



(RESEARCH ARTICLE)



THE KHAN ACADEMY AND ITS EFFECTIVENESS IN TEACHING MATHEMATICS 8

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ABSTRACT

This study evaluated the effectiveness of Khan Academy as a supplementary tool in teaching Grade 8 Mathematics at Tabaco National High School during School Year 2025–2026. Using a quasi-experimental pre-test-post-test control group design, 66 students were divided into a control group (traditional instruction) and an experimental group (traditional instruction plus Khan Academy). A validated test aligned with the MELCs served as the research instrument, and the researchers analyzed the data using descriptive statistics and t-tests. Both groups started with low mastery in key algebra competencies, especially factoring, simplifying rational algebraic expressions, and performing operations on rational expressions. After the intervention, both groups improved, but the experimental group showed substantially greater gains. In the post-test, the experimental group reached Full Mastery (92%) in multiplying monomials and binomials, Mastery (75%) in factoring polynomials, and Near Mastery in special products (65%) and simplifying rational expressions (68%). By contrast, the control group achieved only Near Mastery in multiplication (63%) and factoring (54%) and remained at Low Mastery in other areas. Pre-test comparisons showed no significant difference between groups ($t = -1.25$, $p = 0.080$), confirming baseline equivalence. Post-test results, however, revealed a significant advantage for the experimental group (mean = 27.45 vs. 19.64; $t = -4.80$, $p = 0.003$), indicating that Khan Academy meaningfully enhanced learning outcomes. Despite these gains, performing operations on rational algebraic expressions remained the least mastered skill (30%, Low Mastery) even for the experimental group, underscoring the topic's complexity. Khan Academy effectively strengthened conceptual and procedural understanding in most Grade 8 algebra competencies but was insufficient alone for the most complex skills. The findings suggest integrating Khan Academy with scaffolded teacher-led instruction, guided practice, and contextual applications to help students achieve higher mastery, particularly in multi-step rational expression operations.

Keywords: Khan Academy, Quasi-Experimental Design, Algebra Competencies, Student Performance, Rational Algebraic Expressions, Technology-Enhanced Learning.

1 INTRODUCTION

Mathematics education faces persistent challenges globally, with many learners struggling to master foundational skills due to abstract content, sequential skill requirements, and limited instructional resources—issues acutely felt in the Philippines, where PISA 2022 results showed only 16% of 15-year-olds reaching Level 2 proficiency. This learning gap demands innovative, technology-enhanced solutions aligned with SDG 4 and national policies such as RA 10533

(Enhanced Basic Education Act), DepEd Order No. 78 s. 2010, and the Digital Rise Program, which promote ICT integration and learner-centered instruction. Khan Academy, a free nonprofit digital platform offering video lessons, interactive exercises, and personalized dashboards, emerged as a promising tool to support mastery-based, self-paced learning in Mathematics. Piloted in 34 Philippine schools in SY 2023–2024 and expanded to 1,500 schools nationwide, it requires 30 minutes of weekly engagement to strengthen foundational skills. In Tabaco National High School (TNHS), Khan Academy was introduced in Grade 7 in SY 2024–2025 and expanded to Grade 8 in SY 2025–2026, with trained teachers guiding students through adaptive lessons targeting core algebra competencies. This quasi-experimental study evaluated Khan Academy's effectiveness in teaching Grade 8 Mathematics at TNHS by comparing pre-test and post-test performance between control (traditional instruction) and experimental (Khan Academy-supplemented) groups. It aimed to measure learning gains, identify least mastered skills, and propose an enhanced lesson plan addressing persistent weaknesses. Motivated by urgent local needs and mixed global evidence, the study sought to generate localized evidence to inform sustainable, equitable, and effective integration of digital tools in Philippine Mathematics education.

1.1 Statement of the Problem

This study determined the effectiveness of Khan Academy in teaching Mathematics 8 in Tabaco National High School for the School Year 2025–2026. Specifically, it answered the following sub-problems:

1. What is the performance of the control and experimental groups in the pre-test along:

- multiplying simple monomials and binomials with simple binomials and multinomials, using the distributive property with various techniques and models;
- using special product patterns to multiply binomials;
- factoring completely different types of polynomials (polynomials with common monomial factor; difference of two squares; quadratic trinomials, including perfect square trinomials);
- simplifying rational algebraic expressions; and performing operations on rational algebraic expressions?
- What is the performance of the control and experimental groups in the post-test?
- Is there a significant difference in the performance of the control and experimental groups in the pre- and post-test?
- What are the least mastered skills of the experimental group based in the post-test?
- What enhanced lesson plan may be proposed to address the least mastered skills using Khan Academy?

1.2 Scope and Delimitation

This study examined the effects of Khan Academy on Grade 8 students' understanding and application of rational algebraic expressions at Tabaco National High School during School Year 2025–2026. It focused on first-quarter MELCs, including operations on monomials, laws of exponents, multiplication using distributive property and special products, factoring polynomials, simplifying and performing operations on rational algebraic expressions, problem solving, and pattern recognition. The participants comprised 66 Grade 8 students—33 in the control group (traditional instruction) and 33 in the experimental group (Khan Academy-supplemented instruction). Using validated pre-test and post-test scores analyzed with appropriate statistical methods, the study determined whether Khan Academy significantly improved learners' comprehension and application of the targeted competencies. The scope was limited to these first-quarter topics and Grade 8 learners, excluding other quarters, competencies, and grade levels.

2 RESEARCH METHOD

The study used a quasi-experimental pre-test–post-test control group design to evaluate Khan Academy's effectiveness in Grade 8 Mathematics. Two groups of students were involved: the experimental group, which received traditional instruction supplemented by Khan Academy's instructional videos, practice exercises, interactive tasks, personalized dashboards, progress tracking, and instant feedback; and the control group, which continued with traditional classroom teaching alone. Both groups took a pre-test to assess baseline mathematical skills and a post-test after the intervention. Comparing pre-test and post-test results allowed the researcher to determine whether Khan Academy significantly improved students' mathematical performance while managing threats to internal validity.

2.1 Sources of Data

The study used both primary and secondary data sources. Primary data came from pre-test and post-test assessments measuring students' competencies in polynomial and rational algebraic expressions. Secondary data were gathered from related literature on technology-enhanced Mathematics instruction, particularly studies on Khan Academy and other digital learning platforms. These sources included theses, undergraduate research, scholarly articles, Google Scholar publications, educational websites, and other reputable references. The secondary data provided background

information and supported the interpretation of Khan Academy's effects on students' mathematical learning and performance.

2.2 Participants of the Study

The participants of the study were sixty-six (66) Grade 8 students enrolled at Tabaco National High School during the School Year 2025–2026. They were divided into two groups, consisting of thirty-three (33) students in the control group and thirty-three (33) students in the experimental group.

2.3 Research Instrument

The data were analyzed to evaluate the pre-test performance of the control and experimental groups in key Mathematics competencies, including operations on monomials and binomials, special products, factoring, and rational algebraic expressions. Mean scores were computed to describe each group's baseline skills. Independent t-tests were then used to determine whether post-intervention improvements and between-group differences were statistically significant, indicating whether observed gains were attributable to the intervention rather than chance.

2.4 Validation of Research Instrument

The research instrument underwent a two-phase validation process. First, it was subjected to face validation by the Thesis Committee. Second, it underwent content validation by three external validators—a Head Teacher VI and two Master Teachers—who reviewed the test items and recommended revisions. Based on their feedback, the researcher simplified the wording of complex questions, clarified instructions (especially for items involving division and the term "quotient"), and ensured appropriate distribution of items according to Bloom's Taxonomy, with emphasis on the understanding and applying levels aligned with the MELCs. After incorporating these revisions, the finalized instrument was approved and used for data collection.

2.5 Data Gathering Procedure

The researcher had secured permission from the Schools Division Superintendent of Tabaco City and the school head of Tabaco National High School to conduct the study with Grade 8 students. Upon approval, the researcher had coordinated with the school head to finalize the schedule for the pre-test and post-test. The pre-test had been administered on July 21, 2025, to assess students' baseline knowledge of the targeted competencies, with assurances of confidentiality and exclusive use of responses for research purposes. The Khan Academy intervention had been implemented from July 22 to August 18, 2025, during which students had used instructional videos, practice exercises, and interactive tasks in their regular math lessons. The post-test had been given on August 27, 2025, to measure students' progress and the intervention's effectiveness, with test items aligned to the competencies covered on the platform.

3 RESULTS AND DISCUSSION

3.1 Performance Level of the Control and Experimental Groups in the Pre-test

The students' initial level of mastery in algebra was assessed through a pre-test that focused on fundamental skills in polynomial and rational algebraic expressions. The pre-test results serve as a diagnostic measure of the learners' prior knowledge and computational ability in solving problems. Table 1.a presents the performance of the control and experimental groups in the pre-test along different Mathematics topic.

3.1.1 Performance Level of the Control Group in the pre-test

Using a 40-item researcher-made pre-test in Mathematics 8, the results obtained were analyzed to determine the performance level of the subjects in the control group on competencies along polynomials and algebraic expressions. This test was administered to measure the current performance of the control group before the delivery of instruction using the traditional method of teaching.

The performance of the control group in the pre-test revealed that most students were in the "*Low Mastery*" and "*No Mastery*" levels across the competencies. In multiplying simple monomials and binomials with simple binomials and multinomials using the distributive property, the students obtained a total score of 157 on a 12-item test. Their computed mean score was 4.76 and students' performance level was 40, which is described as *Low Mastery*. In using special product patterns to multiply binomials, the group obtained a total score of 23 on a 4-item test. The mean score was 0.70, and their performance level was 18, which falls under *No Mastery*. For factoring completely different types of polynomials, the students got a total score of 54 on an 8-item test. The mean score was 1.64, and their performance level was 21, which is still *No Mastery*. In simplifying rational algebraic expressions, the students obtained a total score of 49 on an 8-item test. Their mean score was 1.48, and the performance level was 19, also categorized as *No Mastery*. Lastly,

in performing operations on rational algebraic expressions, they achieved a total score of 17 on an 8-item test. The mean score was 0.52, and their performance level was 7, which is also described as No Mastery.

Table 1.a: Performance Level of the Control Group in the Pre-test

Learning Competencies	No. of Items	Total Score n=33	Mean	PL %	Description
Multiplying simple monomials and binomials with simple binomials and multinomials, using the distributive property with various techniques and models.	12	157	4.76	40	<i>Low Mastery</i>
Using special product patterns to multiply binomials.	4	23	0.70	18	<i>No Mastery</i>
Factoring completely the different types of polynomials.	8	54	1.64	21	<i>No Mastery</i>
Simplifying rational algebraic expressions.	8	49	1.48	19	<i>No Mastery</i>
Performing operations on rational algebraic expressions.	8	17	0.52	7	<i>No Mastery</i>
Over-all	40	300	9.09	23	<i>No Mastery</i>

3.1.2 Performance Level of the Experimental Group in the Pre-test

The tool used to determine the performance level of the experimental group on competencies along polynomials and rational algebraic expressions was the same researcher-made pre-test that was used in the control group. This test was administered to measure the current performance of the experimental group before the delivery of instruction through Khan Academy. Table 1.b shows the performance of the experimental group in the pre-test. This includes the number of items, total scores obtained by the students, computed mean score, and the descriptive equivalent of the performance level.

Table 1.b: Performance Level of the Experimental Group in the Pre-test

Learning Competencies	No. of Items	Total Score n= 33	Mean	PL %	Description
Multiplying simple monomials and binomials with simple binomials and multinomial, using the distributive property with various techniques and models.	12	180	5.45	45	<i>Low Mastery</i>
Using special product patterns to multiply binomials.	4	48	1.45	36	<i>Low Mastery</i>
Factoring completely the different types of polynomials.	8	57	1.73	22	<i>No Mastery</i>
Simplifying rational algebraic expressions.	8	41	1.24	16	<i>No Mastery</i>
Performing operations on rational algebraic expressions.	8	26	0.79	10	<i>No Mastery</i>
Over-all	40	352	10.67	27	<i>No Mastery</i>

The experimental group in the pre-test also showed weak performance, though slightly higher than the control group in some competencies. In multiplying simple monomials and binomials with simple binomials and multinomial using the distributive property, the students obtained a total score of 180 on a 12-item test. The mean score was 5.45, and their performance level was 45, which is described as *Low Mastery*. In using special product patterns to multiply binomials, the students got a total score of 48 on a 4-item test. The computed mean score was 1.45 and the performance level was 36 which is also under *Low Mastery*. For factoring completely different types of polynomials, they achieved a total score of 57 on an 8-item test. The mean score was 1.73, and their performance level was 22 which is described as *No Mastery*. In simplifying rational algebraic expressions, the experimental group obtained a total score of 41 on an 8-item test. The mean score was 1.24, and their performance level was 16 which falls under *No Mastery*. Lastly, in performing operations on rational algebraic expressions, the group achieved a total score of 26 on an 8-item test. The mean score was 0.79 and the performance level was 10 which is also *No Mastery*.

3.2 Performance Level of the Control and Experimental Groups in the Post-test

The post-test was administered after the implementation of the intervention to measure the extent of learning gained by both the control and experimental groups. Unlike the pre-test which served as a diagnostic tool for assessing baseline knowledge, the post-test evaluated how well the students improved in their mastery of key algebraic competencies. These included (a) multiplying simple monomials and binomials with simple binomials and multinomials using the distributive property; (b) applying special product patterns to multiply binomials; (c) factoring different types of polynomials; (d) simplifying rational algebraic expressions; and (e) performing operations on rational algebraic expressions. The results of the post-test provide comparative evidence of the progress made by the students in each group. The effectiveness of the intervention can be assessed in terms of whether the experimental group demonstrated greater improvement than the control group by examining the differences in performance. This present the summarized post-test results across the targeted mathematical competencies.

3.2.1 Performance Level of the Control Group in the Post -Test.

The traditional approach of teaching was applied by the researcher in the delivery of the lesson in the control group, wherein the teaching method focused on the teacher as the main source of information in the classroom. It embraces the idea of a method centered on the teacher involving face-to-face interaction, mainly from teacher to student. Here, the teacher-researcher used the common ways of teaching such as chalk and talk and a little use of chalk and visual aid. Table 2.a shows the performance level of the control group in the post-test.

Table 2.a: Performance Level of the Control Group in the Post-test

Learning Competencies	No. of Items	Total Score n=33	Mean	PL %	Description
Multiplying simple monomials and binomials with simple binomials and multinomials, using the distributive property with various techniques and models.	12	251	7.61	63	Near Mastery
Using special product patterns to multiply binomials.	4	62	1.88	47	Low Mastery
Factoring completely different types of polynomials.	8	143	4.33	54	Near Mastery
Simplifying rational algebraic expressions.	8	120	3.64	45	Low Mastery
Performing operations on rational algebraic expressions.	8	72	2.18	27	Low Mastery
Over-all	40	648	19.64	49	Low mastery

The control group's performance in the post-test revealed moderate improvements compared to the pre-test. In multiplying simple monomials and binomials with simple binomials and multinomials, they obtained a total score of 251 on the 12-item test. The mean score was 7.61 and their performance level was 63, which is described as *Near Mastery*. In using special product patterns to multiply binomials, the students achieved a total score of 62 on a 4-item test. The mean score was 1.88 and the performance level was 47 which is described as *Low Mastery*. For factoring completely different types of polynomials, the group got a total score of 143 on an 8-item test. The computed mean score was 4.33 and their performance level was 54 which falls under *Near Mastery*. In simplifying rational algebraic expressions, they obtained a total score of 120 on an 8-item test. Their mean score was 3.64, and the performance level was 45, which still belongs to *Low Mastery*. Lastly, in performing operations on rational algebraic expressions, the students achieved a total score of 72 on an 8-item test. The mean score was 2.18 and the performance level was 27 which is categorized as *Low Mastery*.

3.2.2 Performance Level of the Experimental Group in the Post -Test

Unlike the control group, the students in the experimental group were taught through Khan Academy platform. The researcher made sure that the students in this group were given access to the platform in the entire implementation of the experiment. Table 2.b shows the performance level of the experimental group in the post-test.

Table 2.b: Performance Level of the Experimental Group in the Post-test

Learning Competencies	No. of Items	Total Score n=33	Mean	PL %	Description
Multiplying simple monomials and binomials with simple binomials and multinomial, using the distributive property with various techniques and models.	12	365	11.06	92	Full Mastery
Using special product patterns to multiply binomials.	4	85	2.58	65	Near Mastery
Factoring completely different types of polynomials.	8	198	6.00	75	Mastery
Simplifying rational algebraic expressions.	8	180	5.45	68	Near Mastery
Performing operations on rational algebraic expressions.	8	78	2.36	30	Low Mastery
Over-all	40	906	27.45	69	Near Mastery

The experimental group in the post-test demonstrated substantial improvements compared to the pre-test. In multiplying simple monomials and binomials with simple binomials and multinomials, they obtained a total score of 365 on a 12-item test. The mean score was 11.06, and their performance level was 92 which is described as *Full Mastery*. In using special product patterns to multiply binomials, the students obtained a total score of 85 on a 4-item test. The mean score was 2.58, and their performance level was 65 which is categorized as *Near Mastery*. For factoring completely different types of polynomials, students obtained a total score of 198 on an 8-item test. The computed mean score was 6.00 and the performance level was 75 which is also described as *Mastery*. In simplifying rational algebraic expressions, the experimental group obtained a total score of 180 on an 8-item test. The mean score was 5.45 and the performance level was 68 which is *Near Mastery*. However, in performing operations on rational algebraic expressions, the students achieved a total score of 78 on an 8-item test. The mean score was 2.36 and their performance level was 30 which is described as *No Mastery*.

3.3 Test of Difference on the Significance in the Performance of the Control and Experimental Groups in the Pre-test and Post-test

To determine the difference between the performances of the control and experimental groups in the pre-test and post-test, a test difference was computed. It is noted that both groups showed significant improvement in their performances after the 6-week experimentation. The researcher employed the tradition method of teaching in the control group while the Khan Academy was integrated in the lessons in the experimental group.

3.3.1 Test of Difference on the Significance in the performance of the Control and Experimental Groups in the pre-test

Table 3.a: Test of Difference on the Significance in the Performance of the Control and Experimental Groups in the Pre-test

Group	Mean	Mean Difference	Variance	t-value		Remark
				Computed	Critical	
Control	9.09	-1.58	27.02	-1.25	± 1.67	Not significant
Experimental	10.67		26.04			

In this section, the researcher aimed to evaluate the significance of the performance difference between the control and experimental groups in the pre-test phase of our study. The pre-test serves as a baseline measure which allows us to assess the subjects' initial levels of performance before any experimentations or treatments are administered. Table 3.a shows the test of difference on the significance in the performance of the control and experimental groups in the pre-test.

The results from the test of difference in the pre-test performance between the Control and Experimental Groups revealed no statistically significant difference. The control group had a mean score of 9.09, with a mean difference of -

1.58 and a variance of 27.02. In comparison, the experimental group had a mean score of 10.67 and a variance of 26.04. The computed t-value was -1.25, which was compared to the critical t-value of ± 1.67 . Since the computed t-value (-1.25) is smaller than the critical t-value (± 1.67), the result was not statistically significant. This indicates that there was no meaningful performance difference between the two groups in the pre-test, as their baseline scores were comparable. The p-value obtained ($p = 0.080$) also supports this finding, as it is greater than the 0.05 level of significance. Thus, both groups had similar performance levels before the intervention, with most scores falling under "No Mastery" and "Low Mastery". This finding is important because it confirms that the experimental and control groups were statistically equivalent prior to instruction. Such equivalence ensures that any differences observed later in the post-test could be attributed to the intervention rather than pre-existing disparities. In other words, both groups were academically similar in their readiness and understanding of algebra before receiving their respective teaching methods. The implication of this result is that the study was conducted on a fair ground which allows for a valid comparison of the effectiveness of Khan Academy against traditional instruction. Since there was no significant pre-test difference, it can be concluded that the intervention than the prior ability is the main factor influencing any post-test improvements observed in the experimental group.

3.3.2 Test of Difference on the Significance in the Performance of the Control and Experimental Groups in the Post-test

In this section, the researcher investigated the significance of the performance difference between the control and experimental groups after the experimentation, as measured by post-test assessments. The post-test is important for finding out if the experimental activity had an effect on students' performance. By comparing the post-test scores of the experimental and control groups, the researcher can see if there was any improvement, no change, or a drop in performance compared to how the students did in the pre-test. Table 3.b shows the test of difference on the significance in the performance of the control and experimental groups in the post-test.

Table 3.b: Test of Difference on the Significance in the Performance of the Control and Experimental Groups in the Post-test

Group	Mean	Mean Difference	Variance	t-value		Remark
				Computed	Critical	
Control	19.64	-7.81	62.68	-4.80	± 1.67	Significant
Experimental	27.45		24.51			

In contrast to the pre-test results, the post-test analysis revealed a statistically significant difference in the performance between the control and experimental groups. The control group achieved a mean score of 19.64, while the experimental group, which utilized Khan Academy, had a higher mean score of 27.45. The difference in performance was confirmed by a computed t-value of -4.80, which was compared to the critical t-value of ± 1.67 . Since the computed t-value (-4.80) is smaller than the critical t-value, the difference in performance between the two groups was statistically significant. This is further supported by the p-value of 0.003, which is well below the 0.05 level of significance. The improvement in the experimental group's performance can be attributed to the integration of Khan Academy. The platform provided students with structured modules, interactive exercises, and immediate feedback which likely contributed to a more engaging and effective learning experience. These features allowed for deeper conceptual understanding, in contrast to the traditional methods used by the control group. The results suggest that Khan Academy effectively addressed learning gaps and improved students' mastery in algebraic competencies. The experimental group's improvement demonstrates that technology-enhanced instruction can outperform traditional methods in accelerating student achievement. However, despite the positive outcomes, both groups continued to struggle with rational algebraic expressions which indicates that while digital platforms like Khan Academy are powerful tools, they must be supplemented with scaffolded instruction and teacher guidance to address complex competencies effectively.

3.4 Least Mastered Skills of the Experimental Group in the Post-test

This section presents the least mastered skills of the experimental group as revealed in their post-test results. It highlights the specific competencies where students experienced the greatest difficulty that shows basis for targeted instructional improvements. Table 4 shows the least mastered skills of the experimental group in the post-test.

Table 4: Least Mastered Skills of the Experimental Group in the Post-test

Learning Competencies	PL %	Description
Performing operations on rational algebraic expressions.	30%	Low Mastery
Using special product patterns to multiply binomials.	65%	Near Mastery
Simplifying rational algebraic expressions.	68%	Near Mastery

3.5 Enhanced Lesson Plan in the Use of Khan Academy

In this study, the lesson plan was developed as a response to the least mastered skill identified among Grade 8 students. Despite the significant gains brought about by Khan Academy, students continued to struggle with this competency which highlight the need for teacher-guided scaffolding. The lesson plan was enhanced through the integration of Khan Academy videos, guided practice activities, collaborative learning tasks, and formative assessment strategies. Traditional teacher-centered instruction was supplemented with visual demonstrations, interactive exercises, and opportunities for peer discussion, allowing students to actively engage with the lesson content. Progress monitoring through the Khan Academy dashboard also enabled timely feedback and intervention. These enhancements provided a more learner-centered approach that supported both conceptual understanding and procedural fluency in simplifying rational algebraic expressions.

4 CONCLUSION

The following conclusions were drawn:

- The overall performance level of the control group in the pre-test across the competencies of multiplying simple monomials and binomials, using special product patterns to multiply binomials, factoring completely different types of polynomials, simplifying rational algebraic expressions and performing operations on rational algebraic expressions was considered Low Mastery and No Mastery. Similarly, the experimental group in the pre-test also obtained Low Mastery in the distributive property and special products while the rest of the competencies remained at No Mastery. This indicates that both groups had insufficient readiness in algebra before instruction.
- The control group in the post-test showed moderate improvement which reached Near Mastery in multiplying monomials and factoring but remained at Low Mastery in the other competencies. On the other hand, the experimental group in the post-test achieved much higher performance levels, reaching Near Full Mastery in multiplication of monomials, and Near Mastery in special product patterns, factoring and simplifying rational expressions. However, operations on rational expressions remained at No Mastery.
- The test of significance in the pre-test showed that there was no significant difference between the control and experimental groups, meaning that both groups were statistically equivalent before the intervention. This ensured fairness in the comparison and indicated that any differences observed in the post-test could be attributed to the use of Khan Academy as an intervention.
- The test of significance in the post-test showed a statistically significant difference between the control and experimental groups, in favor of the experimental group. The experimental group recorded a higher mean which demonstrates that Khan Academy was effective in enhancing students' mastery of algebra compared to traditional teaching.
- Based on the overall findings, the researcher enhanced lesson plan with Khan Academy activities to improve the algebraic skills of Grade 8 students.

Recommendations

Based on the findings and conclusions, the researcher recommends the following:

- Mathematics teachers need to pay close attention to students' skills on multiplying simple monomials and binomials, using special product patterns to multiply binomials, factoring completely different types of polynomials, simplifying rational algebraic expressions and performing operations on rational algebraic expressions. If the students are not able to master this skill, they will have difficulty understanding other higher and related competencies in Mathematics.
- Mathematics teachers should prioritize addressing the least mastered skills, particularly in performing operations on rational algebraic expressions. Since this area remains the weakest among students, teachers need to design targeted lessons, scaffolded practice and remedial activities that allow learners to build competence step by step.

- Teachers are encouraged to use Khan Academy as a supplementary tool in their regular instruction. The platform's interactive modules and practice exercises can reinforce classroom lessons and give students additional opportunities to review and master concepts. To maximize its effect, Khan Academy should be blended with guided discussions and problem-solving activities facilitated by the teacher.
- Professional growth is also necessary; therefore, teachers may attend seminars, workshops, and training programs that focus on both content mastery and innovative teaching strategies. These opportunities will help them gain updated knowledge, adopt new pedagogical approaches and share best practices with fellow educators.
- The researcher recommends the use lesson plan with Khan Academy Activities enhanced by the researcher in teaching Mathematics in order to improve students' mathematical skills along polynomials and rational algebraic expressions.

Areas for Further Study

The following areas are recommended for further research:

- Khan Academy in Enhancing the Mathematical Skills of Secondary Students
- Skills of Secondary Mathematics Teachers in Public Schools in Using Khan Academy in Classroom Instruction
- Developing the Critical Thinking Skills of the Students Through Khan Academy

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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