

## **Assessment Practices in Secondary-school Mathematics Teaching in Brazil**

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Classroom-based assessment has been a matter of concern and discussion in academia, especially in recent years. Many studies have been conducted, particularly about the implementation of formative assessment. Although it has been heralded as an important practice, there is still little research about this subject related to mathematics education, particularly in Brazil. Aiming to seek information about the types of approach that secondary-school mathematics teachers in Brazil have been taking in their classrooms, survey research was conducted via an e-questionnaire. The teachers were asked, among other aspects, about the frequency with which they apply and the importance they give to specific assessment methods or procedures. The results from the quantitative analysis show that tests and homework assignments are the methods most commonly used by mathematics teachers, whereas self- and peer-assessment are still not common practice.

**Keywords: Assessment, mathematics, secondary school, Brazil**

### **Introduction**

The issue of assessment has been a subject of intense research. Discussions concerning the importance and purposes of assessment have played a central role among researchers, particularly about its formative and summative functions, with evidence that the former improves learning (Black and Wiliam, 1998).

Even so, as argued by some researchers (James and Lewis, 2012; Shepard, 2002), it seems that the re-shaping of assessment is not occurring at the same pace as the re-shaping of instruction.

Recognising the relevance of teachers' conduct to the development of assessment practices, the present study aimed to analyse which types of approach have been adopted by secondary-school mathematics teachers in Brazil to assess their students. This study also aimed to analyse if there is any evidence that they are implementing assessment with a formative purpose.

### **Teachers' Assessment Practices**

The expression *assessment practices* does not simply refer to techniques, procedures or instruments. It has a broader meaning, covering events that occur in the assessment of daily schoolwork. Both formal procedures, i.e. those that are planned and which inform students that they are being evaluated (e.g. tests and homework); and informal procedures, that occur through the interaction of teachers with students and the students themselves (e.g. observations of students' responses in class), can be included in these criteria.

Black and Wiliam (1998), discuss the results of studies conducted by Crooks (1988) and Black (1993), which revealed many weaknesses in assessment practices:

- The practices generally encouraged superficial and mechanical learning;
- Teachers, in general, did not review the assessment tasks and procedures. Moreover, they were not critically discussed with the students, which indicated little reflection on what was being assessed;
- The attribution of marks was the primary purpose rather than the promotion of learning;
- There was a tendency to conduct norm-referenced rather than criterion-referenced assessment.

Susuwele-Banda (2005), using a questionnaire, interviews and observations concluded that teachers perceive classroom assessment as tests that they give to their students at specific time intervals. Moreover, as they perceive classroom assessment as tests, they showed a limited ability to use different methods and tools to assess their students.

In contrast, Pacheco (2007) investigated primary teachers' assessment conceptions in Brazil and found that, although the participants are still implementing assessment for summative purposes, they recognise the importance of formative assessment and the use of diverse instruments and procedures to assess their students.

The same characteristics were found in the study conducted by Albuquerque (2012), who concluded that, although teachers recognised the necessity of using different methods and instruments to assess their students, the two methods that they used widely are homework assignments and tests. Indeed, some of them still use tests as the only method based on the justification that it is the most practical and objective method, and also because of the time constraints and number of students per class. Homework was mentioned as being used only to provide marks related to the fulfilment of the task or otherwise.

In many cases, as reported by Johnston and McClune (2000), teachers adjust their teaching style in ways they perceive as necessary because of the tests. They spent most of the time on direct instruction and less on providing opportunities for their students to learn. Moreover, Harlen (2004) shows that the teachers' assessment practices are inevitably influenced by the external assessment and that teachers often use these assessments as models for their own, even if they do not use them directly.

However, there is a major thrust of new research and professional thinking about assessment that has been seeking to distinguish the formative and summative functions and suitability of various types of assessment methods for these different purposes.

Frohbieter et al. (2011), for example, analysed three mathematics formative assessment programmes in the US, which showed many different approaches to assessment. Several teachers reported using some form of warm-up exercises and/or pre-assessment at the beginning of an instructional unit in order to determine whether or not their students had specific skills or had mastered the topics that would be covered. Some teachers also reported using these assessments to understand some of the more common mistakes made by their pupils as well as exploring where a solution process had broken down and why, or describing a partially-correct conception that produced the right answers only in certain cases. Many of them pointed out that they preferred using tests with open-ended questions (constructed-answers) because this allows them to see what their students are thinking a lot more clearly. In addition to tests, some teachers reported using informal observations, quizzes and homework assignments.

While Frohbieter et al. (2011) analysed the current practices of the teachers, Black et al. (2003) focused their attention in the King's-Medway-Oxfordshire

Formative Assessment Project (KMOFAP) on innovative strategies that emerged from teachers' participation in the project. Teachers made changes in relation to classroom questioning, feedback through marking, peer- and self-assessment, and the formative use of summative tests. In order to take a formative approach in preparing their students for summative tests, the teachers encouraged the pupils to use *traffic lights* to improve their review schemes. The traffic lights were also used as a means for self-assessment. Teachers also encouraged pupils to generate and then answer their own questions.

Concerning classroom questioning, the teachers wanted to give more time to students to think about their responses; and this made them realise that it would also be necessary to spend more time designing those questions, so they would indeed evoke student understanding. In relation to *comments-only feedback*, some teachers simply stopped marking; others allocated marks only for their own records without showing them to the students, while others only gave marks after receiving answers from the students following the teachers' feedback. In this way, they started thinking about how they should write the feedback so the students could realise what they had already achieved and which specific areas they should improve and also how to engender attitudes that would make the students act upon the feedback given.

Based on the pieces of research reviewed and the fact that almost no research relating to Brazil was found, four specific research questions were addressed:

1. What types of approach have been adopted by mathematics teachers in Brazil to assess their students?
2. How are teachers using the information gathered from assessments?
3. Is there any evidence that professional development courses have influenced teachers' approach to assessment?
4. Is there any connection between teachers' conceptions and their approach to assessment?

In this paper, only results from research question 1 will be discussed.

## **Methodology**

As the main goal of this research was to explore what types of approaches have been adopted by secondary-school mathematics teachers in Brazil for assessing their students, we decided to implement an exploratory questionnaire survey (Cohen et al., 2011).

## **Sample**

The questionnaire was delivered to mathematics teachers in Brazil. However, Brazil is a huge country with approximately 70 000 secondary mathematics teachers. Due to the time and distance constraints and the large number of teachers in the population, we decided that the questionnaire would be delivered only to those who participated in the Gestar II Programme, which was a teacher-training course offered from 2008 to 2011 to those teaching in secondary schools.

The choice of this sample was made in order to facilitate the data collection, since one of the researchers was one of the trainers for the programme, and still had access to the participants. Moreover, having access to all the regions in Brazil would produce more accurate results about the assessments being used throughout the country. Thus, in this particular study, the sample can be characterised as an opportunistic sample that, conveniently for purpose, is already geographically clustered.

However, the choice of this sample carries some biases that were taken into account in the analysis and in the intention of generalising the results. The teachers who were nominated by the local government to take part in the Gestar II programme were chosen from amongst the more knowledgeable and/or professionally active teachers in order to guarantee that the training would be successful in its third level. Therefore, it might be expected that their assessment practices are more effective, with the students and the teaching-learning process playing a central role.

### ***Instrument***

For the present study, a structured e-questionnaire was adopted. It was designed using the web-application Qualtrics® and was divided into five sections: one section required the teachers to provide personal profile information, with the intention of defining the context and classifying the data. The second section was related to the frequency in which the teachers applied specific types of assessment and the importance they ascribe to each of them. Two sections were dedicated to better understand the use of tests and homework assignments. In the last section, the teachers were asked about the actions taken after the implementation of an assessment.

The response options provided for all questions were taken from other studies (Albuquerque, 2012; Black et al., 2003; Black and Wiliam, 1998b; Brookhart et al., 2004; Hodgen and Wiliam, 2006) as well as from our experience as mathematics teachers. The Portuguese version was developed using terms that are widely used in the Brazilian teachers' daily practices, and reviewed by a specialist in assessment in mathematics education (from Brazil). When judged necessary, some specific items had further explanation (e.g. long tests (taking more than one hour to complete)).

### ***Procedure and Data Analysis***

The questionnaire was sent out at the beginning of May 2012 and replies were accepted for approximately a month. The first step was to use descriptive statistics to determine the overall characteristics of the data. The relevant findings were organised in the form of tables and figures. After that, we divided the questionnaire according to the research questions, and cross-tabulation tables were generated to analyse the degree of association and homogeneity amongst all of the questions that were related.

With nominal variables, Chi-squared tests were applied and p-values were obtained through Monte-Carlo estimation to evaluate the statistical significance of the relationship between the questions, taking into account the degrees of freedom (df). The same steps were followed with regard to the ordinal variables, through a Kendall's tau-b test, which measures the relationship between two ordinal or ranked variables.

### ***Findings***

The questionnaire was answered by 332 mathematics teachers, which can be considered an acceptable sample size since this study was intended to be exploratory, where the findings were not intended to be generalised to the entire target population. The majority of the respondents were experienced teachers with more than 16 years of teaching experience, having at least a post-graduate degree. The Northeast was the region with most respondents (38.8%) and those from the North comprised the

minority (3.9%). The remainder was almost equally distributed among the Southeast, South and Midwest (18.7%, 18.7% and 19.9% respectively).

The types of assessment that had the highest number of responses in each category of frequency are presented in table 1.

Question 11: In assessing the work of the students in a typical class of yours, roughly how often do you use each of the following types of assessment?	Never	Annually	Termly	Monthly	Weekly	Daily
Q11.13: Portfolios of student work	<b>54.8%</b>	18.1%	14.2%	7.8%	2.7%	2.4%
Q11.12: Peer-assessment between students	<b>53.0%</b>	6.6%	12.0%	16.9%	9.9%	1.5%
Q11.1: Standardised tests produced outside the school	24.7%	<b>26.5%</b>	23.2%	16.3%	7.5%	1.8%
Q11.5: Long tests (taking more than one hour to complete)	24.4%	4.2%	<b>44.9%</b>	25.0%	0.6%	0.9%
Q11.2: Teacher-made tests involving open-ended questions	5.7%	2.1%	19.0%	<b>54.5%</b>	16.3%	2.4%
Q11.6: Homework assignments	2.7%	0.3%	1.2%	3.6%	<b>36.1%</b>	<b>56.0%</b>
Q11.10: Attention to responses of students in class	0.3%	0.0%	1.2%	2.1%	10.2%	<b>86.1%</b>

Table 1: Frequency of assessment types.

The result indicate that *portfolios of student work* (Q11.13) and *peer-assessment between students* (Q11.12) are the types of assessment that are least widely used among the respondents, since 54.8% and 53.0% of the total respectively, stated that they *never* use these methods to assess their students.

However, the same logic cannot be applied to conclude that *attention to responses of students in class* (Q11.10) is the method most used solely because the majority of teachers stated that they use it in their day-to-day classes. Different methods are expected to be used with different frequencies. That is to say, it is not expected, for example, to apply *long tests* on a daily basis, since the available time also needs to be used for teaching and learning activities, but it is perfectly reasonable to implement it on a *termly* basis.

Following this argument, it can be inferred that *attention to responses of students in class* (Q11.10) is the method most used on a *daily* basis (86.1% of the respondents), which is unsurprising since the teachers are considering their own actions, i.e., their observations of what the students are doing and saying in the classroom, as an important means of assessment. *Homework assignments* (Q11.6) were also indicated as being largely used on a *daily* (56.0%) and *weekly* basis (36.1%).

Different types of test were indicated as most commonly used on a *monthly*, *termly* or *annual* basis. However, it is important to notice that the number of teachers who affirm using *standardised tests produced outside the school* on an *annual* basis (26.5%) is almost the same as that of those who state that they *never* use this method to assess their students (24.7%), which shows that there is no agreement in relation to the use of this type of assessment or perhaps some teachers do not use this approach because they do not have access to these tests.

One could argue that this elevated use of tests is due to school or government rules, such as the obligation to award a final grade with marks coming from specific types of assessment. However, this argument is not supported by the results, since there is a statistically significant relationship between the frequency with which teachers apply the different types of test listed in Q11 and the weight they give to them (Q12). In other words, it was possible to observe that teachers who use tests relatively often also give *quite a lot* or *a great deal* of importance to them.

For example, 93.9% of the teachers who reported applying “teacher made tests involving open ended questions” (Q11.2) *monthly* affirm giving *quite a lot* or *a great deal* of importance to this kind of assessment ( $T_B = 0.230$ ;  $p < 0.0001$ ). The same happens to the other types of test listed in Q11. For teachers applying “teacher-made multiple choice, true-false and matching tests” *monthly*, 91.8% of them give *much* weight to this type of test ( $T_B = 0.271$ ;  $p < 0.0001$ ). For those who stated that they set “teacher-made short answer or essay test that require students to describe or explain their reasoning” *monthly*, 95.1% also give *quite a lot* or *a great deal* of importance to them ( $T_B = 0.223$ ;  $p < 0.0001$ ). The same was observed for those applying Q11.5 *termly*, where 81.8% affirm giving *much* weight to this type of test ( $T_B = 0.425$ ;  $p < 0.0001$ ).

### **Summary and discussion of the main findings**

First of all, it was possible to observe that, although the teachers use different kinds of assessment and with different frequencies, tests and homework assignments are the two methods that are most commonly used by secondary-school teachers of mathematics in Brazil, as corroborated by the importance that the teachers said they give to them, which confirms the results of other studies (Albuquerque, 2012; Pacheco, 2007; Susuwele-Banda, 2005). As the questionnaire had two specific sections addressing these methods, it was possible to analyse in more detail how teachers are using them.

Referring to the tests, before setting them, the teachers reported frequently giving a review lesson, in which they include the contents that were covered in previous lessons, as well as practise in basic skills and in tasks similar to those contained on the test. This action could be considered summative in spirit, if the intention is simply to give students practice in taking the test in order to get better results. On the other hand, if the review also has the intention of promoting learning and helping the students to understand their strengths and weaknesses in order to use the content covered to see what is the next step in their learning process (Harlen and James, 1997), it can be considered formative.

The same can be said in relation to the type of questions that the teachers include in their tests and the kinds of skill they require from their students to answer them. The respondents reported that most of their tests comprised open-response questions, involving the application of mathematical procedures. This can be considered a good indicator, although it is impossible to affirm if they include these questions in order to try to understand the students' thoughts and make use of this to guide their teaching to suit the students' needs, or if they are just encouraging superficial, mechanical learning, focused on memorising isolated details, typical of the weak practices which Black and Wiliam (1998a) reported.

Similarly, some comments can be made about homework assignments. The majority of the teachers reported that they assign exercises and problems from the textbook to their students. After that, they record whether or not the homework was

completed and give feedback to the whole class. Based on these statements, it seems that homework assignments are being used principally for accountability, where the teachers are not considering the student's individual performance, just whether they have completed the assignment or not, without taking into account what has been answered as an indication of what the students have learnt and what they still need to improve.

However, the data did not provide enough information to draw confident conclusions on this. A deeper analysis of how this feedback is being given would be needed in order to decide whether or not it is being used for the improvement of learning or if it is being used just to correct and show what is wrong or right in the assignment. It would be necessary to verify if the teachers give the students the opportunity to think about their learning and how it is possible to focus on the aspects that they still need to improve, as well as if the teachers are giving their students the opportunity "to act upon the feedback and also discuss the feedback with others" (Hodgen and Wiliam, 2006: 19).

Finally, it is important to remember that all the findings presented here are the results of an exploratory study through a self-report questionnaire, which is subject to social desirability bias and may not reflect the actual classroom practices of the respondents.

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