

## **Analysis of Difficulties of Tadris Mathematics Students in Complex Analysis Course**

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### **ABSTRACT**

The Complex Analysis course is often a challenge for students of the Tadris Mathematics study program. This study aims to identify and analyze the difficulties experienced by students in understanding Complex Analysis material. The research method used is descriptive qualitative with data collection techniques in the form of tests and interviews. The research subjects were sixth semester students of Tadris Mathematics study program of UIN K.H. Abdurrahman Wahid Pekalongan who were taking Complex Analysis course. The results showed that students had difficulty in understanding the basic concepts of Complex Analysis. Factors that cause these difficulties include a lack of understanding of basic mathematical concepts, and a lack of ability to apply theorems.

The implication of this research is the need for the preparation of more effective learning strategies and the development of learning resources that can help students overcome difficulties in learning Complex Analysis courses. This research reveals some of the main obstacles faced by students in this course. These difficulties are mainly caused by the lack of understanding of basic concepts that form the basis of Complex Analysis, such as complex functions, derivatives, and integrals. In addition, students also show weaknesses in applying the theorems taught in problem-solving situations. Based on these findings, it is recommended that instructors and educational institutions design more interactive and adaptive teaching methods, such as using innovative educational technologies, providing a greater variety of practice problems, and connecting subject matter to real-world applications. This approach is expected to increase student understanding and improve the overall quality of learning in the Complex Analysis course.

**KEYWORDS:** *Complex Analysis, Difficulty Factors, Concept understanding, Interactive Learning*

## **INTRODUCTION**

Complex Analysis courses have an important role in the curriculum of the Tadris Mathematics program in various universities. Tadris Mathematics study program in various universities, including at UIN K.H. Abdurrahman Wahid Pekalongan. Complex Analysis is one of the core courses that provides students with a conceptual foundation and advanced mathematical skills. conceptual foundation and advanced mathematical skills to students, especially those interested in becoming mathematics educators at the secondary school level.

However, experience in teaching this course shows that some students face students face obstacles in mastering the basic concepts of Complex Analysis. The obstacles These obstacles make them less proficient in more complex material and in teaching this material in the future. teaching this material in the future. Therefore, an in-depth understanding of constraints is very important to facilitate the improvement of the quality of learning in the classroom.

This study aims to identify and describe the difficulties experienced by students in understanding Complex Analysis material. This research is needed in order to provide a more detailed understanding of the challenges faced by students in the learning process. students in the learning process, so that more effective learning strategies can be produced to help them overcome these difficulties. to help them overcome these difficulties.

By highlighting the factors that influence student difficulties, both in terms of basic mathematical concepts, the ability to apply theoretical in terms of basic mathematical concepts, the ability to apply theorems, as well as guidance support from lecturers, this research is needed in order to be able to from the lecturers, this research is needed in order to provide meaningful input for the curriculum and the development of learning resources that are relevant to the needs of Tadris Mathematics Tadris Mathematics students.

## **METHOD**

This research uses a descriptive qualitative approach to identify and analyze the difficulties experienced by Tadris Mathematics students in understanding Complex Analysis understanding Complex Analysis material. The qualitative approach was chosen because it allows researchers to gain an in-depth understanding of the students' experiences and perceptions of the course material, as well as the factors that influence the difficulties experienced by the students in students' experiences and perceptions of the course material, as well as the factors that influence the difficulties they face. they face.

The research subjects consisted of 8 sixth-semester students of the Tadris Mathematics study program who were taking the Complex Analysis course. The selection of sixth-semester sixth semester students was done because they already have a strong enough foundation in mathematics so that they can provide richer insight into the

difficulties they face. mathematics so that they can provide richer insights into the difficulties they experience. they experienced.

The data collection techniques used in this study were interviews and tests. test. Interviews were conducted with students individually or in small groups to get more in-depth information about their experiences in mathematics. to get more in-depth information about their experience in learning the learning Complex Analysis material and the difficulties they face. Tests were conducted by giving practice problems about the basic concepts of complex numbers.

Data obtained from interviews and tests are then analyzed qualitatively using a thematic approach. Relevant data will be categorized based on the main themes that emerge, such as difficulties in understanding basic concepts, obstacles in applying theorems, and factors that influence learning. This analysis is done to identify common patterns and look for relationships between various factors that influence students' difficulties in understanding Complex Analysis material.

Through this method, it is hoped that a more in-depth understanding can be obtained about the difficulties faced by TAD students. about the difficulties faced by Tadris Mathematics students in learning the Complex Analysis Complex Analysis course, so that relevant recommendations can be made to improve the quality of learning and the effectiveness of teaching this material. improve the quality of learning and the effectiveness of teaching this material in the future.

## RESULT AND DISCUSSION

This study took sources from eight sixth-semester students of the Mathematics Tadris Mathematics study program. Of the 8 samples studied, only 25% of students were able to answer the questions correctly, while 37.5% gave half-correct answers, and the rest gave half-correct answers. answer the questions correctly, while 37.5% gave half-correct answers, and Another 37.5% answered incorrectly. This indicates that there are difficulties in understanding of the concepts taught in the course.

### 3.1 Test Result

The test questions given to students are questions about the basic concepts of complex analysis. complex analysis. The test questions are:

$$\frac{2-5i}{3+4i} + \frac{3-4i}{25i}$$

#### 3.1.1 Students Who Answered The Question With The Correct Answer

$$\begin{aligned}
 & \textcircled{1} \quad \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{Penyelesaian:} \\
 & \frac{2-5i}{3+4i} + \frac{3-4i}{25i} = \frac{50i - 125i^2 + 9 + 12i - 12i - 16i^2}{75 + 100i} \\
 & = \frac{50i + 125 + 9 + 16}{75i - 100} \\
 & = \frac{50i + 150}{75i - 100} \\
 & = \frac{50(i+3)}{25(3i-4)} \\
 & = \frac{2i+6}{3i-4} \cdot \frac{3i+4}{3i+4} \\
 & = \frac{6i^2 + 8i + 18i + 24}{9i^2 + 12i - 12i - 16} \\
 & = \frac{-6 + 24i + 24}{-9 - 16} \\
 & = \frac{18 + 24i}{-25} \\
 & = -\frac{18}{25} - \left(\frac{24}{25}\right)i
 \end{aligned}$$

Figure 1. Correct answer

$$\begin{aligned}
 & 1. \quad \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{Jawab:} \\
 & = \frac{50i - 125i^2 + 9 + 12i + 12i - 16i^2}{75i + 100i^2} \\
 & = \frac{50i + 125 + 9 + 16}{75i - 100} \\
 & = \frac{50i + 150}{75i - 100} \\
 & = \frac{50(i+3)}{25(3i-4)} \\
 & = \frac{2i+6}{3i-4} \cdot \frac{3i+4}{3i+4} \\
 & = \frac{6i^2 + 8i + 18i + 24}{9i^2 + 12i - 12i - 16} \\
 & = \frac{-6 + 24i + 24}{-9 - 16} \\
 & = \frac{18 + 24i}{-25} \\
 & = -\frac{18}{25} - \left(\frac{24}{25}\right)i
 \end{aligned}$$

Figure 2. Correct answer

### 3.1.2 Students Who Answered The Question With A Half-Correct Answer

$$\begin{aligned}
 & \textcircled{1} \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{jawab:} \\
 & = \frac{50i - 125i^2 + 9 - 16i^2}{75i + 100i^2} \\
 & = \frac{50i + 125 + 9 + 16}{75i - 100} \\
 & = \frac{50i + 150}{75i - 100} \\
 & = \frac{250(i+3)}{25(3i-4)} \\
 & = \frac{2(i+3)}{3i-4} \\
 & = \frac{2i+6}{3i-4} //
 \end{aligned}$$

Figure 3. Half correct answer

$$\begin{aligned}
 & \textcircled{1} \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{jawab} \\
 & = \frac{50i - 125i^2 + 9 + 12i - 12i - 16i^2}{75i + 100i} \\
 & = \frac{50i + 125 + 9 + 16}{75i - 100} \\
 & = \frac{50i + 150}{75i - 100} \\
 & = \frac{250(i+3)}{25(3i-4)} \\
 & = \frac{2i+6}{3i-4} \cdot \frac{3i+4}{3i+4}
 \end{aligned}$$

Figure 4. Half correct answer

$$\begin{aligned}
 & \textcircled{1} \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{jwb.} \\
 & \frac{50i - 125i^2 + 9 + 12i - 12i - 16i^2}{75i + 100i^2} \\
 & \frac{50i + 125 + 9 + 16}{75i - 100} \\
 & \frac{50i + 150}{75i - 100} \\
 & \frac{250(i+3)}{25(3i-4)} \\
 & \frac{2i+6}{3i-4} \cdot \frac{3i+4}{3i+4} \\
 & \frac{6i^2 + 8i + 9i + 24}{9i^2 + 12i - 12i - 16} \\
 & \frac{-6 + 29i + 24}{-9 - 16} \\
 & \frac{18 + 29i}{-25}
 \end{aligned}$$

Figure 5. Half correct answer

### 3.1.3 Students Who Answered The Question With The Wrong Answer

$$\begin{aligned}
 & \textcircled{1} \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{jawab:} \\
 & \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & = \frac{(2-5i)(3-4i)}{(3+4i)(3-4i)} \\
 & = \frac{6-8i+10i-20}{9+12} \\
 & = \frac{-14+2i}{21} //
 \end{aligned}$$

Figure 6. Wrong answer

$$\begin{aligned}
 & \textcircled{1} \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{jawab:} \\
 & \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & = \frac{(2-5i)(3-4i)}{(3+4i)(3-4i)} \\
 & = \frac{6-8i+10i-20}{9+12} \\
 & = \frac{-14+2i}{21} //
 \end{aligned}$$

Figure 7. Wrong answer

$$\begin{aligned}
 & \textcircled{1} \quad \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & \text{Jawab:} \\
 & \frac{2-5i}{3+4i} + \frac{3-4i}{25i} \\
 & = \frac{2-5i}{3+4i} \cdot \frac{3-4i}{3-4i} + \frac{3-4i}{25i} \cdot \frac{-25i}{-25i} \\
 & = \frac{(2-5i)(3-4i)}{(3+4i)(3-4i)} + \frac{(3-4i)(-25i)}{(25i)(-25i)} \\
 & = \frac{6-8i+10i-20}{9+12} + \frac{-75+100}{625} \\
 & = \frac{-14+2i}{21} + \frac{-25+4}{625} \\
 & = \frac{-14+2i}{21} + \frac{-21}{625} \\
 & = \frac{-14-21+2i}{21}
 \end{aligned}$$

Figure 8. Wrong answer

### 3.2 Interview Result

The results of interviews with students revealed deeper difficulties. Students stated that they did not really understand the complex analysis material. Although the lecturer has explained the material well, when applied to problems, they often feel confused. Students often experience confusion when applying the concepts taught in problems. This shows that there is a gap between theoretical understanding of concepts and the ability to apply them in a practical context.

One factor that may cause such difficulties is the complexity of the complex analysis material itself. Concepts such as analytic functions, complex integrals, and residues can be difficult to understand for students who do not have a strong mathematical foundation. In addition, the lack of time given to understand the material can also be a contributing factor, especially if the material is delivered at too fast a pace.

The research also highlighted the importance of practice in improving students' understanding. Students need more practice in working on problems related to complex analysis so that they can deepen their understanding of the concepts. Regular practice can help students become more familiar with various problem situations and improve their skills in applying the mathematical concepts taught.

In addition to practice, cooperation between students can also be an effective solution. Through group discussions or joint studies, students can help each other solve problems and clarify concepts that are difficult to understand. The approach that has been taken not only improves the understanding of the material, but also strengthens students' communication and collaboration skills.

## **CONCLUSION**

Based on the results of this discussion, it is found that most students have difficulty in applying complex mathematical concepts in the context of the problem. This indicates the need for more attention in the delivery of material as well as a more holistic approach in supporting students' understanding of the material taught. The results also show the importance of the role of practice in improving student understanding. Students need more practice in working on various types of problems related to complex analysis so that they can deepen their understanding of the mathematical concepts taught.

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## **AUTHOR CONTRIBUTIONS**

The first author's contribution in the name of Isnaini Rosidah has been to search for some data for research and making abstractions. The second author, Dwi Widya Larasati, managed the data. The second author provided an overview and assisted in the preparation of this research report. The three authors worked together in making the research report.

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