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Analysis of Student Learning Outcomes on Polynomial Topic in Grade XI During the Teaching Assistance Program

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Abstract: This study aims to analyze students' learning outcomes on the polynomial topic during the Teaching Assistance Program conducted in Grade XI. As polynomials represent a foundational concept in upper secondary mathematics, understanding students' performance provides valuable insights into the effectiveness of instructional practices. This descriptive quantitative research analyzed daily assessment scores from 33 students using statistical measures including minimum, maximum, mean, median, mode, range, and standard deviation. The findings show a moderate performance with an average score of 67.7, a median of 70, and a standard deviation of 7.7. A total of 54.5% of students achieved the minimum mastery criterion, while 45.5% did not, indicating a substantial variation in conceptual understanding. The score distribution also demonstrated clustering around the 68–72 range, suggesting that many students possessed partial comprehension but struggled with deeper algebraic reasoning. These results highlight the need for differentiated instruction, scaffolded learning, and improved feedback mechanisms. The Teaching Assistance Program contributed significantly to the reflective development of teaching skills and provided authentic classroom experience for the pre-service teacher. Overall, this study emphasizes the importance of varied teaching approaches to enhance student mastery of polynomial concepts.

Keywords: Learning Outcomes, Polynomial Topic, Teaching Assistance Program.

Introduction

The Teaching Assistance Program provides university students with opportunities to gain authentic teaching experience while simultaneously supporting the improvement of learning quality in schools (Airlangga, 2025). Through direct involvement in classroom instruction, assessment, and reflection, pre-service teachers are expected to develop pedagogical competence and professional awareness. Within this context, evaluating students' learning outcomes becomes a crucial aspect, as it reflects both the effectiveness of instructional practices and the achievement of learning objectives.

Mathematics learning outcomes are shaped by multiple interrelated factors, including students' intrinsic motivation, instructional strategies, and individual learning characteristics (Fauzi et al, 2024) (Asriyanti & Janah, 2018). Prior research emphasizes that student-centered and interactive teaching approaches can increase engagement and foster a deeper understanding of mathematical concepts (Arifani & Suryanti, 2019). Furthermore,

affective factors such as self-confidence and problem-solving skills have been found to significantly correlate with students' mathematics achievement (Islamiah et al, 2018).

Among various mathematics topics, polynomial functions represent a fundamental component of secondary-level curricula and serve as a prerequisite for advanced topics such as functions, equations, and calculus. Despite their importance, many students experience difficulties in understanding polynomial concepts, particularly in symbolic manipulation and algebraic reasoning. These challenges are often associated not only with students' cognitive abilities but also with instructional limitations, including insufficient contextualization and limited formative feedback (Habibah, 2025).

Although numerous studies have examined factors influencing mathematics learning outcomes, there remains a research gap regarding the analysis of students' achievement within the context of teaching assistance programs. Specifically, limited attention has been given to how students' learning outcomes in polynomial topics reflect the effectiveness of instructional practices implemented by pre-service teachers during such programs. This gap indicates the need for contextualized research that links learning outcomes with teaching practice reflections.

Therefore, this study aims to analyze the learning outcomes of Grade XI-2 students on polynomial topics during the Teaching Assistance Program. The findings are expected to provide insights into students' conceptual understanding and common learning difficulties, while also serving as reflective input for improving teaching strategies. Practically, this research contributes to enhancing instructional quality in mathematics classrooms, and academically, it enriches the literature on mathematics education by highlighting the role of teaching assistance programs in supporting student learning outcomes.

Methodology

This study employed a descriptive quantitative approach to examine students' learning outcomes on the polynomial topic. The data were collected from daily assessment scores of Grade XI-2 students who participated in mathematics instruction during the Teaching Assistance Program. The assessment instrument was developed based on the applicable curriculum and learning objectives, ensuring that the scores reflected students' mastery of polynomial concepts. Using existing classroom assessment data allowed the study to capture authentic student performance in a real instructional setting.

Data analysis was conducted using descriptive statistical techniques, including mean, median, mode, minimum score, maximum score, range, and standard deviation. These statistical measures were used to describe the overall distribution and variability of students' learning outcomes. Manual data processing was carried out carefully to minimize calculation errors and ensure the accuracy of the results. Descriptive quantitative analysis is commonly applied in educational evaluation to identify learning patterns and achievement levels among students (Pertiwi, 2020).

To support the validity of the findings, the assessment data were aligned with predetermined learning indicators and administered uniformly to all students under the same instructional conditions. Reliability was ensured by using consistent scoring criteria

and standardized assessment procedures as applied by the subject teacher. The interpretation of the results focused on identifying trends in student achievement and learning difficulties rather than drawing causal conclusions, in line with the non-experimental nature of the study.

Furthermore, the Teaching Assistance Program emphasizes reflective evaluation as part of professional development for pre-service teachers (Airlangga, 2025). Therefore, the results of this analysis were interpreted as a basis for reflecting on instructional effectiveness and identifying areas for pedagogical improvement. The findings were also presented in the form of a score distribution graph to facilitate clearer interpretation and enhance understanding of students' learning outcomes.

Result and Discussion

Descriptive Statistics

The descriptive statistical analysis of the 33 students' scores revealed the following results:

Table 1. Summary of Descriptive Statistics

N	Mean	SD	Min	Max	Median
33	67.7	7.7	50	80	70

As shown in **Table 1 (Summary of Descriptive Statistics)**, the mean score of 67.7 indicates that the overall class performance was slightly below the minimum mastery criterion. The median score of 70 suggests that at least half of the students met the mastery standard, while the mode score of 71 reinforces that scores around this value were the most frequently obtained.

Mastery Classification

Based on the KKM (70), the mastery distribution is as follows:

- Mastery (≥70): 18 students (54.5%)
- Non-mastery (<70): 15 students (45.5%)

This result indicates a balanced distribution between students who mastered the material and those who did not. A significant proportion of students showed difficulty, suggesting the need for further instructional reinforcement.

Score Distribution

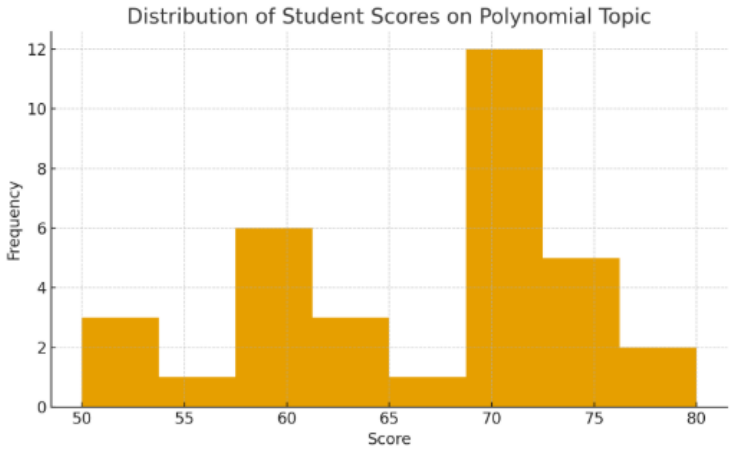

Figure 1. Distribution of Student Scores on The Polynomial Topic

As illustrated in **Figure 1 (Distribution of Student Scores on the Polynomial Topic)**, the histogram shows a clustering of student scores within the range of 68–72, indicating a moderate level of achievement among most students. However, the presence of scores between 50 and 60 suggests that some students still lack the foundational algebraic skills necessary for understanding polynomial expressions.

The effectiveness of classroom instruction is often tied to student motivation and interaction. Studies have shown that learning approaches which encourage student interaction and intrinsic motivation yield better mathematics learning outcomes (Fauzi et al., 2024). In the context of the Teaching Assistance Program, instructional pacing, media usage, and feedback strategies likely played a role in shaping these outcomes.

Pedagogical Implications

These findings imply the need for differentiated instruction, where remediation is provided for students who require reinforcement in algebraic basics, while enrichment is offered for higher-performing students. Such approaches align with the emphasis on creativity and learner engagement highlighted by contemporary educational research (Arifani & Suryanti, 2019).

Additionally, reflective teaching practices—such as analyzing student work, adjusting materials, and improving classroom strategies—are essential components of the teaching process, as supported by prior studies on teaching performance improvement (Habibah, 2025) (Jannah et al, 2019).

Conclusion

The analysis of learning outcomes on the polynomial topic among Grade XI-2 students indicates that overall achievement remains at a moderate level, with only 54.5% of students meeting the minimum mastery standard. This finding implies that a considerable proportion of students still experience difficulties in understanding fundamental algebraic concepts, particularly those related to symbolic manipulation and conceptual reasoning. Consequently, instructional practices need to be strengthened to better support students with lower foundational skills.

The results highlight the importance of implementing varied and student-centered instructional strategies, such as contextual learning, guided problem-solving, and formative feedback, to enhance students' engagement and conceptual understanding. From a practical perspective, teachers and pre-service teachers involved in the Teaching Assistance Program are encouraged to design learning activities that accommodate diverse student abilities and promote active participation. Reflective teaching practices, supported by continuous assessment, play a crucial role in identifying learning gaps and improving instructional effectiveness.

Furthermore, this study demonstrates that the Teaching Assistance Program not only contributes to the development of teaching competencies among pre-service teachers but also serves as a valuable platform for improving student learning outcomes. For future research, it is recommended to employ mixed-methods or experimental designs to explore the effectiveness of specific instructional interventions in polynomial learning. Additionally, further studies may examine affective factors such as motivation, self-confidence, and learning styles to provide a more comprehensive understanding of factors influencing students' mathematics achievement.

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