

# Perception of The Ability to Understand Calculus Concepts in Online Learning

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## Abstract

*This descriptive research analyzes the perception of Panca Budi University students' perception of the implementation of online Calculus learning. Calculus is admittedly difficult, exacerbated by pretest results that show that 60% of students do not understand learning. The results of the study show a comprehensive negative perception of Calculus online learning. This negative perception was studied from three aspects: Content of Material (87% negative), Learning Interaction (75% negative), and Learning Environment (40% negative). Although the presentation of teaching materials by lecturers is considered positive, it is not able to change the negative perception of the material itself. Students argue that the most effective learning process is through face-to-face and direct explanations. This negative perception is a serious challenge, also rooted in the low ability to recall previous learning. Efforts can be focused on reintegrating more effective face-to-face methods, or if online is to be maintained, it is necessary to adapt the learning model that is able to create a more interactive, supportive, and adequate environment to facilitate in-depth problem-solving exercises.*

**Keywords:** perception, calculus, online learning, concept comprehension ability

## I. INTRODUCTION

### A. Background

Education is an important thing in human life. This is in accordance with the mandate of the 2003 SISDIKNAS Law article 1 which reads "education is a conscious and planned effort in order to realize an active learning process and be able to develop students' potential". At this time, students not only have to study up to the high school/vocational level, but are expected to be able to experience higher education according to their interests and talents to determine the major or study program to be chosen.

One of the study programs chosen is electrical engineering. The chosen study program is one of the study programs that are urgently needed today. In the study program, there are various kinds of courses, one of which is calculus. This is supported by the opinion (Syahlan et al., 2022) Calculus courses are mandatory courses that must be passed. This is supported research (Bocconi et al., 2018; Bråting & Kilhamn, 2021) which states that "some countries such as Finland and Sweden are integrating cross-learning with mathematics so that the two have a very strong relationship". Furthermore, an initial test was carried out for students.

In the initial test given to students and informed to the class, it was found that they had very low comprehension skills. In line with opinion (Scott, 2020) states "mathematics learning always begins with comprehension

activities". This is evidenced by the pretest given, where comprehension skills are basic skills that students must have. The results of the pretest from 50 students showed that 60% did not understand calculus learning, this shows that students are required to recall the learning that has been passed. This is supported by the opinion (Subanji, 2011) that "the lowest stage of thinking is to recall Return".



Figure 1. Hierarchy of Thinking

In the picture above, it can be seen that remembering Back is the lowest ability that every human must have. The second stage is basic skills. Furthermore, critical thinking skills. And the highest stage of thinking is creative thinking. At this time, students experience difficulties in learning calculus, due to a lack of understanding that begins with a low ability to remember the learning that has been passed. This is supported by the opinion (Malay, Sarah, et al., 2024)

which states that "education and the ability to think logically are inseparable, because intelligent people can make the best use of their education. Therefore, observations related to this research are needed, one of which is an interview.

Based on the results of interviews with students, it turns out that calculus is one of the courses that is quite difficult. The results of the interview with Tia on October 15, 2025, that the calculus course is quite difficult to understand. The same thing is supported by Habib's opinion, on October 16, 2025 stating that calculus courses are a scary thing. This is supported by opinions (Habinuddin & Binarto, 2020) stated that there are still many students who get obstacles in learning calculus, this is because students are not able to understand the concept of calculus and there are still mistakes and lack of precision in mathematical calculations.

Calculus is the foundation for the disciplines of engineering, science, and economics, occupying an irreplaceable central position in the higher education curriculum. The Calculus course connects logical thinking with basic mathematical concepts towards modeling and solving complex problems in the real world. However, behind the urgency, a pedagogical dilemma arises: the high failure rate and the difficulties that lead students to the abyss of understanding.

For many years, academic studies have focused on analyzing the conceptual difficulties inherent in the material itself—for example, the abstraction of the concept of limits or the interpretation of derivative geometries. But based on statistical data and curriculum analysis, it sometimes fails to capture the human dimension of this problem. For students, difficulties in calculus are not only a matter of not being able to solve problems, but an experience that involves anxiety, *self-doubt*, and the potential for loss of interest in calculus courses.

This phenomenon is the background of the main focus of this research: Perception of Calculus Concept Understanding Ability in Online Learning. This perception is the student's subjective view of the level of complexity of the material, which is shaped by the interaction between the cognitive demands of Calculus and their affective readiness and learning experience. If a student has the perception that Calculus is an impossible subject to master, then his motivation and learning efforts will be hampered, regardless of how well the material is taught.

Therefore, this study aims to explore and describe in depth how students interpret the difficulties they face in learning Calculus. When students are given the opportunity to express their opinions through narratives of personal experiences and interpretations, they hope to

identify the real root of the problem. A more complete understanding of these perceptions will not only enrich the literature on mathematical pedagogy, but most importantly, it will be a critical foundation for designing more empathetic, relevant, and effective learning interventions for future generations of learners. Learning Calculus will feel more difficult if it is carried out online, so this becomes an obstacle to understanding the concept of calculus.

Based on student perceptions, it was found that calculus learning will be more difficult if it is carried out online. Therefore, it is necessary to conduct a study related to how students' perception of calculus courses that are carried out online. Learning is currently required, so that students can face the evolving era of technology.

The development of technology today is developing very rapidly. So that students must be able to think at a high level. This is supported by research (Jin & Cutumis, 2024) stated "The change of the times towards the current era of technology requires students to be able to think at a higher level". This aims to make students able to solve a problem and be ready to face daily life. In this study, students conducted online learning, resulting in various perceptions.

Based on the description above, the purpose of this study is to see how the tendency of student perception in calculus courses that are carried out online. Therefore, from the information obtained, it can be known how the tendency of students' opinions/perceptions is so that efforts can be made to improve the quality of learning

## II. RESEARCH METHODOLOGY

This study uses descriptive research conducted using a survey of students of Panca Budi Development University Semester 1 of the Electrical Engineering Study Program. According to (Scott, 2020) states "Descriptive research is research that aims to determine the value of independent variables, either one or more variables without making comparisons or connecting with other variables. The data collection technique in this study uses a questionnaire that is distributed online to the next student Google Form used in the manufacture of instruments in this study.

The population of this study is all active students of Panca Budi Development University Semester 1 of the Electrical Engineering Study Program which amounts to 167 people, the sample in this study is 90 students. In this study, a questionnaire was also distributed, which aimed to find information related to students' difficulties in understanding the concept of calculus. Based on this, it will be discussed regarding the difficulty of understanding students in learning the concept of calculus online.

## III. RESULTS AND DISCUSSION

According to (Rakhmat, 2007) explained that "perception is a process of giving meaning to something so that individuals get new information. Based on this, Perception can be defined as a mental process in which individuals interpret or give meaning to incoming information, which ultimately results in new understanding or knowledge.

#### A. Early Difficulties and Challenges of Online Learning

The Calculus course at Panca Budi University Medan is a mandatory course for 1st semester students. Based on interviews, Calculus is recognized as a course that is quite difficult to understand. This difficulty was reinforced by the results of the pretest of 50 students which showed that 60% did not understand Calculus learning.

This challenge is increasingly complex as the learning process shifts to an online system (online/via zoom/gmeet). Students explicitly stated that learning Calculus feels more difficult when carried out online, which is an obstacle in understanding concepts.

#### B. Students' Perception of Online Learning Calculus

This descriptive research uses an online questionnaire to see the tendency of students' perception towards the implementation of online Calculus lectures. The results of the study show that students have a negative perception of online learning for Calculus courses. This negative perception is studied from three main aspects.

Table 1. Student perception in online Calculus learning

Aspects of Online Learning	Percentage of Negative Perception
Content	87%
Learning Interactions	75%
Learning Environment	40%

##### 1. Perception of the Content (87% Negative)

Based on the data above, it was found that most students as many as 87% have a negative perception of the Calculus material itself in the context of online learning. Although the majority of students have a positive perception of the presentation of teaching materials by lecturers, these interesting teaching materials are not able to change students' negative perceptions of Calculus materials. This negative perception is caused by various difficulties experienced by students when learning Calculus

##### 2. Perception of Learning Interactions (75% Negative)

Based on this data, it was found that the perception of learning interactions was realized. As many as 75% of students have negative perceptions related to learning interactions, especially regarding assignments. This happens because to solve Calculus problems, students feel the need for an understanding of various sample problems, whose implementation is not carried out optimally in online learning. Therefore, interactive learning is needed, involving two directions, so that students will be actively involved.

Based on the opinion above, there are students who state that online learning makes them more active and dare to interact such as question and answer sessions, but there are also students who have difficulty interacting with each other. Understanding the problem is needed by students in solving a problem. Because understanding a problem is the first step in solving a problem. This is supported by the opinion (Polya, 1945) in the stage of solving problems, namely "*understanding the problem* (understand the problem), *devising a plan* (drawing up a plan), *carrying out the plan* (carry out the plan), and *Looking back* (looking back at the results)". Each child or student has a different understanding, so learning interactions, whether in online learning such as using zoom meetings or video applications and google class rooms, do not experience the same problems.

In the process of solving problems, students are expected to be able to turn a complex problem into a small problem or be fragmented. This aims to make students better understand the material presented. This is supported by the opinion (Rich et al., 2019) which states "solving problems into smaller parts will make it easier to manage and solve them". This is also needed in the computational thinking process (*Computational Thinking/CT*). In line with research (Vee, 2013; Wolfram, 2016; Yes, 2019) which states that "*Computational Thinking* (CT) in the process takes complex problems and decomposes them so that they become simpler". The problems faced in calculus learning require this. Therefore, various views from both the lecturer and student sides are different.

##### C. Perception of the Learning Environment (40% Negative)

Based on this data, it was found that the perception of the learning environment was different. As many as 40% of students also have a negative perception of the learning environment during online learning of Calculus courses. This is because the learning environment supports the online learning process. Therefore, a learning environment that supports online learning is needed. So this leads to a lack of motivation and interest in learning. The learning process is also influenced by several factors. One of the factors regarding the high and low level of student understanding is motivation. This is supported by the opinion (Malay, Sihotang, et al., 2024) states "motivation is closely related to the student's emotions, interests, and needs".

##### C. Implications and Need for Face-to-Face

The overall findings show that students still think that the most effective learning process of Calculus is

face-to-face and getting a direct explanation from the lecturer. This corroborates that the difficulty of conceptual understanding of Calculus, which for students involves anxiety and *self-doubt*, requires a presence and direct interaction that is difficult to replicate online.

This negative perception is a serious challenge, considering that the lowest stage of thinking that students must have is to *recall*, while students are currently experiencing difficulties due to a lack of understanding that begins with low ability to remember previous learning. Based on the findings of this negative perception tendency, various actions can be taken to improve the quality of Calculus learning in the future.

#### IV. CONCLUSION

This descriptive research has succeeded in mapping the perception of Panca Budi University students' perception of the implementation of online Calculus lectures and produced several crucial conclusions that can be a foothold for improving the quality of learning in the future:

1. Negative Perception as a Pedagogical Contradiction: Overall, students show a tendency to negative perception towards the implementation of online learning for Calculus courses. Interestingly, although the majority of students (83%) positively assessed the way lecturers presented teaching materials, the interesting presentation effort was not able to change their negative perception of the complexity of the Calculus material itself. This underlines that the core of the difficulty lies in the essence of the substance of the material and the need for a deep conceptual understanding, not solely in the technique of its delivery.
2. Limitations of Interaction in Assignments: This difficulty is exacerbated by constraints in online learning interactions. As many as 75% of students gave a negative assessment of the assignment aspect. The main reason is that online learning is considered not optimal in facilitating understanding through various example problems, which is a crucial element to

master the solution of Calculus problems.

3. Face-to-Face Urgency for Affective Concepts: The findings clearly show that students still believe that the most effective learning process for Calculus is through face-to-face and direct explanations from lecturers. This negative perception reinforces that the conceptual understanding of Calculus—which is loaded with affective dimensions such as anxiety and *self-doubt*—requires direct interaction and physical presence that are difficult to replicate through online platforms.
4. Implications on Basic Cognitive Abilities: In addition to pedagogical factors, students' comprehension difficulties are also rooted in fundamental cognitive implications, namely their low ability to recall previous learning. This is a serious challenge, considering that *the ability to recall* is the most basic stage of thinking that must be mastered.

Follow-up Suggestions:

Based on the findings of this negative perception, it is suggested that actions to improve the quality of Calculus learning are recommended. Efforts can be focused on reintegrating more effective face-to-face methods, or if online is to be maintained, it is necessary to adapt the learning model that is able to create a more interactive, supportive, and adequate environment to facilitate in-depth problem-solving exercises.

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