

The Effect of Teachers' Perceptions on the Role of Technology in Assessment: the Case of Macau

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Abstract. Technology is shaping the process and outcome of educational assessment. This paper explores how teachers and pre-service teachers view the role of technology in educational assessment. Participants in the study were students taking an educational evaluation course taught in a public university in Macau. Students' views were collected through open-ended questions. Content analysis of students' responses was categorised using the framework of assessment for learning and assessment of learning. It was found that teachers envisaged the role of technology to be more on the assessment of learning. Results suggested that educators should provide learning experiences to make teachers aware of the uses of technology for instructional purposes.

Keywords: educational assessment, teachers' perceptions, role of technology.

Introduction

Teachers' beliefs and knowledge play a significant role in mediating how teachers implement classroom practices (Clark & Peterson, 1986). Teachers with a constructivist teaching rationale are more likely to introduce exploratory activities that allow students to build knowledge on their own. Likewise, teachers who believe that knowledge exists on its own tend to present students with more structured activities (Hermans, Tondeur, van Braak, & Valcke, 2008). This article examines and interprets teachers' views on the role of technology in educational assessment, after completing an educational assessment course. Bliem and Davinrou (1997) argue that identifying teachers' implicit beliefs and knowledge of assessment and its relation to instruction is necessary before introducing new forms of assessment to them. Because assessment practices depend increasingly on technology, an understanding of teachers' beliefs about the role of technology in assessment is crucial. It can shed light on factors that promote teachers' intentions to use technology in a classroom assessment. To set the stage for the study, we provide literature on the impact of technology in educational assessment. After that, we review teachers' concepts of assessment to make the case for this study.

Technology and assessment practices

The effect of technology on educational assessment is emerging. Evidence from assessment organisations and authorities, such as the Educational Testing Services (ETS) and the Hong Kong Examination and Assessment Authority (HKEAA) demonstrates that technology in educational assessment is common. The Programme for International Student Assessment (PISA) is planning to use technology on a large scale in the near future. These assessment practices are mainly for assessing learning or for policy research. Online assessment offered by ETS was meant to certify one's proficiency in English¹; the territory-wide System Assessment² offered by HKEAA was meant to assess student performance at the Basic Competency level. The assessment was first conducted using paper and pencil. Collected data are made available online for schools who wish to improve their schools' learning and teaching effectiveness.

Rationales driving the use of technology-based assessment include the alignment of instruction and assessment; efficiency and feedback to students (Gipps, 2005). Because e-learning, mobile learning, and blended learning are quite common now, assessment practice has to catch up with instruction. The information and communication technology (ICT) environment allows the construction of more sophisticated items with multimedia material. Technology-based assessment platforms seem more authentic because every aspect of life today involves the use of technology. In addition, using ICT supports the administration, distribution, and scoring of scripts. It may improve the reliability of the test.

In fact, assessment may be an approach to improving instructional practices (Wiggins, 1989). Using technology to provide formative feedback can be used by both students and teachers. The eVIVA project in the UK is an example of an innovative application of technology in assessment (McGuire, 2005). In the eVIVA project, technology empowered students to collect their work on a website over time. They reflected on their own work and received feedback from teachers. Students enjoyed this innovative assessment practice and valued the comments provided by teachers. In New Zealand, the Assessment Tools for Teaching and Learning (asTTle) is an educational computing resource that allows teachers to create curriculum-aligned items and provide feedback on student progress (Harris & Brown, 2009).

As indicated above, technology plays an important role in assessing learning. In any technology-based assessment initiative, teacher confidence, belief, and perception of the value of technology in teaching and learning are more challenging barriers (Ertmer, 2005; Zhao, Pugh, Sheldon, & Byers, 2002), while first-order barriers including hardware and software resources, training,

¹ http://www.ets.org/toefl/ibt/about?WT.ac=toeflhome_ibtabout2_121127

² <http://www.bca.hkeaa.edu.hk/web/TSA/en/Introduction.html>

and support are more likely to be tackled in near future with the advance of technology and related support of the school or government (Ertmer, 2005). Therefore, identifying pre-existing beliefs held by teachers about technology-based assessment is beneficial. The purpose of this study is to investigate teachers' beliefs about the role of technology in assessment. Key concepts such as a teachers' beliefs in assessment, assessment for learning, and assessment of learning, which frame this study, and the research context are presented in the next section.

Teachers' beliefs of assessment

The term *teachers' beliefs of assessment* refers to an array of meanings that teachers associate with assessment practices or phenomena (Pajares, 1992). Some of these meanings are central and some are peripheral. Brown (2004) demonstrated that teachers had at least four concepts related to assessment. They are: (1) assessment is related to improving student learning and teachers' instruction; (2) assessment is to certify student learning; (3) assessment evaluates the quality of teachers and schools; (4) assessment is irrelevant to teachers' instruction. These various conceptions of assessment may lead teachers to different practices. Teachers' conceptions of assessment are affected by the historical, social, and cultural context (Brown, Kennedy, Fok, Chan & Yu, 2009). In examination rich Asian cultures, such as Hong Kong and mainland China, teachers think that assessment is meant to improve instruction and make students accountable for their learning. It is a way to direct students to learn. In low-stakes assessment systems, as in New Zealand and Australia, teachers do not endorse the concept that assessment makes students accountable for their learning, but rather that the school should be accountable for student learning (Brown, 2004, 2006). There is also variation between primary teachers and secondary teachers. Primary teachers endorse the concept of assessment for learning more than secondary teachers do (Brown, Lake, & Matters, 2011).

Assessment serves several purposes. Teachers use assessment to plan for instruction and facilitate student learning in the classroom. In addition, they have to be accountable to the school and parents. Brown's (2004) study provides a preliminary notion of teachers' conceptions. In a more recent study, Harris and Brown (2009) found that teachers held complex conceptions of assessment, ranging from (1) compliance, (2) external reporting, (3) reporting to parents, (4) extrinsically motivating students, (5) organising group instruction, (6) teacher use for individualising learning, and (7) joint teacher-student use for individualising learning. In Hong Kong, Hui (2012) found that teachers' concepts of assessment for improvement were concerned mainly with identifying student potential, changing students' attitudes towards learning, and preparing them for future challenges. Remesal (2011) found that teachers' beliefs about assessment were related to the four dimensions of "the learning process, the teaching process, and accreditation of learning and accountability of the professional teaching activity." Teachers have all of these different levels and contrasted dimensions of assessment. These conceptions revealed the tension that teachers have to balance the interests of different stakeholders. On one hand, teachers want to use assessment to facilitate student learning. On the other hand, they have to fulfil the expectation of accountability imposed by the school

authority. Despite the various associations that teachers have with assessments, it is argued that teachers' conceptions would change if technology existed within the process of educational assessment.

Assessment of learning in the classroom

As its name suggests, the term *assessment of learning* is used to mean assessment with the purpose of providing a valid and reliable summary of each student's achievements at a particular point (Harlen, 2007). Its role is to provide information about student learning to the concerned parties, such as parents, schools, and government officials. It is used for the purposes of certification and accountability, so the term *summative assessment* is associated with it. It has been dominant in education for many years, which Shepard (2000) construes as reflecting behaviourist theories of learning, social efficiency, and scientific measurement.

Assessment for learning in the classroom

With the emphasis of constructivist and social constructivist learning theory, the concept of *assessment for learning* (Afl) has gained attention in recent years. Afl is defined as "a process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go, and how best to get there" (Assessment Reform Group, 2002). The central purpose of Afl is to contribute to student learning by providing information about performance. In this case, assessment is used for formative purposes (Black & Wiliam, 1998). In search of the path to student learning, Black and his associates identified ways that were conducive to student learning. They are constructive feedback, questioning, peer- and self-assessment by students, and the formative use of summative tests (Black, Harrison, Lee, Marshall, & Wiliam, 2003).

Assessment in the context of Macao

Macao, a special administrative region of China since 1999, was a Portuguese colony for about 400 years. Because the Portuguese government paid little attention to the education section, this post-colonial region has a long history of *laissez-faire* toward education. This implies that schools in Macau have high autonomy in the school curriculum. There is no public examination in Macau to serve the purpose of quality assurance.

In practice, depending on the policy of each school, schools may adopt textbooks from Hong Kong, Taiwan, and mainland China as teaching material. Preparing students for various university admission examinations is an interesting phenomenon in Macau, owing to its historical and social development. For instance, schools using English as a teaching medium will prepare students for external examinations such as the International General Certificate of Secondary Education (IGCSE), the local university entrance examination, the General Certificate of Education (GCE), and the Teaching of English as a Foreign Language (TOEFL). As in other Asian countries, education in Macau was deeply affected by the long tradition of examination cultures

(Kennedy & Lee, 2007). People believe that strong academic performance in public examinations or university entrance examinations is a symbol of quality. Morrison and Joan (2002) described assessment in Macau as “overwhelmingly construed as testing.” Their comment was supported by many teachers and teacher educators in Macau. Students are required to take tests frequently. This is an effort to motivate students to put more effort into learning (Kennedy, Chan, Fok, & Yu, 2008). In addition, student performance in university admission examinations or external examinations is often considered by schools as an indicator of a school’s success. It is also an indirect indicator of teacher effectiveness.

In 2006, a revision of the fundamental law of the non-tertiary education system in Macau was enacted. On one hand, the law gives the government the right to monitor the quality of school education. On the other hand, it was stated clearly that the purpose of assessment was to promote student learning and should be carried out through several approaches³. However, teachers, students, and parents equate assessments with the concept of testing to serve the purpose of grading students. This was supported by the study of Morrison and Joan (2002). They found that tests and examinations dominated the kinds and amounts of assessment and so the curriculum. There is a lack of awareness of other forms and amounts of assessments. Although the disadvantages of tests and examinations are recognised, teachers do not feel their lack of knowledge of other forms of assessment to be problematic. Morrison and Joan (2002, p. 293) found that “notions of authentic assessment, portfolio assessment, open-ended assessment, ipsative and facilitated self-assessment, and assessment other than by testing have little currency in Macau.”

Although Macau’s languages and cultures are similar to those in Hong Kong and mainland China, the policy and the examination system in Macau is quite different. With the Macau government’s emphasis on assessment for quality control and using assessment for student learning, it is interesting to explore the assessment concepts of teachers in Macau. In addition, limited research has explored teachers’ concepts of the role of technology in educational assessment, but the impact of technology in educational assessment is emerging. It is necessary to explore teachers’ concepts of the value of technology in educational assessment.

The purpose of this study was to uncover both prospective and in-service teachers’ views of the role of technology in educational assessment after they completed a course emphasising the principles of assessment for learning in a technological environment.

³ http://www.dsej.gov.mo/~webdsej/www/edulaw/law_9_2006/content/chap05-e.htm

Instructional context

The educational evaluation course is offered by a public university in Macau. The course's goal is to prepare students to understand and integrate assessment principles and concepts into their practice. It covers the basic concepts applicable to various types of assessments: statistical concepts, reliability, validity, and interpretative framework. It highlights the features of preparing a valid and reliable classroom assessment. Topics include planning for assessment, selected-response items and the broad array of constructed-response items, administration and analysis of classroom tests and grading of tests, and alternative assessments. After completing the course, students are expected to explain the basic concepts in the field of educational assessments, develop assessment methods appropriate to instructional decisions and student achievement, and appreciate the value of assessment for learning.

The course is delivered over 14 weeks. Moodle is used as the course management system (CMS) to supplement face-to-face instruction. Weekly course content including lecture notes and questions are housed in Moodle to facilitate student learning. Participants are requested to review the lesson and answer the questions weekly. If instructors detect interesting student responses, they share the responses with the whole class during the lecture. In order to encourage student engagement in the course, their responses are graded according to frequency. In addition, participants are grouped to view and evaluate a project posted online. With the availability of Web 2.0 services, participants' comments can be shared beyond the scope of the course. In this way, participants are ensured of having the experience of using technology for instructional purposes.

Participants

The study had 43 participants. The first cycle of the study included 27 students (13 male and 14 female). They ranged in age from 20 to 35; most were between the ages of 25 to 30. Ten were pre-service teachers taking the Bachelor of Education in Chinese and Mathematics. The remaining 17 teachers were teaching in local secondary schools. All participants have a Bachelor degree in their subject area, but lack a background in education. Therefore, they had to complete a Postgraduate Certificate in Education (PGCE) in order to earn a teacher certificate and qualify for a government subsidy. Their teaching experience ranged from two to five years. The second cycle of the study happened two semesters after the first cycle. This time, students were all pre-service teachers taking the Bachelor of Science in Mathematics Education. There were 18 participants (nine male and nine female).

Data sources and analysis

This study was a descriptive case study (Yin, 2003). In order to answer the research question, various data sources were collected. These include (1) archival records in the CMS to serve as evidence of their participation in a technology environment, (2) a survey conducted at the end of the course, and (3) informal conversations and discussions with students held during and after the course to verify the results and interpretations.

Student responses to the survey were analysed using the quantitative content analysis approach (Miles, Huberman, & Saldana, 2013). The frameworks of assessment for learning and assessment of learning were identified to understand participants' experiences and knowledge of technology in educational assessment. Their engagement with the CMS was studied using descriptive statistics. Multiple data sources were then used to triangulate the observations and interpretations of the findings.

Results

Teachers' engagement with the CMS. Teachers' engagement with the CMS provided a backdrop to understand their view of the role of technology in educational assessment. Records in the CMS demonstrated that teachers did engage with the CMS. One of the highly engaged tasks was the weekly assignment. The average number of students in the weekly assignment was ca. 62 with a standard deviation of 37, and the average number of students using course materials such as PowerPoint notes and web resources was 220, with a standard deviation of about 156. This information demonstrated that students did make use of the technology in their learning process. They read and posted their responses to the weekly assignment. They also surfed the online learning materials provided in the CMS. However, the standard deviation of student numbers in the weekly assignment and course materials revealed that their participation in technology environment varied greatly. The variation might explain the wide range of the value placed on technology in instruction and in educational assessment.

Teachers' view of technology in assessment. Most participants have their own perception of the role of technology in assessment, as shown in Table 1. Only one student was unable to provide a clear response that specified the role of technology in assessment. Nearly half of the participants would first outline the value of technology for instructional purposes before specifying its value in assessment. One student's (s) response is typical:

Technology minimizes the workload of marking for teachers. They have more time to work on their teaching plans and professional development. The use of analytical tool for testing makes it possible to provide teachers with timely and enlightening details of their students' performance and hence enhance their teaching. (s26)

Table 1. Teachers' perceptions of the role of technology.

Major themes emerged	No. of students listed/Sample Size	No. of ideas identified
Technology for instruction	16/43	16
Technology for assessment	42/43	82

Their perception of technology seems to be in two different areas: technology for instruction and technology for assessment. An interesting result is that most of them did not have the concept of using technology-based assessment for instructional purposes. In other words, they did not envisage the connection between assessment and instruction. Only two students had the

perception that technology can serve the purposes of assessment for learning and assessment of learning.

Ideas grouped under the theme of technology for instruction include the following:

- Technology facilitates communication between teachers and students.
- Technology may be a source of learning materials.
- Technology facilitates the presentation of materials.
- Technology facilitates student learning and interest.
- Technology provides evidence for teachers to adjust instruction.

Teachers had a wide range of views on the role of technology in assessments, as shown in Table 2. Many teachers thought that technology might improve the collection of student responses, the scoring of test items, item analysis, and the distribution of assessment results. Technology allows those processes to be done faster and more accurately. Less common perceptions of teachers included: technology may contribute to the preparation of valid items; it provides practice opportunity for students; more options are available to evaluate students, a quality control tool. These views revealed that it was easier for teachers to associate the more explicit role of technology in assessment, i.e. technology makes the assessment process better. An example of a teacher candidate response is as follows:

Technology eases the analysis process. The overall performance of students can be easily shown using technology and the difficulty index of the test can be calculated easily. (s1)

Only two students were able to link the role of technology in educational assessment with that of instruction. One student, s15, wrote:

Technology make the adjustment of instruction easier. This is because students' responses can be analysed immediately. Their weakness can be identified and such information allows teachers to revise their instruction. s15

Table 2. Frequencies of teachers' perceptions of the role of technology in assessment.

Themes	Cycle 1	Cycle 2	Total
Technology collects student responses better.	4	5	9
Technology facilitates the scoring of test items.	8	3	11
Item analysis of tests becomes faster and more accurate.	11	11	22
Technology provides immediate feedback to students. It facilitates the process of communication of test results.	9	3	12
It allows teachers to analyse student performance.	5	7	12
Preparation of test items is more systematic and valid.	2	4	6
Technology may allow students to practice.	2	1	3
Technology allows school to do quality control.	1	0	1
Teachers have more options to evaluate student learning.	0	4	4
Technology provides evidence for teachers to adjust instruction.	0	2	2

Discussion

The purpose of the study was to explore teachers' conceptions of the role of technology in educational assessment. Results suggested that both in-service teachers and teacher candidates participated in the course that emphasised the use of technology in instruction. However, participation of teachers in the CMS varied considerably. Teachers were aware of the role of technology in assessment. Their beliefs about the role of technology were twofold: one for instruction and one for assessment. Although teachers in the educational evaluation course experienced various ways that technology is associated with educational assessment, many of them still had difficulty relating the value of technology in achieving the purpose of assessment for learning. The overwhelming culture of testing in Macau may be one reason that teachers hold such beliefs (Morrison & Joan, 2002). They could easily list the value of technology in facilitating the purpose of assessment of learning. This might be because teachers were explicitly guided in the importance of validity and reliability during the course. The teachers' learning experience in the course context might affect their perception (Pajares, 1992), so care must be taken to make teachers aware of the instructional role of technology in assessment in future.

This study identified the teachers' conceptions of technology in educational assessment. Some of the concepts are common because they are found in the literature. For example, their view of the role of technology as a way of quality control was also identified in Brown (2004), i.e. assessment evaluates the quality of teachers and schools. Another view is that technology facilitates the process of communication of test results (Harris and Brown 2009). As this study focused on the role of technology in educational assessment, it found that teachers' perceptions were more inclined towards assessment of learning. Few teachers had a clear vision of how technology might collect and analyse data to provide evidence of how teachers can improve their instruction. This might be attributable to the lack of an explicit introduction of the role of technology for assessment for learning purposes. Therefore, the findings reveal the importance of explicit introduction of formative assessment strategies. Nyberg and Olander (2015) found that teachers were more aware of the formative assessment strategies after professional training. This exploratory study contributes to the literature with the findings that the teachers' conceptions of the role of technology in educational assessment mainly emphasise the purpose of the assessment of learning, whereas they have a vague view of its role in assessment for learning.

One limitation is that the study's findings are too weak to generalise in other settings, as this is collected after the completion of an educational evaluation course. Further studies are needed to examine the extent to which the patterns observed in this study reflect perceptions of teachers. More teachers are integrating technology in their teaching or using technology as a means of assessment. Teacher perception of the role of technology in assessment using the framework of assessment of learning and assessment for learning should be investigated in future using formal interviews to provide in-depth knowledge of teachers' perceptions. It would also be interesting to explore the relationship

between teachers' conceptions of the role of technology and their model of teaching.

Implications

It is argued by Popham (2011) that an effective teacher should be assessment literate. Several implications related to teacher education programmes may be drawn from the pattern of the teachers' conceptions of the role of technology in assessment. If education of assessment in teacher education programmes is to be effective, prospective and in-service teachers should be exposed to a technology-rich instructional environment. In such an environment, students are more likely to envisage the constraints and potential for technology-based assessment. They should be challenged to tackle the practical issues involved in order to facilitate their assessment practice. This is supported by the work of Kahn (2000) that teachers' new assessment practices were affected by their concern for student attention, cooperation, and classroom control. They should also be given examples of research work that looks at the innovative uses of technology in assessment. Explicit guidance on how technology might facilitate assessment and instruction should be given to students.

A closing remark

This study contributes to the current understanding of teachers' beliefs about the role of technology in assessment. It builds on previous findings of Brown (2004) that teachers have multiple connotations of assessment. In this study, teachers' perceptions of the role of technology in assessment were associated with the efficiency of technology in the assessment process. Technology makes the process faster in terms of test collection, scoring, and communication of assessment results. In addition, teachers believe that using technology in assessment would be more reliable. The integration of technology in the course provided an interactive platform for teachers to experience the role of technology in assessment. For teachers to associate technology with the purpose of assessment for learning, they should be engaged in more innovative uses of technology in assessment.

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