

Teachers' Practices of Assessment in Secondary Level Mathematics

- Yubaraj Bhattarai

Abstract

The purpose of my study was to find teachers' practices of assessment in mathematics at secondary level from 2005 AD to 2020 AD in the local context in Nepal. I conducted the study in Kavrepalanchok district in Nepal with a narrative research inquiry and interpretive paradigm under a qualitative research approach. The construction of assessment knowledge by in-service mathematics teachers as participants was the epistemology of my research, which tried to explain subjective perception through mental constructs. Interactions and communication among students contribute to the construction of reality.

I conducted in-depth interviews using interview guidelines to excavate the narrative stories of respondent participants as a method of data collection. I transcribed the shared stories of the participants to generate themes using qualitative tools of data analysis. Five in-service teachers selected using a purposive sampling method from the district were the participants in the study.

In-service mathematics teachers in Nepal are passionate about instilling curiosity and motivation in their students, and they are particularly interested in contextual assessment related to their daily activities. Sufficient feedback from the mathematics teachers has supported students to promote their mathematics learning. The study concluded that mathematics assessment practices provide multiple opportunities for teachers and students to transform their usual practices and establish classroom activities as a discourse for knowledge construction

Key words: *Assessment, Mathematics, Practices, Research*

Introduction of the Issues in Assessment

Assessment in mathematics has been an essential component in educational system in recent years. Mc Tighe & Ferrara (2000) stated that by having access at the start of the lesson, students become assessment partners with the teacher. According to Acharya (2019), assessment has a significant role in improving educational standards in terms of instruction, understanding, and attainment of educational purposes set by the curriculum. Assessment results are applicable to determine the success or failure of teachers and schools. As stated by Dahal et al. (2017), the degree of student learning achievement has been a major concern in reform and development of school system. Students should construct models that

link mathematics to real, actual life as part of this process. They should regularly solve issues of mathematics on their own instead of depending on others for solutions.

“The overemphasis on scores and the narrowly conceived notion of achievement are problematic in Nepalese school education in general and particularly in mathematics” (Pant, 2015, p.194). There are many types of assessment, but all have the same purpose of promoting academic achievement of students through proper classroom instruction. Thompson et al. (2018) stated that students should demonstrate their understanding, aptitude, and skills in any learning process or assessment. In this context, Poudel (2016) stated that assessment of students is the method

of gathering and analysing data regarding performance of students and providing them feedback.

Different ways such as facial expressions, writing work, asking questions, listening to their views, supporting discussions, and other tasks are all part of an effective teaching tool (Dahal, 2017). According to Thompson et al. (2018), teachers should engage students in both content and process to ensure that students develop robust mathematics proficiency such as procedural competency, critical reasoning, knowledge acquisition, productive inclinations, and conceptual understanding of current mathematics education perspectives. A variety of educational and practical activities in mathematics assessment challenges needs their solution for the betterment of educational system.

Assessment on talents, knowledge, capacities, attitudes, skills as construction has proven to be a challenging work. The dimensions of socio-economic backgrounds, learning environments, curriculum, access to learning resources, personal traits of students, pedagogical practices are some examples that are difficult to assess and accomplish in regard of students' assessment (Dahal, 2019). However, conducting paper-pencil tests to grade students at the completion of the academic year has been common practice in school education. Even the practices of assessing students in Nepal are not far from such paper-pencil tests and periodic examinations. This can only measure the purpose of remembering, literal information, operational strategies, and talents to answer book-based regular questions. It cannot widen cognitive potential of students through constructivism.

Assessment is crucial in communicating clearly and concisely about

learning of student and the operation of educational systems in response to the national call for educational outcomes. Acharya (2015) stated that assessment creates competition among students to flourish the learning environment. However, experts in the field of educational assessment argue that traditional assessment methods, like our existing public exams, cannot measure several attributes that are highly valued in modern education (Khaniya et al., 2015). In this scenario, assessment should be the academic guiding mechanism. It plays a critical role in supporting students and parents in assessing academic performance. Assessment is increasingly used to categorize, forecast, and rank students in order to improve student learning as well as to ensure accountability (National Research Council, 1993). With the paradigms shifts in education, the viewpoints of stakeholders on mathematics assessments have remained unchanged.

Mathema & Bista (2006) stated that assessment of learning of students at the end of ten years of school education serves primarily two purposes as the certification of students and selection of students for higher education or jobs. Furthermore, they stated that SLC scores are vital indicators to know learning of students and the strengths and weakness of the prevailing education system. In this context, my study incorporated the existing assessment practices in mathematics classrooms adopted by mathematics teachers over a period of fifteen years from 2005 AD to 2020 AD in the local context in Nepal.

Assessment of students possesses a very important position in an instructional program, especially for assessing the taught curriculum (Khaniya et al., 2015). The issue of assessment has been a hotly debated issue in the context of Nepal. As soon as the results are published for the secondary level board

examinations for grades X, XI, and XII, the issues of assessment get top headlines in the national news (Dixit, 2019). The SLC/SEE results frequently reveal that most students fail in mathematics (Mathema & Bista, 2006). As mentioned by Panthi & Belbase (2017), the majority of students accept mathematics as one of the most difficult or time-consuming disciplines because of obsolete learning and assessment mechanisms that are inescapable in schools.

Khadka (2017) stated, “School education in Nepal, over the past few years, has exhibited a gradual improvement in pass percentage as revealed by SLC examination results. Yet, this performance cannot be considered optimum” (p. 7). Every year, the government spends a substantial amount of money on education, but satisfactory outcomes are still far away. The methods, instruments, and standards should have proper applications to achieve the genuine achievement of learning outcomes envisioned in the curriculum.

Teachers and students have constrained perspectives on assessment fairness and reliability, and they believe a single assessment or examination can reveal the truth in the achievement of stakeholders (Dixon & Haigh, 2009). In this regard, Panthi & Belbase (2017) asserted that the assessment system emphasizes rote learning, memorization of facts to get good marks in the examinations. It does not provide enough value to the experience of students and thus necessitates new modality of assessment in mathematics.

Rosli et al. (2013) mentioned that mathematics practice should take steps forward to improve the assessment tools from traditional to more authentic assessment to measure learning of students holistically. The assessment system for the evaluation of

students performances during every academic year has become a major issue of discussion among scholars and teachers (Shrestha, 2017). New perspectives on assessment advocate for activities to be integrated into the curriculum, with the idea that assessment should be an expansion instead of a disruption of the learning process (de Lange, 1999). This enables stakeholders to take ownership of the planning, implementation, and analysis of student assessment. The majority of currently used assessment frameworks ignore the educational context that teachers encounter in their classrooms (Thompson et al., 2018). The concept of assessment has evolved from global and national to local perspectives as the framework of outcome-oriented education has expanded. Teachers' practices of assessment may have variations over time bound. With a major focus on these issues, I exposed their current practices of mathematics assessment as in-service mathematics teachers from 2005 AD to 2020 AD.

Exploring Assessment in the Literatures Assessment for Learning

Observation, class activities, examinations or analysis of student tests are some examples of assessment for learning. Assessment for learning is frequently formative in design, and teachers use it to reflect on their teaching techniques and make the required preparations for individual students in the class (Adam et al., 2014). Such measures ensure that student improvement in learning of students is possible through assessment. Classroom assessment information collected supports to customize teaching and learning to meet the needs of students with different instructional approaches or offering extra remedial instruction.

The goal of assessment is to improve students' educational outcomes by placing them at the forefront (Thompson et al., 2018).

Assessment in mathematics is effective in improving students' learning purposes, practical use of mathematics, behaviour modification, institutional development, and student accomplishment. Students should always be completely involved in their lessons and have the ability to assess their own performance, which is also an effective learning skill.

National Research Council (1993) stated that assessments are powerful instrument for conveying the purposes and content of mathematics education transformation to a wide range of stakeholders. In my study, I took students, instructors, parents, politicians, and public appreciate the goals of mathematics learning, and assessment in mathematics. Ampadu (2012) mentioned that when a teacher transmits knowledge to students, they apply that information to solve mathematical problems by following procedural norms. Students gradually become passive learners because of this approach. As a result, it is crucial to track wider learning outcomes including rational reflection, cognitive skills, learning motivation with instruction, and holistic well-being.

As stated by Gardner et al. (2008), personal and group improvement in assessment practice are potential. The impact of assessment on learning demands a higher focus than the program itself. Teachers play a significant role in improving students' learning outcomes through assessment for learning using a variety of tools. Students share assessment knowledge with colleagues as needed, and get learning-oriented feedback on their achievements.

The Absolutist and Fallibilist View of Mathematics Knowledge

Absolutists believe mathematics knowledge consists of unquestionable truths. Aside from logic and claims, mathematical

knowledge is a collection of universal facts, unshakable beliefs, and the only area of certain knowledge in which there is such a thing as mathematician. According to Ernest (1994), the absolutist paradigm portrays the body of knowledge as a collection of algorithms developed by mathematicians. The fact that propositions employed in proofs and mathematics axioms are true is the basis for arguing that mathematics delivers absolutely certain knowledge. This view divides mathematical knowledge into two classes - the assumption of theorems and terminology and the argument linked to the supposition of hypothesis, standards of reasoning and formal language.

According to Acharya (2015), the absolutist regards mathematics as a collection of knowledge is just partially true, but the fallibilist view sees mathematics as an incomplete and ever-evolving learning experience that is revisable, changing as new mathematical truths are discovered or emerge as by-products of inventions. In this context, it is legitimate to suggest a new agenda for mathematics philosophy rather than seeking incontrovertible truth, give an account of mathematics knowledge as it is fallible, uncertain, and changing, just like any other type of knowledge (Taylor & Medina, 2011). I claim these two views of mathematics in my thematic review, as they have a crucial role regarding assessment in the mathematics classroom.

Post/Positivist View in Assessment

Assessment system is a part of an educational entity envisaged by the curriculum at a certain level. According to Acharya (2015), the most prominent characteristic of positivist assessment approach is that they treat instructional methods and assessment techniques as separate initiatives. It indicates that formal mathematics assessments depend

on_paper-pencil related tests to measure students' understanding of subject matters. Luitel (2009) considered knowledge to be outside already existing on the world. The major task of teachers is to impart knowledge to students in the form it exists thereby determining whether students can recall or replicate the knowledge.

Assessment is as an external factor in the summative function of assessment. It determines the ranking of students after the completion of a certain course of study in the academic year. It means that the summative assessment measures the actual mathematics knowledge gained during classroom instruction activities (Suurtamm et al., 2016). The aim of instruction assessments is to quantify the non-measurable characteristics of students' capacity, potential and potential without taking into account other elements that have a significant impact on mathematical accomplishment. The obtained scores results are used to create a hierarchical system among practitioners. This leads to a set of social practices in the classroom leading the majority of moderate or low-level students to feel powerless.

Bhandari (2016) stated that Nepalese assessment system encourages the memorization and repetition of students rather than their creativity in learning. The assessment system in Nepal declares students unsuccessful unless they memorize mathematical contents and cannot express them in words in the examination. Most curricular documents (CDC, 2007, 2008, and 2015) emphasize that standardized mathematics assessments are used to support students in their mathematical understanding, skills and knowledge and the assessment system is highly dependent on their performance based on periodic examinations throughout year (Acharya, 2015). Belbase

(2015) commented that a weak, rigid, and authoritative prior experience of mathematics such a belief system in which teachers emphasize rote memorization of mathematical facts, logic, and theorem to find the accurate solutions. Individual variables, including social and economic background, financial status, educational prospects, and personal traits such as ideas, opinions, emotions, and sentiments are rare in externally imposed standardized paper-pencil assessments.

Methodology

Sampling of Respondent Participants

A sample is a part of an entire group selected to be representative of the whole group. According to Paton (1990), qualitative research usually focuses on small-sized samples, even single cases ($n = 1$), that are chosen purposively. Qualitative methods work primarily with small groups of respondent participants. The information for my study is the experiences and stories provided by the respondent participants in in-depth interviews. Accounting for these considerations, I also used a purposively sampling method in my study. The participants had diverse representations on training, experience, recruitment process, types of appointment, religion, socio-economic background, and others.

Nature and Source of Narrative

Interviewing the respondent participants was my data collection technique. An interview is such a flexible tool, which helps to collect data with the use of multisensory channels. According to Dickinson (2012), engaged in meaning-making discourses, the researcher and the researched co-construct their experiences and interpretations of the stories. I discovered a variety of innovative approaches by respondent participants conveying mathematics assessment at the secondary level using narrative stories. Guba & Lincon (1981) stated that without face-to-

face and verbal engagement with individuals, it is almost hard to get into their experience in their own natural language. Thus, a major source of data collection for finding answers to research issues is interviews.

Narrating Process

I conducted interviews with the respondent participants every week, narrating and reflecting on the story. The interview helped me to understand their current practices of mathematics assessment in their career. Since my research is related to social sciences, it was often difficult for me to gather data from my research participants. For this, I got prior consent from them regarding the use, purpose, and significance of collected data.

Handling of Narratives

Following each interview, I translated the audio recordings in a peaceful location at my house on the same day. I transcribed the audio-recordings of the interviews accurately to protect the confidentiality of each response of the respondents. To keep the teacher's voice intact, I transcribed the interviews, laying the focus on the speaker (Christopher, 2017). I audio-recorded teacher conversations for the sake of anonymity; the names of the respondent participants, their institutions, and their addresses are all pseudonyms. As a result, any identities stated could ensure the privacy of all parties involved.

Creswell (2009) stated that analysing the qualitative data refers to the process of sense making through the texts and images collected to answer the research questions. This included my complete process of interpreting and developing insights from raw data/information. It also included data categorization, theme generation, reporting findings, and ultimately qualitative tool interpretation. In summary, to get a better comprehension of the stories I used Aronson's four-stage theme analysis methodology to

conduct thematic analysis of the interview transcripts utilizing manual coding approaches (Aronson, 1995 as cited in Dahal, 2017). These include the collection of data in the form of interviews and transcripts, and the analysis of thematic patterns found by analysing text for meaning making.

Current Practices of Assessment of Mathematics Teachers

Assessment with Life Context

Teachers created a learning environment by connecting real-life examples with mathematics assessment. They provided the mathematical knowledge and skills associated with unitary methods, money exchange, simple and compound interest, area and volume measurement etc. to the students. This led the students to construct their mathematics knowledge in a comfortable scenario. There are discussions worldwide over whether the goal of mathematics education should be to prepare students for future mathematics studies or to use mathematics to solve problems relevant to their future living situation (Bansilal & Debba, 2012). In order for students to learn essential mathematical skills, teachers must actively participate in determining the context. Students are increasingly confident in situations that are more familiar to them. A background created by nature, society, and everyday life can be extremely stimulating for students. To help students progress in their mathematics understanding, it is vital to build concrete ties between the context and the mathematical ideas (Widjaja, 2013). The application of mathematics in regular activities involves the use of real-world examples.

Relevancy of Curricula in Students' Activities

Teachers must relate mathematics to their students' backgrounds and perspectives

of the curriculum. In this regard, Pant (2015) has focused that when the mathematical contents are relevant to everyday society and culture of students, they are likely to memorize them for a long time. Mathematics shapes our experience at work and must be accessible and practical for students to understand. This argument explains why teachers should place a high priority on students' daily activities. By explaining the function of mathematics in regulating our daily lives through a broad variety of accessible mathematics technologies, mathematics shapes our experiences at work. Legner (2013) stated that a large part of the secondary mathematics curriculum does indeed not seem very useful in everyday life. The application of mathematics in our regular activities comprises employing concrete examples of the environment to stimulate students' interest. As a result, we must construct the curriculum to meet the needs of the social and cultural context. In this connection, Johnson (2017) stated that broad implications of mathematics, unlike its practical, everyday applications, are skills that can be utilized in a variety of circumstances. This is a tough challenge, but I think it will help them become thinkers that are more creative and improve their understanding of the subject.

Equity and Opportunity in Assessment

Mathematics teachers should not discriminate against students because of their gender, ethnicity, religion, or habits. They need to value students' experiences to provide them with opportunity and equity. The labelling of students assessment results for the access to higher classes, institutions or placement in jobs, it becomes a challengeable issue for the attainment of equity (de Lange, 1999). The tendency toward more complicated and authentic assessment, as well as extensive written responses, might generate severe

equity concerns. This is because learning mathematics in various environments can affect outcomes for specific groups.

In the context of Nepal, Budathoki (2017) advocated that since every mathematics classroom is heterogeneous in terms of students' achievement, socio-cultural practices, power-sharing and opportunities for resources. Inquiry practices in mathematics teaching can be effective tools for organizing them together. Classroom communities are to advocate for a just society, where everyone enjoys an equal opportunity to flourish.

Class Work as an Assessment

Mathematics teachers need to focus on the class work of their students. Practice makes a student perfect at problem solving in mathematics. After the completion of any mathematics topic, they conduct class tests and unit tests on a regular basis. Students become more engaged in computing and problem-solving because of class work as a formative assessment and further get chances of the questioning about the issues to find solutions (Panthi, 2016). Assessment-based learning is more relevant and can help students refine their ideas. Group leaders pass on their knowledge of mathematics to a member of their group. They also assist their classmates in identifying the issues that arise in a competitive atmosphere. In addition, the teacher supports them in resolving the problems.

Watching and Caring of Students in Assessment

Acharya (2015) emphasized that students need active engagement in looking for patterns in mathematical solutions to problems, developing specific hypotheses, modifying these hypotheses, making assumptions, and defending their ideas. Students manipulate a series of

representations to accomplish this. Teachers who care for their students seek to address unfair power relationships in their classrooms without bias to improve the performance of all students. In this context, Panthi (2016) highlighted that individualized teaching is extremely important for marginalized, frail, or sluggish students. Teachers need to care for marginalized, disadvantaged, slow, and weak students for the meaningful understanding of mathematics. With a caring relationship, teachers work to understand whether each student has dignity regarding engagement with mathematics. This contributes to the achievement of mathematical justice inside the classroom.

Extra Classes in Mathematics and Individual Support

Students can increase their learning habits when teachers support them for additional time, except in regular classes. If a school serves a largely poor population, it may need to spend additional time on students' special needs. Such schools also need to provide sufficient time for the support of students' mathematical understanding. In the course of class work as stated by Pijls & Dekker (2011), mathematics teachers need to treat students individually so that each student can improve his/her performance. Teachers need to be able to respond to the needs of individual students according to their needs and thinking. However, it may not be possible for teachers who teach large numbers of students to do so. In this situation, teachers need to concentrate more on low-performing and backward students individually.

Assessment in Groups

According to Ampadu (2012), the teacher can employ an assessment system where the instructor scores a group's activities depending on the quality of the group's discussions. One of the main roles of a group

leader is to be responsible for appropriate understanding of all members. Group leaders will make a decision after talking to their group members and talking to their teacher. Schunk (2012) argued that constructivist classrooms use student activities, interpersonal interactions, and rigorous assessments to teach the main mathematical concepts. Teachers explore ideas of students constantly during this process, and there is less emphasis on surface learning and more emphasis on deeper comprehension than in regular classes.

Dhakal (2017) stated that group learning is known as a collaborative classroom. Group leaders cooperate with other members of their group and solve problems, which decreases the burden on teachers. Every group learns more from his/her group.

Dandis (2013) focused that other techniques of assessment, such as group work, contests, encouraging students to participate in a group work, and verbally presenting their work can enhance learning in groups. Many testing strategies emphasize personal responsibility. In a genuinely cooperative way, everyone is actively involved in finding a solution to the problem. When students are actively participating in the assessment, their performance working cooperatively would be a valid indicator of individual competency for many different subject areas.

Regular Assignments to Students

Teachers should provide assignments for their students so that they can develop a continuous learning habit and motivate them to learn mathematics. Teachers can also identify students' abilities, and it supports treating them accordingly. This practice increases student performance and makes them more prepared for the real world. Acharya (2015) argued that students might use projects as an assignment to overcome challenging aspects of their lives. Despite the fact that

the heterogeneous classroom is a chorus of differences, the students are likely to share more similarities than disparities. I also found that giving regular assignments supports reducing injustice in the classroom. All students can be busy doing assignments at home. Consequently, they can improve their computational skills and knowledge of mathematics. Therefore, teachers need to encourage students to do assignments regularly.

Peer Assessment in Cooperative Learning

Cooperative learning is an approach to teaching that encourages students to participate actively in classroom activities and, as a result, builds their confidence. The relevancy of the cooperative learning method in our classroom situation is through academic achievement made by the students. As part of a peer assessment, students can score a typical test with comments from peer students. By collaboration, they have started to learn comfortably in peer groups and feel free from such a mathematics-phobia. Pengiran et al. (2018) argued that by being introspective when analysing or marking their peers' work, the student benefits from peer assessment. Peer assessment frequently includes assessing others' work. This allows students to discover and make judgement about their work by thinking deeply and reflecting on it. It provides them with a learning opportunity.

Curiosity and Motivation of Students in Assessment

The curiosity and motivation of students in mathematics assessment have a vital role in increasing the learning achievement of students in mathematics. Motivation is an incentive or reward for completing a task. Dahal (2019) emphasized that stimulating and inspiring students to learn a mathematical idea is difficult due to a number of indicators that can directly

affect students' achievement in mathematics. Teachers' enthusiasm, relevance, and appropriateness of materials, organization of the course, active involvement of students, variety, and rapport between teacher and students are the primary characteristics of students' motivation. Motivation is essential for good mathematics learning, and it is one of the pedagogical factors.

Acharya (2015) argued, "Positive attitude creates enjoyment, enthusiasm, fascination, and appreciation that help to bring joy in learning. People will most likely avoid or postpone doing it if their attitude is negative" (p. 58). Because students are more likely to internalize the conversation observed in the group, motivation in students facilitates the development of cognitive operations in them. In this way, the method seemed popular among students and made each level of student more hopeful. Therefore, the relevancy of this method has a similar wavelength to the pre-existing thought. Dahal (2019) further argued that facilitators can help students by giving constructive feedback and encouraging them with guidance. I had recognized the usefulness of tools in assessment and the feedback of teachers in such educational processes construct assessment tasks, or even complete projects.

Feedback in Assessment

According to de Lange (1999), feedback is critical in the discussion form, although it might be difficult to provide. Teachers must adjust immediately, but without much time to reflect. Feedback from teachers has typically emerged as a tool for students to assess their development (Ginsburg, 2009). Teachers have a crucial impact on supporting students to understand the self-evaluation approach. They risk the opportunity of misinterpreting a student's comment. Feedback also underpins a task

as a cueing approach. It results in more effective information acquisition and implementation of task strategies. The idea is supported by Dahal (2016), as he believes that feedback from teachers is a powerful component of ongoing assessment, which de/motivates learners to learn progressively. It may be very powerful if carried out well. Consequently, there should be a strong link between student action and teacher feedback.

Findings of the Study

Mathematics teachers are adopting new ways to encourage students' understanding of the subject, such as extra classes and individual treatments for students with learning disabilities. In-service teachers have taken assessments to empower their students' mathematics learning with much focus on class work rather than assessment in a classroom setting. By adopting these methods of assessment, teachers are encouraged to see diversity among students as an asset in the classroom in order to create a dynamic instructional and assessment environment (Dawadi, 2018). In-service secondary level mathematics teachers are keen on providing regular assignments to students as a part of mathematics assessment. From my study, I found as stated by De Luca et al. (2012) that within the current educational atmosphere, teachers have been able to implement an assessment structure that encourages student learn effectively. Furthermore, I found that secondary teachers prefer collaborative and peer assessment as well as contextual assessment in mathematics classroom.

Participant teachers during their teaching have raised substantial curiosity and motivation among their students. As stated by Ampadu (2012) that when students interact with the world and encounter a variety of ideas, the teacher plays an

important role in facilitating and leading them in developing suitable knowledge and skills. The in-service participant teachers provided enough feedback in assessment to promote students' mathematics learning. Thapa (2016) advocated that teachers employ assessment to plan for proper feedback to students in order to provide a successful learning environment. It is implemented honestly in collaboration with the student. It implies that excellent performance of teachers has a significant impact on learning outcomes of students (Sharma, 2016). The respondent participants mostly apply constructivism and social constructivism to promote mathematics learning of students through assessment and learning.

Conclusions

My study showed as stated by Klenowski (2009)2001 that assessment is founded on a vision of the learning is an active process. Teachers' activities emphasize meaningful understanding and knowledge construction in the mathematics classroom. Teachers found such practices very useful for enhancing students' learning and empowering them. Teachers have been practising their actual participation and contribution in mathematics learning through assessment. They regarded students as potential resources for mathematics knowledge. Teachers have the power to make classroom activities more inclusive, and to make mathematics learning more socio-culturally encapsulated and value-laden. The study concludes that mathematics assessment practices offer teachers a variety of opportunities to change their usual practices.

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