

Secondary mathematics teachers' conceptions of assessment

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Teachers' conceptions play an important role in their instructional practices. In this study, the researcher explored a small sample of Fijian secondary school mathematics teachers' conceptions of assessment. Thirteen mathematics teachers from two case study schools took part in this study that utilised one-to-one interviews to gain insights into teachers' beliefs on the purposes of assessment. The findings further indicate that a majority of the teachers held contemporary conceptions of assessment. While they did value summative assessment roles, teachers tended to support the use of assessments to improve or support student learning.

The term assessment can be interpreted in different ways by different stakeholders. For example, while some teachers see assessment as an activity that is used to improve classroom instruction, others may value it as a means of establishing accountability within the school. Moreover, some may even perceive assessment as an activity that has no value at all (Brown 2003, 2004). In other words, varying conceptions of assessments can be placed on a continuum that has traditional conceptions on one end and the other representing contemporary conceptions. For example, teachers can, on one hand believe that assessments serve solely accountability purposes (and seen as irrelevant (Brown, 2004)), while on the other end of the continuum of conceptions, they may see assessments as purely an activity with a pedagogical aim. Educators can hold mixed beliefs, representing any point on the traditional–contemporary continuum. For the purpose of this study, we define conceptions following Brown (2004) as a guiding framework used by an individual to understand, respond to, and interact with a given phenomenon. In other words, teachers' conceptions of assessment can include their beliefs, attitudes, or perceptions (Harris & Brown, 2016).

Research suggests that such a continuum of teacher conceptions is likely when teachers are asked to list various purposes of assessment (Barnes et al., 2015). Apart from the 'purposes' category, assessments can be differentiated using other criteria such as nature of tasks used, cognitive demands associated with tasks, including frequency and grading of assessments (Wallace & White, 2014). The traditional-contemporary continuum of assessment can be seen as parallel to the commonly used summative-formative classification. Summative assessments are those that usually come in the form of standardized tests, measuring terminal performance while formative assessments represent any assessments that are designed primarily to support student learning (William, 2007, p.1053).

Teachers' conceptions play an important role in their instructional practices (Ashton, 2015; Buehl & Beck, 2015; Marshall & Drummond, 2006; Skott, 2015). Despite notable progress in re-thinking learning and assessment over the past two decades, there exists many different understandings of the term assessment and other associated terms such as formative assessment (van de Watering et al., 2008). For example, Popham (2014) explains that American educators usually see teachers' role in formative assessment as more important than students' roles in improving their own learning.

Differences in conceptions therefore could mean that teachers take relatively different perspectives on using assessment information. There is sufficient evidence that assessments, when developed and used appropriately, would lead to improved student learning (Black & William, 1998). In the Fijian secondary education context, assessments are generally

conducted to prepare the learners for the external examinations at the end of the year. As such, the majority of the ongoing assessments take the form of written examinations that are similar in content and structure to the national examinations. In light of the relative importance of teacher conceptions, this study aimed to explore how a small group of Fijian secondary mathematics teachers' perceived assessments amidst an examination-oriented education system. While the study reported here was part of a larger study that aimed to explore how well mathematics teachers took up formative assessment practices (Dayal & Cowie, 2019), exploring teachers' initial conceptions about assessment was seen as an important part of the larger study's context. The following research question guided this study: *What are Fijian secondary mathematics teachers' conceptions of assessment? Are Fijian secondary mathematics teachers' able to conceptualise the contemporary purposes of assessment?*

After presenting the sociocultural framework used for this study, a brief review of literature is provided. This is followed by research methods, results, and discussion. Finally, some conclusions and implications are outlined.

Theoretical Orientation

Brown and colleagues have identified the following four teacher conceptions of assessment. These include assessment serving four distinct purposes: improving teaching and learning; holding students accountable for learning; making schools and teachers accountable for student learning, and assessment serving no legitimate purpose in schooling (Brown 2003; Brown 2004; Brown & Hirschfeld 2007). The first conception presents a rather fallibilist or humanist view of assessment. It sees assessment as learner-focused, for joint use by students and teachers to improve teaching and learning. This conception blends well with the idea of formative assessments or 'assessment for learning' loosely defined as any activity from which the elicited information is actually used to make changes to teaching and learning with the view to improve learning (Black & Wiliam, 1998). Formative assessments are in line with student-centred learning and Sheppard (2000) calls this the emergent assessment paradigm. Formative assessments are more about feedback that could be used to improve learning. Such a view of learning and teaching is consistent with the sociocultural theory that regards knowledge as fallible and a product of human creativity. This view of knowledge means that learning or knowledge creation is seen as a social process in which the learner is an active participant.

Conceptions not confined to this contemporary end of the assessment conceptions continuum would fall somewhere in between and would likely be represented by the other remaining conceptions identified by Brown and colleagues. At or near the traditional end, assessments serve rather authoritarian roles such as measuring how much learning has taken place, monitoring, recording and reporting students' performance, and holding individuals and institutions accountable for their actions. Toward this traditional end, knowledge is seen as objective and infallible (Sheppard, 2000; Wallace & White, 2014). Seen from this perspective, assessment's purpose is mainly for grading and certification. Such conceptions align well with the behaviorist ideas and sees assessment as merely measuring students' learning using quantitative methods. While realizing the important roles of assessment, this study took sides with Popham (2014) who claimed we must not rely only on traditional notions of assessment but should, instead, consider those conceptions of assessment that support effective teaching and learning. This paper conjectures that mathematics teachers would benefit a lot with a contemporary conception of assessment.

Literature Review

Hui and Brown (2010), in their study involving primary school teachers' in Hong Kong, revealed that these teachers were very well aware of the "improvement" purpose of assessment. In other words, the Hong Kong teachers generally held an 'assessment for learning' conception of assessment. The study did note, however, that some teachers also held accountability conceptions of assessment. Their data indicated that some teachers believed that the assessment tasks they designed were also valid for "accountability" and "examination" purposes. The study concluded that the prevalence of accountability as well as examinations conceptions of assessment among Chinese teachers may hinder the successful implementation of an assessment-for-learning policy.

In another study, involving Fijian pre-service and in-service teachers, Dayal and Lingam (2015) also noted that teachers held multiple conceptions of assessment. While a majority of the seventy participants' initial understandings aligned to a traditional conception that involved measuring students' performance, some of the participants agreed that assessments could have formative functions when they were asked to list down other major purposes of assessment. The study revealed that a higher proportion of pre-service teachers held an 'assessment of learning' conception of assessment in comparison to the teachers who had some years of teaching experience. This was revealed when both group of teachers were asked to choose from two different roles of assessment that they would favour: the master role, indicating 'whatever assessed should be given importance', against the servant role which suggested that 'whatever is important should be assessed'. Of the practicing teachers, 74% favoured the servant role, compared to only 30% of the pre-service teachers. The authors, however, showed concerns regarding a good number of in-service teachers still holding a narrower view of assessment. Dayal and Lingam's (2017) study utilized an open-ended questionnaire to explore pre-service and in-service teachers' beliefs about the two major purposes of assessment. Their findings confirmed that pre-service and in-service teachers could hold beliefs which are in support of summative assessment, formative assessment, or both types of assessment. Majority of the pre-service and in-service group gave explicit support in favour of formative assessments. None of the participants, however, noted that both forms of assessment are irrelevant, contrary to findings such as Brown (2004).

In terms of how secondary mathematics teachers perceive assessments, one notable, yet small study was that of Wallace and White (2014). The authors followed six pre-service mathematics teachers through what they termed a reform-minded teacher education programme in the United States. A notable feature of these programs was the inclusion of assessment ideas embedded in course assignments. The study's findings confirmed that pre-service secondary mathematics teachers initially held traditional perspectives on assessing student learning. The authors called this the 'test-oriented' perspective, characterised by assessment beliefs such as: assessments are tests, the purpose of assessment is to provide a grade, and assessment involves closed-ended tasks. The study noted that the pre-service teachers could modify their assessment practices by evolving through the 'task-oriented' and 'tool-oriented' perspectives on assessment. The latter represented the developmental phase where these pre-service teachers were able to see assessments as designing new ways that would help facilitate student learning.

The studies reviewed here and others such as Nisbet and Warren (2000) and Smith et al. (2014), confirm that both practicing and pre-service teachers have different conceptions of assessments. Some of these studies also point out that different assessment perspectives may have the potential to lead to different assessment practices, and the inherent need to explore

teachers' conceptions of assessment. Studies such as Wallace and White provide evidence that teachers can modify their assessment-related conceptions when given support. While this is not an explicit aim of the current study, exploring the conceptions of a small group of practicing Fijian mathematics teachers will add to our understanding of how assessments are perceived by mathematics teachers. The context of our study is presented next.

Context and Methods

The participants in this study were 13 mathematics teachers from the two case study schools: *Marau College* and *Kaivata College* (pseudonyms used). *Marau College* had nine teachers in the Mathematics Department, and *Kaivata College* had only four. The mathematics teachers had taught for an average of 9 years, ranging from 20 years to only three years. All of them had tertiary qualifications. For the five male and eight female teachers, real names are replaced by pseudonyms beginning with the letters A to M, the letters indicating the order in which the interviews were carried out. In order to elicit teachers' conceptions of assessment, one-to-one interviews were held at the teacher's respective schools. One-to-one interviews seemed suitable for two reasons. Firstly, it allowed the teacher participants to express freely their beliefs and experiences with assessments in mathematics. Secondly, the one-to-one interviews helped the researcher know the participants better, and this helped build positive relationships for the later phases of the study that involved teachers as key stakeholders in research (Kieran et al., 2013). On average, one interview lasted for fifteen minutes. The study utilised the following prompts for the interviews:

1. Think of the term *Assessment*. What comes to mind? List as many ideas as possible.
2. What is the main purpose of assessment? What are some other purposes of assessment?

All thirteen interviews were audio taped and transcribed. The interview data were analysed using traditional–contemporary continuum presented under the theoretical framework of the study. For example, upon transcribing the interviews, each response was read in full and the keywords or phrases that represented each participant's beliefs about assessment were highlighted and placed under either traditional or contemporary conceptions. For example, if the participants used the keywords or phrases that resembled traditional conceptions of assessment such as 'grading', 'passing an exam', 'measuring' or 'testing', these participants were classified as showing a traditional conception of assessment.

Results

This section presents the findings of the study.

Assessment Purposes

While all thirteen participants were able to define the term assessment, only five of the participants showed a narrower, traditional view of assessment. For these teachers, assessment essentially meant "testing students' knowledge" (Ella) , or "getting to know whether the students have got the content we have taught" (Cathy) , "to test whether students have understood and whether they are revising their work" (Fran), and "to know how much they know" (Bhim). A strong focus on answering the 'how much' question, coupled with ideas related to 'testing' or 'exams' revealed that, for this group, assessment meant answering the question 'how much does a student know?', thus reflecting a traditional,

measurement view of assessment. For example, Jenny, in her description of assessment said that assessment is “the test given to see how much students have learnt from something” and “it is an activity to grade the students”. When asked about the major purpose of assessment, Jenny replied: “To rank”. When asked to list a few other purposes, she said “to test and select the best”. From Jenny’s interview account, it could be said that she had a strong inclination towards an ‘assessment of learning’ view of assessment. This view of assessment has a strong leaning towards a testing culture, promoting competition, and using examination results to select students for placements. In her interview, Jenny revealed that she did not use assessments in a formative manner.

For the rest of the participants, assessment was more than ‘testing’. For example, Kumar said that assessment meant “monitoring the performance throughout the year”. Her definition viewed assessment as a continuous event, and not a one-off task. A similar view was given by Ledua, who said that “assessment is an ongoing process to see if the student is learning the concepts or not”. Isha listed a number of ideas such as “exam, presentation, short test, assignments, tutorials, oral assessment, quiz and class-based assessment (CBA)” when talking about her views on assessment. She showed strong emotions against summative assessment – “sometimes assessment is like a ‘torture’ to students, especially the three- hour exams.” Gavin showed an understanding that assessment not only concerned the students but also the teachers when he stated that “assessment is something which tells me how I have done in my class as a teacher”. Overall, the majority of the teachers showed an expanded, contemporary view of assessment in their initial discussions on assessment. These views had elements of formative assessments such as views about having multiple forms of assessment; views about assessment as a continuous process; and views about assessment as informing the teachers on their work as well.

When asked to recall the major purpose of assessment, the teachers in this study exhibited the same tendency. Those who had initially shown a measurement view of assessment (Ella, Cathy, Fran, Bhim and Jenny) listed its summative function as the main aim of assessment. Examples of these included: “To test the students’ knowledge” (Fran), and “to test students’ ability” (Bhim). When asked to list any other purposes of assessment, three out of the five teachers were able to pick up some formative aims of assessment. For example, Cathy referred to teachers’ teaching techniques and how assessment could help teachers know how they are performing. Ella stated that teachers could work on weaker students as a result of assessment. However, this group of teachers was still hanging on with their initial ideas about testing and examinations. As Ella noted, “if they have done a test, they have got low marks, it means we place more time on them.” Only two teachers, Bhim and Jenny, in this group were unable to list any formative purposes of assessment. In their view, all purposes of assessment were summative in nature. Excerpts from Jenny’s interview are shared below:

Researcher: In your view, what is the major purpose of assessment?

Jenny: To test the students’ ability, to assess students and to know how much they know.

Researcher: Can you think of any other purpose?

Jenny: To pass exams and go to higher level?

Researcher: Any others?

Jenny: Ummm...to see which students are, I mean good at which particular field, and whether they are supposed to go to tertiary institutions.

The other eight participants had listed formative assessment practices as one or more of the purposes of assessment. For example, Dan explained that the major purpose was for “us to know how well the students have learnt”. He went further to claim that assessment “helps us to improve in our weak areas”. For Ana, assessment helped provide feedback not only to the students but also to the teachers. She showed formative aims or purposes when she claimed that “tests are not always giving us all about learning.” Mere claimed that the main purpose of assessment was to help students to learn. Apart from this, she added that assessment is used “to improve students’ learning and teachers’ teaching – when the activities I have given have not been done well, I come back and re-think about my teaching strategies.” Another teacher, Gavin, held similar beliefs about assessment. His views about assessment reflected an inclination toward the formative view of assessment as well. He viewed assessment as something “which tells how I have done as a teacher”. For him, good assessment meant that he had to “re-look at what students have given me and what I expected as the correct answer. If there were some differences, I have to do that again, or re-design my class and take another approach”. These statements reveal that this group of teachers had strong views about the role of feedback in assessment. Their overall view of assessment could be classified as being more aligned towards assessment for learning.

Teachers in this group had also shown a combination of summative and formative purposes. For example, Isha mentioned “gaining certification” as the second purpose of assessment. In summary, majority of the participants were well versed in both summative and formative purposes of assessment. This group of teachers seemed to favour formative practices much more than summative or measurement purposes of assessment. Some even had strongly rejected the idea of “testing” alone. These sentiments are clearly visible in the accounts of some of these teachers: “the current assessment (three-hour exams) does not tell much as it is just a paper and pencil test – a lot of writing and recalling is involved. Learning/expressing is not there” (Isha); “assessment in mathematics can be very broad, in various forms. In my school, we just assess using paper work. We can assess by doing more practical work. There can be theory and practical assessment” (Haris). The views expressed by teachers suggest that they value formative assessment even more than summative assessment.

Discussion and Conclusion

Two types of assessment have been well distinguished in the assessment literature – summative and formative assessment, although these may not necessarily be mutually exclusive dimensions. A more productive view about assessment is the former and this is in line with the socio-cultural views of learning (Sheppard, 2000). Only five of the participants held a narrow, summative view of assessment. Two of these five (Jenny and Bhim) had very strong traditional conceptions of assessment, while the other three showed some support for formative assessments. This group of teachers tended to value the testing and grading function of assessment more. One reason for this could be that these teachers simply disregard the value of formative assessments. Another reason could be that they may not have used formative assessment practices well and thus may not have experienced any positive consequences of such assessments on student learning. The latter is more likely given the examination-oriented education system in Fiji.

Eight of the 13 participants held contemporary conceptions of assessment. While they did value summative assessment roles, teachers tended to support the use of assessments to improve or support student learning. Despite working in an environment dominated by the summative culture, it is interesting how this group of teachers supported the idea of formative assessment. It would be worth investigating how these beliefs are formed. Initial instincts, including understanding gained from sociocultural perspectives suggest that personal experiences with the use of summative testing may be one of the factors. As one teacher indicated, three-hour examinations are a kind of ‘torture’ to pupils’ brains. From a social perspective, it can be argued that while summative examinations have been part of the Fijian education system from decades, teachers may have had bad experiences with summative assessments. It may also be inferred that the teachers in this study had seen that there are no real learning benefits from too much summative testing. It is interesting to note that a majority of the mathematics teachers do not render much support for traditional assessment practices, although they use such ‘examinations questions’ in their usual classroom teaching. Such a finding is consistent with previous studies like Dayal and Lingam (2015, 2017) that noted a relatively higher percentage of practicing teachers who favoured formative assessment practices. Ashton (2015) noted that belief systems rely heavily on evaluative and affective components. This may, to some extent, mean that a majority of the teachers in this study have negative feelings about summative assessments. In summary, it can be said that while cultural aspects may have affected the teachers’ beliefs about the nature of mathematics, personal experiences, including external factors such as school and national policies may have had some impact on shaping the teachers’ beliefs about learning, teaching and assessment.

References

- Wallace, M., & White, T. (2014). Secondary mathematics preservice teachers’ assessment perspectives and practices: an evolutionary portrait. *Mathematics Teacher Education and Development*, 16(2), 25–45.
- Ashton, P. T. (2015). Historical overview and theoretical perspectives of research on teacher beliefs. In H. Fives & M. G. Gill (Eds.), *International handbook of research on teachers’ beliefs* (pp. 31–47). NY: Routledge.
- Barnes, N., Fives, H., & Dacey, C. M. (2015). Teachers’ beliefs about assessment. In H. Fives & M. G. Gill (Eds.), *International handbook of research on teachers’ beliefs* (pp. 284–300). London: Routledge.
- Black, P., & Wiliam, D. (1998). *Inside the black box: Raising standards through classroom assessment*. London: Kings College.
- Brown, G. T. L. (2004). Teachers’ conceptions of assessment: Implications for policy and professional development. *Assessment in Education*, 11(3), 301–318.
- Brown, G.T. L., & Hirschfeld, G. H. F. (2007). Students’ conceptions of assessment and mathematics: Self-regulation raises achievement. *Australian Journal of Educational and Developmental Psychology*, 7, 63–74.
- Buehl, M. M., & Beck, J. S. (2015). The relationship between teachers’ beliefs and teachers’ practices. In H. Fives & M. G. Gill (Eds.), *International handbook of research on teachers’ beliefs* (pp.66-84). London: Routledge.
- Dayal, H. C. & Cowie, B. (2019). Professional Learning Intervention in Mathematics: A Case of Developing Portfolio Assessment. *Australian Journal of Teacher Education*. <https://ro.ecu.au/ajte/vol44/iss2/7>
- Dayal, H. C. & Lingam, G. I. (2017). Formative or summative? Preservice and inservice teachers’ conceptions of assessment. *Directions*, 33.
- Dayal, H. C. & Lingam, G. I. (2015). Fijian teachers’ conceptions of assessment. *Australian Journal of Teacher Education*, 40(8), 43–58.
- Harris, L. R., & Brown, G. T. L. (2016). The human and social experience of assessment: Valuing the person and context. In G. T. L. Brown & L. R. Harris (Eds.), *Handbook of human and social conditions in assessment* (pp. 1-17). London: Routledge.

- Hattie, J. (2016). Forward. In G. T. L. Brown & L. R. Harris (Eds.), *Handbook of human and social conditions in assessment* (pp. x–xiii). London: Routledge.
- Heritage, M. (2014). *Formative assessment in practice: A process of inquiry and action*. Cambridge: Harvard Education Press.
- Hui, S. K. F., & Brown, G. T. L. (2010). *Contrasting teacher's espoused and enacted classroom assessment: Exploring Hong Kong Chinese teachers' conceptions of assessment*. Paper presented at The International Association for Educational Assessment (IAEA) 36th annual conference, Bangkok, Thailand.
- Kieran, C., Karabiner, K., & Shaughnessy, J. M. (2013). Linking research to practice: Teachers as key stakeholders in mathematics education research. In M. A. (Ken) Clements, A. Bishop, C. Keitel, J. Kilpatrick, & F. K. S. Leung (Eds.), *Third international handbook of mathematics education* (pp 361–392). NY: Springer.
- Marshall, B., & Drummond, M. J. (2006). How teachers engage with assessment for learning: Lessons from the classroom. *Research Papers in Education*, 21(2), 133–149. <https://doi.org/10.1080/02671520600615638>
- Nisbet, S., & Warren, E. (2000). Primary school teachers' beliefs relating to mathematics, teaching and assessing mathematics and factors that influence these beliefs. *Mathematics Teacher Education and Development*, 2, 34–47.
- Oliveri, M. E., Gundersen-Bryden, B., & Ercikan, K. (2013). Scoring issues in large-scale assessments. In M. Simon, K. Ercikan, & M. Rousseau (Eds.), *Improving large-scale assessment in education: theory, issues, and practices* (pp. 143–152). New York: Routledge.
- Scott, J. (2015). The promises, problems, and prospects of research on teachers' beliefs. In H. Fives & M. G. Gill (Eds.), *International handbook of research on teachers' beliefs* (pp.13-30). London: Routledge.
- Sheppard, L. (2000). The role of assessment in a learning culture. *Educational Researcher*, 29(7), 4–14.
- Smith, L. F., Hill, M. F., Cowie, B., & Gilmore, A. (2014). Preparing teachers to use the enabling power of assessment. In C. Wyatt-Smith, V. Klenowski, & P. Colbert (Eds.), *Designing assessment for quality learning* (pp. 303–323). NY: Springer.
- Van de Watering, G., Gijbels, D., Dochy, F., & van der Rijt, J. (2008). Students' assessment preferences, perceptions of assessment and their relationships to study results. *Higher Education* 56, 645–658. <https://doi.org/10.1007/s10734-008-9116-6>
- Vandeyar, S., & Killen, R. (2007). Educators' conceptions and practice of classroom assessment in post-apartheid South Africa. *South African Journal of Education*, 27(5), 101–115.
- Wiliam, D. (2007). Keeping learning on track: Classroom assessment and the regulation of learning. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp 1053–1098). Charlotte, NC: Information Age Publishing.