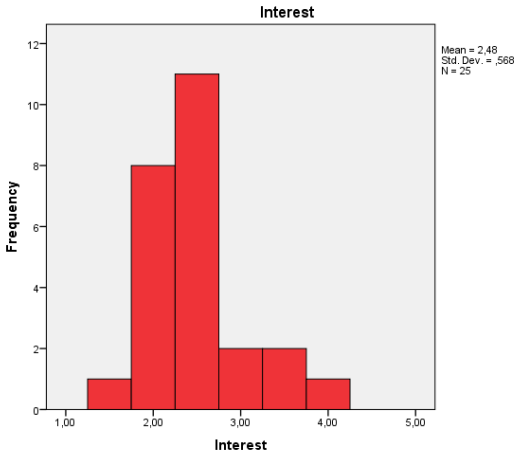

Figure 1. Distribution of Interest Aspects

The questionnaire results of 25 respondents regarding the need for motivation and willingness in calculus courses showed that six students agreed, four disagreed, four agreed

and strongly agreed, and eleven respondents agreed or disagreed. Further details are in Figure 2 below:

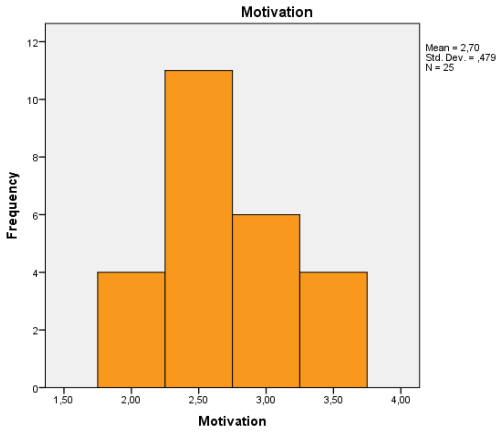

Figure 2. Distribution of Motivation Aspects

The questionnaire results of 25 respondents regarding the need for talent in solving calculus problems show that 4 students agree, 3 students disagree, 2 students are between agree and strongly agree, and the rest are in the agreement range. Further details are in Figure 3 below:

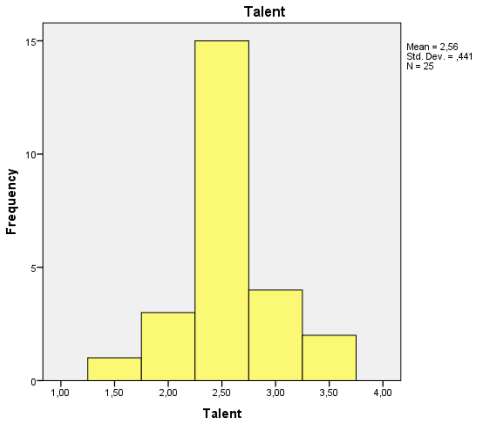

Figure 3. Distribution of Talent Aspects

The questionnaire results of 25 respondents regarding intelligence in facing calculus challenges show that 4 students agree, 3 students disagree, 2 students were between agree and strongly agree, 1 student was between strongly disagree and disagree, and the other 15 respondents in the range between agree and disagree. Further details are in Figure 4 below:

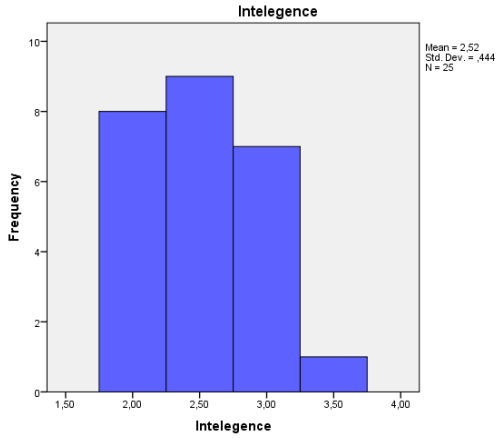

Figure 4. Distribution of Intelligence Aspects

The results questionnaire of 25 respondents regarding the need for supporting facilities for calculus learning, found that 12 students agreed and strongly agreed, one student disagreed, six students agreed and strongly agreed, and six other students disagreed and disagreed. Details can be seen in Figure 5 below:

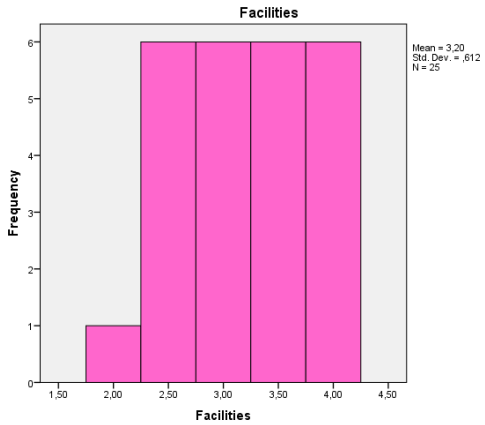

Figure 5. Distribution of Facilities Aspect

From the results questionnaire of 25 respondents regarding how helpful they were with clear and in-depth explanations from the teachers in calculus learning, the results showed that eight students agreed or strongly agreed, two disagreed, three students agreed and strongly agreed, and twelve students agreed and disagreed. Further details in Figure 6 below:

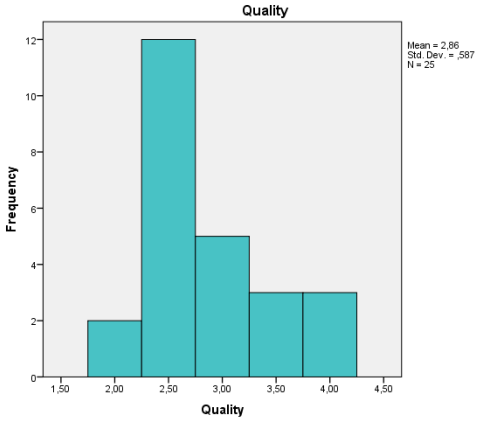

Figure 6. Distribution of Quality Aspect

From the questionnaire distributed to 25 respondents regarding the importance of paying attention to learning methods in calculus, it was found that fifteen students agreed and strongly agreed, five students disagreed, two students agreed and strongly agreed, and three students agreed and disagreed.Further details in Figure 7 below:

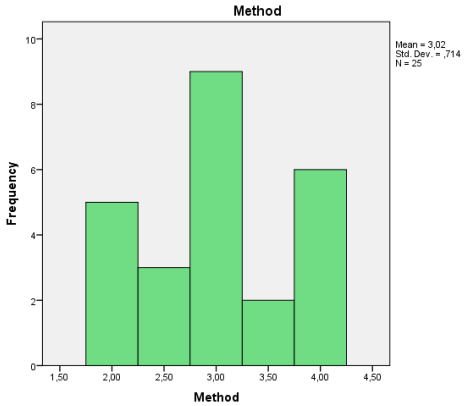

Figure 7. Distribution of Method Aspect

After the response questionnaire was distributed to students who became research subjects, the students' learning difficulties score data that obtained from SPSS output then categorized according to Table 1. The students' learning difficulties criteria can be seen in Table 3 below:

Table 3. Learning Difficulties Criteria

No	Indicator	Aspects	PP (%)	Average
1.	Internal	Interest	62	**64 (High)**
		Motivation	68	
		Talent	64	
		Intelegence	63	
2.	Eksternal	Facilities	76	**75 (High)**
		Quality	72	
		Method	75	

Based on Table 3, it can be seen that many aspects that affect student learning difficulties are classified as internal factors and external factors. The factor that really influences is external factors with an average of 75% in high category, where aspects of infrastructure (facilities) with PP average of 76% in high category. From this data, it means that student learning difficulties are more influenced by external factors in the aspect of facilities and infrastructure that support calculus learning.

After the response questionnaire was distributed to students who became research subjects, the response score data obtained from SPSS output then categorized by referring to the Table 2. The results of students' perception can be seen in Table 4 below:

Table 4. Student Response Result

Category	Students	Percentage (%)
Very Low	3	12
Low	20	80
Medium	2	8
High	0	0
Very High	0	0

Based on Table 4, it can be seen that students' response are in the very low, low, and medium categories. The very low category is 3 people with a percentage of 12% . The low category is the category with the highest number of students, namely 20 people with a percentage of 80%. Furthermore, the number of students in the medium category is 2 people with a percentage of 8%. From this data, it means that the prospective math teacher students of IAIN Kerinci have an unfavorable response of learning difficulties in calculus courses.

The results showed that most respondents, namely 15 students, agreed on the importance of interest and enthusiasm in dealing with calculus course problems.The importance of student interest in mathematics learning and its impact on academic achievement. This supports Dalyono's statement, cited by Djamarah (Senjaya, 2017) states that high learning interest often contributes to better academic achievement compared to low learning interest. In addition, Ahmadi and Suprijono in Senjaya research (2017) argue that interest is an internal factor that affects student learning difficulties. Kusumo (2016) is also in line with Slameto (2015) view who asserts that interest plays a crucial role in the learning process, where a lack of understanding of the material can affect learning outcomes. Therefore, an accurate understanding of the respondents' level of agreement or disagreement can provide an overview of their interest in improving their understanding of calculus, which in turn can affect their learning outcomes.

This study describes students' response related to motivation and willingness to face the challenges of calculus courses. From the questionnaire results, most students showed agreement on the awareness of the need for motivation in overcoming these difficulties. However, some students showed disagreement with the need for motivation in calculus learning. According to research Agustina & Kurniawan (2020) which is reinforced by the opinion Sardiman (2019), previous experience in the same situation can affect the desire to learn. For example, if a person has been successful in an activity, he or she is likely to have expectations of doing the same thing. Motivation can be defined as a set of efforts to make a person intend to perform an action, and if they do not feel like it, work to overcome the discomfort. As a result, a person may want to learn more math if they know the basics, so this expectation can be a motivation or stimulus to learn.

The study revealed the need for aptitude in solving calculus problems from 25 respondents. A small proportion of students agreed, while others disagreed. According to William in Sari & Suhaili's research (2020) aptitude is a person's ability to complete tasks that do not depend on practice and come from knowledge and skills that are learned gradually. In addition, conditions or characteristics are considered an indication of a person's educational acceptance, according to Bingham in Desriandi & Suhaili's research (2021). To achieve achievements that require knowledge, experience, and motivation, talent is needed. Therefore, aptitude is very important in calculus learning, and this aptitude can have an impact on learning outcomes.

This study details the results of a questionnaire regarding the importance of intelligence in calculus learning which shows that some students agree, while others disagree. Students are classified as good, medium, and weak. According to Sugilar (2017) mathematics education students are often not confident in conveying mathematical concepts and making arguments that are in accordance with mathematical facts, principles, and techniques. This is supported by Galton in Krathwohl & Anderson research (2019) and Ruesffendi (2006) who stated that in a group of generally selected students, there are students with medium, low, and high abilities. Intelligence affects learning, which is especially important for math learning. Therefore, mathematical ability is very important for students to solve math problems when learning calculus.

The questionnaire results show that the majority of students agree on the importance of facilities and infrastructure in calculus learning, although there are some who disagree. To achieve educational goals, better processing and utilization of

facilities and infrastructure are needed to achieve the success of educational programs and the learning process. The success of learning is strongly influenced by the availability and optimal utilization of resources (Nurstalis et al., 2021). According to research conducted Akomolafe & Adesua (2016), there is a relationship between learning outcomes obtained by a person and facilities and infrastructure. Therefore, learning facilities and infrastructure must be considered to support the success of student learning.

The questionnaire results show that the majority of students agree on the importance of facilities and infrastructure in the calculus learning process, although there are some who have different opinions. To achieve educational targets, optimization of facilities and better infrastructure are needed to achieve the success of educational programs and learning processes (Sugilar, 2017). Furthermore, the goal of educational programs is to achieve quality learning (Sugilar, 2017). Quality learning means that lectures have quality materials and effective method approaches so that students participate actively (Ainy et al., 2018).

This research reveals the importance of paying attention to calculus learning methods. Although there are some students who disagree, most students agree that it is important to pay attention to the learning approach. In order for students not to get bored, the educational process in higher education must be done as well as possible. In higher education institutions, students who take calculus courses generally come from various disciplinary backgrounds at the high school level. In addition, teachers only use conventional approaches to teach calculus students. Learning methods are used to make it easier to achieve learning objectives (Djamarah & Zain, 2010); (Yusup & Sari, 2020). Therefore, lecturers must be very creative when changing methods so that the material is easily understood by students.

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Based on the research results, it is concluded that the level of student learning difficulties in calculus learning is categorized as high. Descriptive analysis shows that as many as the factors that cause calculus learning difficulties in students are classified as high, such as lack of interest, motivation, talent, intelligence, quality of facilities and infrastructure, and learning methods. The implication of this finding emphasizes the importance of increasing students' interest, motivation, and development of talent and intelligence in calculus learning. It is also necessary to improve the quality of facilities and infrastructure, as well as adjusting learning methods to overcome learning difficulties faced by students. Nevertheless, this study has limitations in generalizing the results because the sample may not represent the student population as a whole, and the descriptive analysis may not cover all variables that affect calculus learning difficulties. Therefore, future research is recommended to integrate more

comprehensive analysis methods and involve more representative samples to gain a deeper understanding of the factors causing learning difficulties in calculus courses.

CONCLUSION

The conclusion of the study on the responses of prospective mathematics teacher students to the difficulties of learning calculus at IAIN Kerinci shows that most respondents experience a high level of difficulty in understanding calculus material. This finding indicates that external factors, especially facilities and infrastructure that support learning, have a significant influence on students' learning difficulties. Therefore, more attention is needed in providing adequate learning facilities to help students overcome difficulties in learning calculus in order to improve the quality of education for prospective mathematics teachers at IAIN Kerinci.

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