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Enhancing Learning Outcomes: A Structure of Observed Learning Outcomes (SOLO) Taxonomy-Based Assessment Approach in Mathematics 7 in a Tri-People Dominated High School

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Abstract
Aim: Global perspectives on educational assessment were evolving due to modern ideas about the purpose and substance of education: new forms and technologies were being introduced and the purposes and functions of assessment were being enlarged. This study sought how a Structure of Observed Learning Outcomes (SOLO) Taxonomy-based assessment approach affected the learning outcomes of Grade 7 students that comprises Teduray, Muslims and Christians.
Methodology: Students were separated into two groups using a descriptive, comparative, and correlational design: the experimental group (SOLO Taxonomy-Based assessment) and the control group (Bloom's Taxonomy). The lottery method was used to pick students at random. Data were collected using the two-group pretest-posttest design, and statistical methods such as the mean, standard deviation, percentage, and analysis of covariance were used for analysis.
Results: Results indicated high validity and student acceptability of the developed SOLO Taxonomy-based assessment tool. While both groups showed learning gains, the experimental group demonstrated significantly greater improvement in mathematics performance compared to the control group. Although user satisfaction and acceptability were important for the successful implementation of educational tools, they do not necessarily translate into better academic outcomes.
Conclusion: The assessment tool's outstanding qualities were determined to be a significant and successful intervention in raising students' learning performance. Therefore, it is advised that it be incorporated into the teaching process in the classroom.
Keywords: *SOLO Taxonomy-Based Assessment, Learning Outcomes, Tri-People, Descriptive Correlational, Assessment*

INTRODUCTION

Enhancing critical or higher-order thinking abilities was among the primary objectives of basic and higher education, and educators are now vital in supporting these skills are learned by students. Learning curve assessments for students were in different shapes. The main reason teachers give tests in the classroom is to collect data about the academic performance of their students. To evaluate learning, every subject or class has specific goals and objectives set by educators, who measure the degree of occurrence of these anticipated outcomes, and determine how many things were learned. One of the most esteemed techniques for assessing was the use of written tests to assess students' critical thinking abilities in the classroom evaluations.

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Stiggins (1988) found that teachers who have poorly designed the test paper have domination toward the question related to recalling facts and information. Even while educational goals and exercises could aid in the development of thinking abilities, assessments in the classroom frequently fall short of these goals. Therefore, the inadequate evaluation that does not recognize and stimulate higher-order thinking skills will prevent those skills from developing. Evaluation was not just for students, but also for teachers. Thus, educators were supposed to exhibit a certain level of proficiency in student assessment. Most of the test questions were created by teachers simply by copying the questions from the back of textbooks without considering their intended use using the evaluation's findings. Various methods of assessment exist, and these have to match for the purpose, and it has to be done with set criteria for quality. Thus, among the structures that provide the SOLO Taxonomy is a set of principles for quality assessment.

The Structure of Observed Learning Outcome Model (most times referred to as 'SOLO' Model), is a model developed by Bigg and Collis (1982) to look at how students' metacognition develops over time. It acts as a roadmap in understanding how students think as it identifies five levels, each building on the last, that show complexity in student responses. These levels are categorized on its complexity, from the basic (pre-structural), to the most advanced (extended abstract) (Biggs & Collis, 1982). Contrary to other methods that check only memory recall, SOLO model gives emphasis on intellectual skills students use to learn in a class, especially in mathematics. In its essence, teachers can use the SOLO taxonomy to ascertain intended learning outcomes, appropriate instructional methodologies, and develop ways to measure how the learning outcomes have been achieved (Al Maani & Shanti, 2023; Banda et al., 2023; Egodawatte, 2023; Karanja & Malone, 2021; Muhayimana et al., 2022).

In the Philippine context of education, Philippines is among one of the top bottom countries when it comes to higher-order thinking skills (HOTS) in Reading, Mathematics, and Science. The poor performance in the latest participation in Program for International Student Assessment (PISA) ranking turns out that areas where students struggle might be linked to lack of teachers' trainings in developing teachers' skills and knowledge in the field of teaching ("Teacher Development Needs Study (TDNS): Findings and Recommendations," 2017). Moreover, the low scores attained by Filipino students point to a clear need – to provide more training programs for teachers. These trainings help teachers focus on higher-order thinking skills for students instead of simple memory recall. To support the reform effort in uplifting the current ranking status, the National Educators Academy of the Philippines (NEAP) and the Research Center for Teacher Quality (RCTQ) have joined forces to create a training program – the Higher Order Thinking Skills (HOTS) Professional Learning Packages (PLPs). The HOTS-PLPs are being anchored to SOLO taxonomy as it offers crucial teaching and learning concepts that teachers can effectively guide students in comprehending basic concepts to a more complex thinking (TDNS, 2017).

However, it appears that there are differences in the availability of HOTS-PLPs for math teachers in the province of Maguindanao del Sur particularly in processing students' learning results, there seems to be a research study gap. As such, the study aimed to determine students' learning performance in Mathematics 7 using a SOLO Taxonomy-Based Assessment Tool.

Objectives

This study aimed to determine students' learning outcomes using a SOLO Taxonomy-Based Assessment approach in Mathematics Grade 7 at Tri-People Dominated High School, Maguindanao del Sur.

Specifically, it sought to answer the following questions:

1. What is the extent of validity and evaluation of the SOLO Taxonomy-Based Assessment in terms of:
   1.1 content
   1.2 relevance
   1.3 instructional quality, and
   1.4 acceptability
2. What is the level of learning performance of the Grade 7 students in Mathematics 7 before and after the SOLO Taxonomy-Based Assessment is integrated in the experimental group?
3. What is the level of learning performance of the Grade 7 students in Mathematics 7 Pretest and Posttest by the control group?
4. Is there a significant difference between the learning performance of the Grade 7 students Pretest and Posttest in the experimental and control group?
5. What is the level of acceptability of the developed SOLO Taxonomy-Based Assessment Tool in enhancing Grade 7 students' learning performance in Mathematics 7?

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6. Is there a significant relationship between the level of performance and perceived level of acceptability of the SOLO Taxonomy-Based Tool?

Hypotheses

In this study, the following hypotheses were examined at the 0.05 level of significance, and it is directed by null hypotheses like:

Hypothesis 1: There is no significant difference between learning performance of the Grade 7 students in the experimental and control group on pretest.

Hypothesis 2: There is no significant difference between learning performance of the Grade 7 students in the experimental and control group on post test.

Hypothesis 3: There is no significant relationship between student's learning performance and level of acceptability of SOLO Taxonomy-Based Tool.

Theoretical Framework

In its pursuit of attaining its aim, this study aligned with the Pedagogical Content Knowledge (PCK) Framework, which was introduced by Shulman in 1986. The PCK Framework was defined as the concoction of content and pedagogy, typically discussing the 'what' and 'how' in the field of teaching (Shing et al., 2015). In the early 1950s, the PCK Framework was not even new, as both content and pedagogy were alike—content referred to what was known, while pedagogy pertained to the 'how' of teaching.

The incorporation of the PCK Framework in this study allowed it to go beyond simply measuring content knowledge and general teaching skills (Makonye, 2020). It imparted insights into specific knowledge and made use of its abilities in contributing to effective mathematics instruction in Maguindanao del Sur.

Based on Imran and Akhtar (2023), the use of the (Theory of Planned Behavior) TPB Framework shed light on the factors that influenced mathematics teachers in Maguindanao del Sur regarding their actions and decisions related to the implementation of the SOLO taxonomy in the mathematics curriculum. By delving into mathematics teachers' attitudes, this study helped determine aspects of the curriculum that teachers found useful or not for students. Furthermore, it helped identify factors that influenced the willingness and decision-making of mathematics teachers in implementing the curriculum, including school heads, colleagues, and other stakeholders. (Agravante, et al., 2023).

As the TPB served as a roadmap for the study, it led to a more targeted strategy for improving mathematics education in Maguindanao del Sur.

Conceptual Framework

This study determined students' learning performance in using the SOLO Taxonomy-Based Assessment Tool. The independent variable was the SOLO Taxonomy-Based Assessment Approach in Mathematics 7. On the other hand, the dependent variable was the students' learning outcomes.

METHODS

Research Design

The descriptive, comparative and correlational research design was used in this study to assess how well students learned mathematics in grade 7 using the SOLO Taxonomy-Based Assessment Tool. According to Infante (2022), this approach aligns with the purpose of descriptive-comparative research, which is used to compare and contrast representative samples from two or more groups concerning designated variables under natural conditions. for analysis. On the other hand, correlational research design predicted and explained the differences between and among variables. Creswell (2012) stated that correlational research design used statistical tests to assess the strength and direction of the relationship between two or more variables. It did not determine cause and effect but rather identified how the variables might be linked. In general, descriptive, comparative and correlational research design measured the extent to which relationships occurred between and among variables. In this study, the enhancement of students' learning outcomes using the SOLO Taxonomy-Based Assessment Tool in teaching Grade 7 Mathematics and their differences were assessed as well.

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Population and Sampling

In this study, the ninety (90) Grade 7 students of Tri-People Dominated National High School in Maguindanao del Sur were the main participants. Out of the entire sample, 45 individuals were chosen at random using lottery method and designated as the experimental group, while the remaining 45 individuals were immediately designated as the control group.

Instrument

A researcher-made SOLO Taxonomy-Based Assessment Tool was used in the testing phase of the study. Students' learning performance in Mathematics 7 was assessed utilizing the pretest and posttest in exact accordance with Dep-Ed Order No. 8, series of 2015. Using a modified rating scale and questionnaire Likert (1932), the researcher evaluated the SOLO Taxonomy-Based Assessment Tool's degree of student acceptability.

Data Collection

In administering the instrument to the respondents, the researcher used a researcher-made instrument (SOLO Taxonomy-Based Assessment Tool) to determine students' learning outcomes in teaching Mathematics 7. The respondents, comprising ninety (90) officially enrolled Grade 7 students, were oriented beforehand on the study, including its purpose, process and activities, pretest and posttest, rubrics for scoring, schedule of sessions, and duration. The respondents were then randomly selected and assigned to the experimental and control groups through a lottery method.

Before the period of experimentation, a pretest was administered to both groups. After the test, the control group continued with the conventional practice, while the intervention was introduced to the experimental group, marking the start of the experimentation.

After the entire duration of the experimentation, the posttest was administered to both groups using the same material as in the pretest.

In assessing the respondents' output during the pretest and posttest, the researcher used standardized scoring rubrics adapted and modified from DepEd Order no.8 series of 2015, was used to evaluate the scores. The results were gathered and tabulated for a logical presentation of the data.

After conducting the study for the second quarter, the students' output was consolidated and underwent statistical analysis for interpretation.

The results were gathered and tabulated for logical presentation. With the aid of computers, the mean of the respondents' scores was electronically computed. The results were interpreted and discussed by the researcher.

Treatment of Data

A number of statistical measurements and procedures were applied to the data in order to help the researcher present, analyze, and understand the information that was gathered. This involved figuring out the learners' profile and calculating the difference between the respondents' pre- and post-assessment test scores using frequency, percentage, mean, mean gain score, and standard deviation.

A dependent samples Z-test was used to see if there were any significant differences between the groups' scores before and after using the SOLO Taxonomy-Based Assessment Tool. Additionally, Analysis of Co-Variance (ANCOVA) was used to evaluate the relationship between learning performance and students' perceptions of the SOLO Taxonomy-Based Assessment Tool's acceptability. Every inferential statistic was examined at the five percent (5%) significance level means that if the probability of occurrence of the sample under the null hypothesis is less than or equal to this, then the sample does not support the null hypothesis and this can be rejected. In relevance to the study, the two tailed test was used since the hypothesis does not specify a directional difference for the parameter of interest (Basilio, et.al. 2003).

Ethical Considerations

A researcher-made SOLO Taxonomy-Based Assessment Tool was used in the testing phase of the study. In order to ascertain the learning performance of students in Mathematics 7, the researcher observed research protocols to guarantee the validity and dependability of the study and research results. The dean, the superintendent of the schools division, the principals, and the participants were all asked for their consent before the researcher could begin the study. Participants were given the opportunity to sign consent letters indicating their willingness to participate in the study. The researcher planned the interventions with the participants after receiving approval.

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RESULTS and DISCUSSION

Extent of the Validity and Evaluation of SOLO Taxonomy-Based Assessment Tool

This experimental study aimed to determine the effectiveness of using the developed instrument by the researcher, the SOLO Taxonomy-Based Assessment Tool prior to the conduct of the study. The tool has been evaluated and validated by a group of five experts coming from the different divisions and universities using adapted evaluation and validation instruments to validate the content, relevance, instructional quality and acceptability of the tool.

Table 1
Extent of Validity and Evaluation of SOLO Taxonomy-Based Assessment Tool.

Areas	Mean(M)	Std. Deviation (SD)	Interpretation
Content	4.52	.48	Excellent
Relevance	4.40	.32	Excellent
Instructional Quality	4.50	.50	Excellent
Acceptability	4.28	.31	Excellent
Grand Mean	**4.43**	**.40**	**Excellent**

Table 1 presents the overall summary of the evaluation of the SOLO taxonomy-based assessment tool in terms of content, relevance, instructional quality, and acceptability. Content validity was rated as excellent, with a mean of 4.52 (SD = 0.48), as was relevance with a mean of 4.40 (SD = 0.32), and instructional quality with a mean of 4.50 (SD = 0.50). Acceptability, while still considered excellent, received a slightly lower mean score of 4.28 (SD = 0.31). Overall, the SOLO taxonomy-based assessment tool was highly rated across all measured aspects. As such, the data strongly supports the use and implementation of the SOLO taxonomy-based assessment tool, suggesting it is a valid, relevant, instructionally sound, and well-accepted assessment method. The SOLO taxonomy-based assessment tool is highly rated for its effectiveness in enhancing students' mathematical understanding, supporting the goal of deep learning that prioritizes conceptual understanding over rote memorization (Biggs & Tang, 2014). The strong support for the tool's implementation suggests it is a relevant and sound choice for educators aiming to assess both the breadth and depth of student knowledge (Liu & Carless, 2018). This further implies that the SOLO taxonomy-based tool is a valuable addition to the suite of assessment instruments. . The general acceptance of the tool among educators also highlights its potential for broader use in educational settings, making it an adaptable and versatile assessment method that can contribute to improving student outcomes across different learning environments (Miller & Greene, 2021).

Table 2
Level of Learning Performance in Mathematics 7 before and after the integration of SOLO Taxonomy-Based Assessment Tool by the Experimental Group

Level	Pretest		Description	Posttest		Description
	Initial Rating	Transmuted Rating		Initial Rating	Transmuted Rating	
Pre-structural	36.51	69	Did not Meet Expectation	81.90	89	Very Satisfactory
Unistructural	27.50	66	Did not Meet Expectation	72.50	82	Satisfactory
Multi-structural	25.64	66	Did not Meet Expectation	64.96	78	Fairly Satisfactory

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Relational	38.52	69	Did not Meet Expectation	61.85	76	Fairly Satisfactory
Extended Abstract	45.56	71	Did not Meet Expectation	54.07	73	Did not Meet Expectation
Grand Mean	**34.74**	**68**	**Did not Meet Expectation**	**66.44**	**80**	**Satisfactory**

Table 2 displays the impact of integrating a SOLO Taxonomy-Based Assessment Tool on the learning performance of Mathematics 7 students in the experimental group. Before the integration of the developed assessment tool, the final rating score was 68, categorized as "Did not Meet Expectation." Post-integration, the final rating score increased to 80, which is considered "Satisfactory." As such, the developed assessment tool is a valuable resource for enhancing mathematics learning outcomes. The integration of the SOLO Taxonomy-Based Assessment Tool appears to have a positive impact on Mathematics 7 students, as evidenced by shifts to higher performance levels across various categories (Hattie & Yates, 2017; Lee & Kim, 2016; Tsai & Chang, 2020). This suggests that the tool is an effective resource for improving learning outcomes by supporting students in achieving deeper conceptual understanding.

Table 3
Level of Learning Performance in Mathematics 7 Pretest and Posttest by the Control Group

Level	Pretest		Interpretation	Posttest		Interpretation
	Initial Rating	Transmuted Rating		Initial Rating	Transmuted Rating	
Pre-structural	37.46	69	Did not Meet Expectation	68.25	78	Fairly Satisfactory
Uni-structural	40.83	70	Did not Meet Expectation	69.17	80	Satisfactory
Multi-structural	25.13	66	Did not Meet Expectation	60.17	75	Fairly Satisfactory
Relational	18.52	64	Did not Meet Expectation	58.15	75	Fairly Satisfactory
Extended Abstract	9.26	62	Did not Meet Expectation	20.37	65	Did not Meet Expectation
Grand Mean	**26.24**	**67**	**Did not Meet Expectation**	**49.80**	**75**	**Fairly Satisfactory**

Table 3 presents the learning performance of a control group of Mathematics 7 students on which no integration of the developed assessment tool was given. The control group's final rating score improved slightly from 67 (Did not Meet Expectation") at pre-test to 75 ("Fairly Satisfactory") at post-test. While there were improvements in the different domains of the taxonomy, results show that the improvement is not as big as to compare with the experimental group which the assessment tool was integrated. It points out that, while the control group demonstrated some improvement in mathematics learning performance between pre-test and post-test. The findings suggest that the SOLO Taxonomy-Based Assessment Tool significantly contributed to enhanced learning outcomes for the experimental group, as evidenced by their greater improvement in mathematics performance compared to the control group (Liu & Kuo, 2017; Lim & Chai, 2016). While the control group showed some progress, it was more limited, highlighting the value of the SOLO tool in fostering deeper understanding and higher achievement (Hattie & Yates, 2017). This underscores the potential of integrating such assessment tools into mathematics instruction to improve student performance and promote higher-order cognitive skills influences when evaluating the true impact of interventions to ensure accurate conclusions about their effectiveness.

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Table 4
Results of the Z- test Analysis Between Pretest and Posttest of Experimental and Control Group

Scores	n	Mean (M)	Std. Deviation (SD)	z	df	p	Interpretation
Pre-Test (Experimental)	45	13.13	3.21	1.96	88	0.00	Significant
Pre-Test (Control)	45	10.84	2.75				
Posttest (Experimental)	45	26.93	2.61	2.17	88	0.00	Significant
Posttest (Control)	45	14.96	2.41				

a = 0.05 level of significance

In Table 4, it presents comparison of pre-test scores between the experimental and control groups . The experimental group had a mean pretest score of 13.13 with a standard deviation of 3.21, while the control group's mean pretest score was 10.84 with a standard deviation of 2.75. An independent samples z-test of 1.96 revealed no statistically significant difference between these pretest scores of the experimental and control groups with a p-value of greater than 0.05 significance level suggesting that the observed difference may be due to sampling variability rather than a true population difference. This connotes that the result of having no statistically significant difference between pretests of experimental and control groups suggests that this initial difference, while not directly related to the intervention itself, is an important factor to consider when analyzing the post-test results and interpreting the effectiveness of the intervention. This points out that the two groups were not entirely equivalent at baseline, which could influence the magnitude of any observed treatment effect. The statistically significant difference between the pre-test scores of the experimental and control groups indicates that these groups were not equivalent at baseline (Levene & Thompson, 2015; Shadish et al., 2019; Bakker & Doolaard, 2017). This pre-existing difference should be carefully considered when analyzing post-test results and interpreting the effectiveness of the intervention.

A comparison of posttest scores between the experimental and control groups. The experimental group's mean post-test score was 26.93 with a standard deviation of 2.61, while the control group's mean post-test score was 14.96 with a standard deviation of 2.41. An independent samples z-test showed a statistically significant difference between these post-test scores of a p-value of less than the significance value of 0.05. It provides evidence of a statistically significant difference in post-test scores between the experimental and control groups. This strongly suggests that the intervention implemented with the experimental group was effective in improving their performance compared to the control group. The substantial difference in means, coupled with the statistical significance, provides compelling support for the positive impact of the intervention. The statistically significant difference in post-test scores between the experimental and control groups suggests that the intervention had a meaningful impact on student performance (McMillan & Wergin, 2014; Thomas & Brubaker, 2017; Choi & Kang, 2019). This substantial difference in means, along with the statistical significance, strongly supports the effectiveness of the intervention in enhancing learning outcomes. It provides compelling evidence that the intervention was successful in improving the experimental group's performance relative to the control group, reinforcing the potential value of incorporating such interventions in educational settings to promote better student achievement.

Table 5
Respondents' Perception on the Extent of Acceptability of the SOLO Taxonomy-Based Assessment Tool

Indicators	Mean (M)	Std. Deviation (SD)	Interpretation
1. Makes me more interested in learning about the topics.	4.82	.39	Highly Acceptable

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2. Encourages me to get the fundamental knowledge of the topics.	4.60	.50	Highly Acceptable
3. Holds my interest and maintains it.	4.73	.50	Highly Acceptable
4. Allows me to critically evaluate the learning competencies that my teacher introduced.	4.69	.51	Highly Acceptable
5. Increases my engagement with necessary learning tasks in the current trend.	4.71	.46	Highly Acceptable
6. Provides me with educational opportunities that are beneficial and efficient throughout the procedure.	4.69	.59	Highly Acceptable
7. Enhances my effectiveness in the teaching-learning process as a component of how well I performed in class.	4.60	.48	Highly Acceptable
8. Makes me understand deeper and appreciate the importance of learning the topics.	4.69	.47	Highly Acceptable
9. Aids in determining how well I understand the subjects my teacher has covered.	4.67	.48	Highly Acceptable
10. Motivates me to evaluate my own performance level in class.	4.80	.46	Highly Acceptable
Grand Mean	**4.84**	**.32**	Highly Acceptable

The perceptions of the student respondents regarding the degree of acceptability of using the SOLO Assessment Worksheets during class discussions were shown in Table 5. The students' aggregate evaluation of 4.84 (SD=0.32) suggests that they are comfortable using the assessment tool. This suggests that the students believe the worksheet helped them gauge their own comprehension of the subjects the teacher covered. . It also had exercises designed to accommodate each student's preferred method of learning, such as a performance task, a written task, a task that incorporates graphics, and a listening task. As stated by Wong, et al. (2020), interest is a key component in learning. Learning is enhanced when students show interest in the subject matter. It was evident in the pre and posttest scores of the students that their understanding and performance significantly improved. The findings suggest that worksheets with progressively complex tasks can effectively help students assess their understanding of mathematical topics (Chan & Bui, 2015; Jansen & Fischer, 2020; & Pires & Nunes, 2019). The structure, where one task is completed before progressing to the next, seems to support students in measuring their own learning. Additionally, the design elements, such as pleasing colors, graphics, and varied activity types (written, performance-based, visual, and auditory), enhance student engagement and cater to different learning preferences. This approach not only motivates students but also helps to make the content more accessible and engaging, potentially fostering a deeper interest in studying Mathematics 7.

Table 6
Results of ANCOVA Between Perceived Level of Acceptability of SOLO Taxonomy Based Tool and Level of Performance

Source	Sum of Squares	df	Mean Square	F	P	Interpretation
Mean Gain Scores Acceptability of SOLO	19.816	10	1.982	1.190	0.332	Not Significant

α = 0.05 level of significance R squared = .259 (Adjusted R Squared = .041)

In Table 6, it shows that the results of the Univariate Analysis of Variance (ANOVA) indicate that the model, which examines the effect of mean gain scores and acceptability of SOLO on the dependent variable does not show a

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statistically significant effect. The corrected model has an F-value of 1.190 and a significance level (p = 0.332), which is greater than the conventional 0.05 threshold, indicating that the independent variable does not significantly predict the dependent variable. The interaction term (Mean Gain Scores * Acceptability of SOLO) also has an F-Value of 1.190 with a p-value of 0.332, further confirming that there is no significant interactions effect between these factors. Additionally, the R-squared value is 0.259, and the adjusted R-squared is 0.041, meaning that only 4.1% of the variance in the dependent variable is explained by the model, which is quite low. In conclusion, the findings suggested that the factors analyzed do not significantly impact mean gain scores, and the model does not explain much of the variance in the dependent variable. This implies that other factors not included in the outcome, and further investigation with a more refined dataset or additional predictors may be necessary. Educators and students may find the tool useful or appealing, its perceived acceptability does not directly impact how well students perform academically (Moore & Johnson, 2016; Raudenbush & Liu, 2018; & Zhao & Spector, 2020). Other factors, such as instructional quality, student engagement, or prior knowledge, may be more influential in driving student performance. Although user satisfaction and acceptability are important for the successful implementation of educational tools, they do not necessarily translate into better academic outcomes.

Conclusions

This study investigated the effect of a SOLO Taxonomy-based assessment approach on the mathematics learning outcomes of Grade 7 students at Tri-People dominated High School. The findings indicate that the developed SOLO Taxonomy-based assessment tool demonstrated high validity, receiving excellent ratings across content validity, relevance, and instructional quality, with strong acceptability among both validators and students. While both the experimental group (integrated with the SOLO Taxonomy-based assessment tool) and the control group (traditional using Bloom's Taxonomy) showed remarkable learning gains between pre- and post-tests, the magnitude of improvement appeared greater in the experimental group, suggesting a positive influence of the intervention. Although there is an evident increase in the posttest, as well as between the pretest scores of the experimental and control groups, these has seemingly irrelevant to the student performance. It is suggested that other factors beyond simple acceptance of the tool can drive learning gains.

Recommendations

In the light of the findings and conclusion of the research study, the following are recommended:

1. Teachers may integrate the developed SOLO taxonomy-based assessment tools into mathematics instruction, providing professional development for effective implementation.
2. School administrators may provide teachers with more trainings in the application of SOLO taxonomy in lesson planning and explore applications catering the varied learning styles of students.
3. Teachers may Investigate the applicability and effectiveness of SOLO taxonomy-based assessments in other disciplines to further check its effectiveness
4. The Mathematics teachers should have an extensive training about other instructional strategies to make the teaching learning situation effective and improve their teaching competencies in Mathematics.
5. The students should actively participate in any type of assessments to enhance their mathematical ability.
6. The teachers must provide the students with materials or tools to improve and enhance their ability in answering Higher Order Thinking Skills (HOTS) questions.
7. Future researchers may conduct relevant and longitudinal studies to examine the long-term effects of SOLO taxonomy-based assessment tools on the learning outcomes of students and help areas more specifically for the improvement of SOLO taxonomy.

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