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Article

Understanding Mathematics Teachers' Assessment Practices: Experiences in Using the Revised Bloom's Taxonomy for Summative Assessment

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Abstract

Summative assessment is a fundamental component of mathematics instruction, providing evidence of learners' achievement of intended learning outcomes. The Revised Bloom's Taxonomy has become an important framework for designing assessments that measure varying levels of cognitive processes, from remembering and understanding to analyzing, evaluating, and creating. This study explored the assessment practices and experiences of mathematics teachers in using the Revised Bloom's Taxonomy when developing summative assessments. A qualitative phenomenological research design was employed involving ten mathematics teachers selected through purposive sampling from public secondary schools. Data were gathered through semi-structured interviews, document analysis of teacher-made summative tests, and classroom observations and were analyzed using Braun and Clarke's six-phase thematic analysis. The findings revealed that teachers intentionally designed assessment items that reflected varying cognitive levels, balanced lower- and higher-order thinking skills, aligned assessments with curriculum competencies, and continuously refined their assessment practices through professional reflection and collaboration. Participants also encountered challenges related to item construction, time constraints, and designing higher-order thinking questions. The study highlights the importance of assessment literacy, sustained professional development, and collaborative assessment design in strengthening classroom assessment practices. The findings provide valuable insights for curriculum developers, school leaders, and mathematics teachers in improving the quality of summative assessment.

Keywords: *summative assessment, Revised Bloom's Taxonomy, mathematics education, assessment practices, teachers' experiences, assessment literacy, phenomenology, qualitative research*

1. Introduction

Assessment plays a central role in mathematics education by providing evidence of learners' understanding, monitoring academic progress, and informing instructional decision-making. Among various forms of classroom assessment, summative assessment serves as an important mechanism for determining the extent to which learners have achieved the intended learning competencies at the end of a lesson, unit, or grading period. Well-designed summative assessments not only measure learners' mathematical knowledge but also evaluate their ability to apply concepts, solve problems, analyze situations, and demonstrate higher-order thinking skills.

The **Revised Bloom's Taxonomy** developed by Anderson and Krathwohl has become one of the most widely used frameworks for designing classroom assessments. The taxonomy classifies cognitive learning into six levels remembering, understanding, applying, analyzing, evaluating, and creating allowing teachers to develop assessment tasks that measure different levels of thinking. In mathematics education, the framework guides teachers in constructing balanced assessment items that extend beyond factual recall and encourage conceptual understanding, mathematical reasoning, critical thinking, and problem-solving.

Mathematics teachers play a significant role in ensuring that assessment practices align with curriculum standards and intended learning outcomes. They carefully select assessment strategies, develop test items, analyze learner responses, and interpret assessment results to improve instruction. Applying the Revised Bloom's Taxonomy requires teachers to possess assessment literacy, content expertise, and pedagogical knowledge to design meaningful assessments that accurately measure learners' cognitive development while maintaining fairness, validity, and reliability.

Despite the widespread use of the Revised Bloom's Taxonomy, mathematics teachers continue to encounter challenges in developing high-quality summative assessments. Constructing higher-order thinking questions, ensuring balanced cognitive representation, aligning assessment items with curriculum competencies, addressing learners' diverse abilities, and managing time constraints during assessment development remain common concerns. These realities require teachers to continuously reflect on and refine their assessment practices while engaging in professional collaboration and ongoing learning.

Although numerous studies have examined classroom assessment and the application of the Revised Bloom's Taxonomy, much of the existing literature has focused on quantitative analyses of test-item alignment and cognitive levels. Limited qualitative research has explored the lived experiences of mathematics teachers in designing summative assessments using the Revised Bloom's Taxonomy. Understanding these experiences provides valuable

insights into teachers' assessment practices, decision-making processes, challenges, and professional growth.

Therefore, this study explored the assessment practices and experiences of mathematics teachers in using the Revised Bloom's Taxonomy for summative assessment. The findings are expected to contribute to strengthening assessment literacy, improving mathematics assessment practices, and informing professional development initiatives that promote high-quality classroom assessment.

2. Objectives of the Study

This study aimed to explore the assessment practices and experiences of mathematics teachers in using the Revised Bloom's Taxonomy for designing summative assessments.

Specifically, it sought to:

1. describe the assessment practices employed by mathematics teachers in developing summative assessments using the Revised Bloom's Taxonomy;
2. explore the experiences of mathematics teachers in designing assessment items across different cognitive levels;
3. identify the challenges encountered by mathematics teachers in applying the Revised Bloom's Taxonomy in summative assessment;
4. examine the strategies employed by teachers to improve the quality, validity, and cognitive rigor of their summative assessments; and
5. provide implications for strengthening assessment literacy, professional development, and classroom assessment practices in mathematics education.

3. Review of Related Literature

Assessment is an integral component of effective mathematics instruction, providing evidence of learners' achievement and guiding instructional improvement. Summative assessment is commonly administered at the end of a learning unit or grading period to determine the extent to which learners have attained the intended learning competencies. High-quality summative assessments measure not only factual knowledge but also learners' conceptual understanding, mathematical reasoning, problem-solving abilities, and higher-order thinking skills. Consequently, teachers are expected to design assessments that are valid, reliable, fair, and aligned with curriculum standards.

The **Revised Bloom's Taxonomy** developed by Anderson and Krathwohl (2001) has become one of the most widely adopted frameworks for designing classroom assessments. The taxonomy categorizes cognitive learning into six hierarchical processes: remembering, understanding, applying, analyzing, evaluating, and creating. This framework assists teachers in constructing assessment tasks that measure varying levels of cognitive complexity, ensuring that learners are challenged to demonstrate deeper understanding and critical thinking rather than simple recall of information.

In mathematics education, the application of the Revised Bloom's Taxonomy supports balanced assessment design by encouraging teachers to include questions that require learners to interpret mathematical concepts, apply procedures, analyze relationships, justify solutions, and generate alternative problem-solving strategies. Research has shown that assessments incorporating higher-order cognitive processes contribute to improved mathematical reasoning, conceptual understanding, and learner engagement. Such assessments also provide more comprehensive evidence of learners' mathematical competence.

Assessment literacy is another critical factor influencing teachers' assessment practices. It encompasses teachers' knowledge and skills in planning assessments, developing quality test items, interpreting assessment results, and using assessment evidence to improve instruction. Mathematics teachers with strong assessment literacy are better equipped to align assessment tasks with curriculum competencies, construct cognitively appropriate items, and ensure the validity and fairness of classroom assessments. Continuous professional development and collaborative assessment planning have likewise been identified as important mechanisms for strengthening teachers' assessment competencies.

Despite the recognized value of the Revised Bloom's Taxonomy, teachers frequently encounter challenges in designing summative assessments. Developing higher-order thinking questions, balancing cognitive levels, ensuring curriculum alignment, addressing diverse learner abilities, and managing limited preparation time remain common concerns. These challenges require teachers to engage in reflective practice, collaborate with colleagues, and continuously refine their assessment design strategies to maintain assessment quality and instructional relevance.

Although previous studies have examined cognitive levels of assessment items and teachers' assessment literacy, relatively few qualitative investigations have explored the lived experiences of mathematics teachers in applying the Revised Bloom's Taxonomy during the development of summative assessments. This study addresses this gap by examining teachers' assessment practices, experiences, challenges, and strategies, providing deeper insights into classroom assessment within mathematics education.

4. Theoretical Framework

This study is anchored on Anderson and Krathwohl's Revised Bloom's Taxonomy, Constructivist Learning Theory by Jean Piaget, and Assessment for Learning Theory by Black and Wiliam. These theories provide the conceptual foundation for understanding mathematics teachers' assessment practices and experiences in designing summative assessments.

The Revised Bloom's Taxonomy (Anderson & Krathwohl, 2001) serves as the primary framework of this study. The taxonomy classifies cognitive processes into six hierarchical levels: remembering, understanding, applying, analyzing, evaluating, and creating. It guides teachers in developing assessment items that measure varying levels of cognitive complexity and promote higher-order thinking skills. In mathematics education, the taxonomy assists teachers in constructing balanced summative assessments that move beyond factual recall to include conceptual understanding, mathematical reasoning, problem-solving, and critical thinking. The framework emphasizes the alignment of assessment with intended learning outcomes and supports the development of valid and meaningful classroom assessments.

Constructivist Learning Theory (Piaget, 1972) explains that learners actively construct knowledge through meaningful experiences and interactions with mathematical concepts. Learning occurs when learners connect prior knowledge with new information, solve authentic problems, and reflect on their understanding. Consequently, assessment should evaluate not only learners' ability to recall information but also their capacity to apply, analyze, evaluate, and create mathematical solutions. This theory supports the design of authentic summative assessments that encourage deep learning and conceptual understanding.

Assessment for Learning Theory proposed by Black and Wiliam (1998) emphasizes that assessment should contribute to improving teaching and learning by providing meaningful evidence of learners' progress. Although summative assessment primarily measures learning outcomes, effective assessment design also informs teachers about learners' strengths, misconceptions, and areas requiring further instruction. Teachers use assessment results to reflect on instructional effectiveness, improve classroom practices, and support continuous learner development.

Collectively, these theories explain how mathematics teachers utilize the Revised Bloom's Taxonomy to design cognitively balanced summative assessments while promoting meaningful learning, improving instructional decision-making, and strengthening assessment quality.

5. Methodology

This study employed a qualitative phenomenological research design to explore the assessment practices and experiences of mathematics teachers in using the Revised Bloom's Taxonomy for designing summative assessments. The phenomenological approach was selected because it enables an in-depth understanding of teachers' lived experiences, perceptions, and decision-making processes in constructing classroom assessments.

The study was conducted in selected public secondary schools within the Schools Division. The participants consisted of ten (10) mathematics teachers handling junior and senior high school mathematics subjects. Participants were selected through purposive sampling based on their teaching experience, active involvement in preparing summative assessments, and familiarity with the application of the Revised Bloom's Taxonomy in classroom assessment.

Data were gathered using a researcher-developed semi-structured interview guide, complemented by document analysis and classroom observations. Teacher-made summative tests, table of specifications, assessment blueprints, lesson plans, and curriculum guides were reviewed to triangulate the interview data and gain a comprehensive understanding of teachers' assessment practices. Prior to data collection, permission to conduct the study was secured from the appropriate educational authorities and school administrators. Individual interviews were conducted with participants after obtaining written informed consent. All interviews were audio-recorded with permission, transcribed verbatim, and verified through member checking.

The collected data were analyzed using Braun and Clarke's (2006) six-phase thematic analysis, which involved familiarization with the data, coding, searching for themes, reviewing themes, defining and naming themes, and producing the final report. This systematic analytical procedure facilitated the identification of recurring patterns describing teachers' assessment practices, experiences, challenges, and strategies in applying the Revised Bloom's Taxonomy.

To ensure the trustworthiness of the study, the researcher employed the criteria of credibility, transferability, dependability, and confirmability. Credibility was established through prolonged engagement, member checking, and triangulation of interview, document analysis, and observation data. Dependability and confirmability were strengthened through peer debriefing and maintaining an audit trail, while transferability was achieved by providing rich descriptions of the research setting, participants, and assessment context.

Ethical principles were observed throughout the conduct of the study. Approval to conduct the research was obtained from the appropriate educational authorities before data collection. Participation was voluntary, and all participants signed informed consent forms

after being informed of the objectives, procedures, potential benefits, and possible risks of the study. Confidentiality and anonymity were maintained through the use of pseudonyms, and all collected information was securely stored and used solely for academic and research purposes.

6. Findings and Discussion

Theme 1: Designing Balanced Summative Assessments across Cognitive Levels

The findings revealed that mathematics teachers intentionally designed summative assessments that represented different cognitive levels of the Revised Bloom's Taxonomy. Participants explained that they carefully distributed assessment items from remembering and understanding to applying, analyzing, evaluating, and creating to measure learners' mathematical knowledge, conceptual understanding, reasoning, and problem-solving abilities. They believed that cognitively balanced assessments provided a more comprehensive evaluation of learners' achievement and encouraged the development of higher-order thinking skills.

Participant 2 shared:

"When I prepare a summative test, I make sure that the questions are not limited to recall. I include application, analysis, and problem-solving items so that learners can demonstrate deeper mathematical understanding."

Participant 7 stated:

"The Revised Bloom's Taxonomy serves as my guide in preparing examinations. It reminds me to distribute questions across different thinking levels instead of focusing only on memorization."

These responses indicate that teachers consciously utilized the Revised Bloom's Taxonomy as a framework for developing balanced assessments that evaluate multiple dimensions of learning. By incorporating varied cognitive levels, teachers promoted meaningful mathematical thinking and ensured that learners had opportunities to demonstrate conceptual understanding, analytical reasoning, and creative problem-solving. The findings support Anderson and Krathwohl's Revised Bloom's Taxonomy, which advocates the development of assessments that address progressively complex cognitive processes. They also reinforce Constructivist Learning Theory, which emphasizes meaningful learning through active engagement with mathematical concepts.

Theme 2: Aligning Assessment with Curriculum Standards and Learning Competencies

The participants emphasized that curriculum alignment was an essential consideration when constructing summative assessments. They explained that every assessment item was carefully developed based on the Most Essential Learning Competencies (MELCs), lesson objectives, classroom instruction, and the Table of Specifications (TOS). This systematic process enabled teachers to ensure that assessments measured the intended learning outcomes while maintaining fairness, validity, and instructional relevance.

Participant 4 explained:

"Before writing test questions, I review the learning competencies and prepare a Table of Specifications. This helps me make sure that every competency is properly assessed."

Participant 9 remarked:

"The examination should reflect what learners have actually studied. Using the Table of Specifications and the curriculum guide helps me avoid including questions that are not aligned with the lesson objectives."

These findings demonstrate that mathematics teachers view curriculum alignment as a fundamental aspect of quality assessment design. Careful alignment between learning competencies, instructional objectives, classroom activities, and assessment items strengthens assessment validity and ensures that learners are evaluated fairly. The findings support Assessment for Learning Theory, which emphasizes that effective assessment should provide accurate evidence of learners' achievement and inform instructional improvement. Furthermore, the use of curriculum guides and Tables of Specifications promotes consistency, transparency, and quality assurance in mathematics assessment practices.

Theme 3: Overcoming Challenges in Constructing Higher-Order Thinking Assessment Items

The findings revealed that mathematics teachers considered the construction of higher-order thinking skills (HOTS) questions as one of the most challenging aspects of designing summative assessments. Participants explained that creating items requiring analysis, evaluation, and creation demanded deeper content knowledge, creativity, and careful consideration of learners' readiness and cognitive abilities. They also noted that developing authentic mathematical problems that assess reasoning rather than memorization required considerable time and effort.

Participant 3 shared:

"Developing higher-order thinking questions is challenging because they should encourage learners to think critically without becoming too difficult or confusing."

Participant 8 stated:

"Creating problem-solving questions that measure analysis and evaluation takes time. I always revise my questions several times before including them in the examination."

These responses indicate that teachers recognize the complexity of constructing cognitively demanding assessment items while maintaining fairness and clarity. Despite these challenges, they continuously refined their test items to ensure that learners were provided opportunities to demonstrate deeper mathematical understanding and reasoning. These findings support the Revised Bloom's Taxonomy, which encourages teachers to design assessments that progressively measure higher levels of cognitive processing and critical thinking.

Theme 4: Strengthening Assessment Quality through Reflection and Professional Collaboration

The participants emphasized that reflective practice and collaboration with fellow mathematics teachers significantly improved the quality of their summative assessments. They regularly participated in Learning Action Cells (LACs), subject-area meetings, peer review sessions, and professional development seminars where assessment items were reviewed, discussed, and refined. These collaborative activities enabled teachers to improve item quality, ensure cognitive balance, and align assessments with curriculum standards.

Participant 2 explained:

"Before administering our examinations, we review one another's test questions. Our discussions help us improve the quality and difficulty level of each assessment item."

Participant 6 remarked:

"Learning Action Cell sessions allow us to exchange ideas on how to write better questions using the Revised Bloom's Taxonomy. Collaboration has improved my confidence in preparing examinations."

These findings demonstrate that professional collaboration enhances teachers' assessment literacy and strengthens the quality of classroom assessments. Through peer feedback, reflective discussions, and continuous professional learning, teachers improve their ability to construct valid, reliable, and cognitively balanced summative assessments. The findings reinforce Assessment for Learning Theory, which highlights continuous teacher learning and reflective practice as important components of effective classroom assessment.

Theme 5: Enhancing Learner Achievement through Purposeful Assessment Design

The findings revealed that teachers viewed well-designed summative assessments as important tools for improving learner achievement and instructional quality. Participants explained that assessments guided by the Revised Bloom's Taxonomy enabled them to evaluate not only factual knowledge but also learners' conceptual understanding, mathematical reasoning, communication, and problem-solving abilities. Assessment results were subsequently used to identify learning gaps, provide remediation, and improve future instruction.

Participant 5 shared:

"After checking the examination, I analyze which competencies learners found difficult. The results help me decide what concepts should be reviewed or retaught."

Participant 10 stated:

"A well-prepared summative assessment benefits both teachers and learners because it shows whether learning objectives have truly been achieved."

These responses indicate that teachers regard summative assessment as an essential component of the teaching-learning process rather than merely a tool for assigning grades. Purposefully designed assessments provide meaningful evidence of learner achievement, support data-informed instructional decisions, and contribute to continuous improvement in mathematics instruction. The findings highlight that effective assessment practices promote deeper learning, strengthen mathematical competence, and encourage teachers to continuously refine their instructional and assessment strategies in response to learners' needs.

7. Conclusion

This study explored the assessment practices and experiences of mathematics teachers in using the Revised Bloom's Taxonomy for designing summative assessments. The findings revealed that teachers intentionally developed cognitively balanced assessment items by integrating various levels of the Revised Bloom's Taxonomy and aligning them with curriculum standards, learning competencies, and instructional objectives. Despite challenges in constructing higher-order thinking questions, ensuring cognitive balance, and managing time during test development, teachers demonstrated commitment to improving assessment quality through reflective practice, collaborative planning, and continuous professional learning. The study further revealed that purposeful assessment design enabled teachers to gather meaningful evidence of learners' mathematical understanding, reasoning, and problem-solving abilities, thereby supporting instructional improvement and learner achievement. Overall, the study concludes that effective summative assessment is grounded in teachers' assessment literacy, pedagogical competence, and deliberate application of the

Revised Bloom's Taxonomy to create valid, reliable, and meaningful mathematics assessments.

8. Implications

The findings of this study have significant implications for mathematics education, assessment practice, and teacher professional development. Schools should strengthen assessment literacy by providing continuous training on the development of cognitively balanced assessment items, higher-order thinking skills (HOTS) questions, authentic assessment, and the effective application of the Revised Bloom's Taxonomy. Mathematics departments should institutionalize collaborative assessment design through Learning Action Cells (LACs), peer review sessions, and professional learning communities where teachers can develop, evaluate, and refine assessment instruments collectively. School leaders should encourage regular item analysis, assessment validation, and reflective assessment practices to improve the quality, validity, and reliability of teacher-made examinations. Curriculum developers and education leaders may utilize the findings to enhance assessment guides and instructional resources that promote meaningful classroom assessment aligned with curriculum competencies. Future researchers are encouraged to replicate this study in other educational contexts or employ mixed-methods and comparative research designs to further examine teachers' assessment practices and their influence on learner achievement, mathematical reasoning, and assessment quality.

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