

Chapter 45

Focusing on the Classroom: Assessment for Learning

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Introduction

Teachers are required to conduct assessment in the classroom for a variety of purposes, including data for monitoring the system and school accountability, the award of individual qualifications, and informing teaching and learning. However, following the review by Black and Wiliam (1998), the central role of formative assessment in shaping teacher and student classroom experiences has come in for special attention. Formative assessment, also referred to as assessment for learning, is a process in which teachers and students recognise and respond to student learning, during that learning. Typically it is embedded in teacher–student interaction, but it also involves planned tasks: an assessment is formative when the assessment information is used to enhance teaching and learning. In practice, formative assessment depends on the dynamics of the interaction between curriculum, teaching and learning and, in turn, this is underpinned by a conception of learning, learners/students and what it means to know. This chapter explores the proposition that socio-cultural views of learning offer new insights and opportunities for the classroom practice of assessment, including formative assessment.

Assessment and Views of Learning

How learning and the learner are viewed shapes what counts as evidence of learning and the type of activity that might comprise assessment of and for learning. A constructivist view of learning underpinned initial formulations of formative assessment

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(Sadler 1989). This view supports the use of clear goal statements and success criteria, targeted feedback and student self-assessment. Social views of learning draw attention to the role of social interaction and support the efficacy of peer assessment and discussion. Current research and theorising are exploring the implications for classroom assessment of a variety of socio-cultural conceptions of learning (Gipps 1999). Learning from a socio-cultural perspective revolves around issues of belonging and the transformation of participation and identity. This shifts the focus from what is in a student's mind to student actions and interactions in a particular social, cultural and material setting where certain goals and practices are valued above others. What counts is not just what students know, although this is important, but also the development of students' identities as capable and competent learners (Gipps 1999). A socio-cultural orientation draws attention to the temporality of learning and knowing: what, why and how students are learning is also of interest. All this has implications for the conceptualisation of student active engagement in assessment for learning. Socio-cultural views problematise the notion of assessment as a tool for measuring individual achievement and challenge the assumption that it is possible to decouple learning outcomes from the learning process and the social, material and historical context of the classroom in which learning and the assessment of it takes place. The shift to a socio-cultural view of learning in science education has informed, and been informed by, the debate about the nature of the outcomes of value in science education.

The Curriculum and Classroom Assessment

Assessment and curriculum interact in complex ways. Science curricula have undergone a number of transformations, most notably from a focus on content knowledge to a focus that Richard Duschl (2008) sums up in terms of three integrated domains: conceptual structures and cognitive processes; epistemic frameworks used when developing and evaluating scientific knowledge; and the social processes and contexts that shape how knowledge is communicated, represented, argued and debated. These expanded curriculum goals have implications for pedagogy and assessment, particularly at a time when relatively greater importance is being accorded to assessment. Official curricula are at the start of a cascade of interpretations. The intended curriculum becomes an implemented curriculum and then an experienced and achieved curriculum through a dynamic interaction between curriculum, assessment and pedagogy. This constructs local meanings for being students, teachers and the discipline. The strategic value attributed to teacher classroom assessment in shaping curriculum and student experience is clearly signalled by the current substantial investment in the development of resources to support teacher classroom-based assessment.

The Classroom as the Site for Assessment

Formative assessment is based on the principle that students need to become more than consumers of assessment activity (Sadler 1989). By foregrounding the promotion of student autonomy (power with students), this principle has the potential to disrupt the traditional power balance in classrooms (Gipps 1999). Its enactment can require the renegotiation of teacher and student roles and responsibilities. A socio-cultural view of learning directs attention towards classroom interaction as a locus for formative assessment (Bell and Cowie 2001).

Student opportunities to participate actively in assessment for learning interactions are inextricably entangled with the discourse of power that is in operation in a particular classroom (Munns and Woodward 2006). This discourse includes what counts as knowledge, who has access to really useful knowledge, who has ability, who controls the teaching space, who is valued as an individual and a learner, and whose voice is given credence. The social norms and practices of a classroom not only make meaning public, but also position learners in particular ways in relation to their being active generators of knowledge. For instance, the sequence of teacher question–student response–teacher evaluation, common to many science classrooms (Lemke 1990), constitutes teachers as people with authority over students and knowledge. The tendency for teacher questions and evaluations to incorporate the language of science further contributes to teacher authority over the subject and students. For students to generate knowledge as part of social practices they must be given the authority for and the resources with which to build knowledge. The idea of authoritative and accountable positioning with conceptual agency suggests being entitled and expected to move about the environment freely, with access to resources throughout the environment and with the authority to use, adapt and combine those resources in unconventional ways (Greeno 2006).

Research by Rosalind Driver, John Leach, Robin Millar and Phil Scott (1996) has highlighted that student decision making in science can involve: their acceptance of the authority of the teacher, text or peer as the ‘final warrant of viability’; their testing the coherence of their explanation in comparison with other knowledge claims; and their testing the ability of their explanation to predict what happens in a practical situation. Students interviewed by Bronwen Cowie (2005a) used a similar range of criteria to evaluate their ideas. Bronwen Cowie and colleagues (Cowie et al. 2008; Glynn et al. 2008) demonstrate the efficacy of teacher use of multiple and multi-modal means to make their learning intentions and criteria of quality explicit, as well as supporting the use of a range of sources of knowledge as feedback. While teacher talk as feedback was, and is likely to remain, the main source of individualised feedback, students also consulted peers, books and people outside the classroom and conducted trials and tests.

Studies in science education that adopt a socio-cultural perspective provide insights into classroom environments that are supportive of student agency and therefore would support a culture conducive to assessment for learning. Randi Engle and Faith Connat’s (2002) work on productive disciplinary engagement is one

example. Work in the development of student skills of argumentation provides many of the tools that students need to engage in productive self-assessment through consideration of the linkages between evidence and explanation (Simon et al. 2006). There is, therefore, potential for productive dialogue between researchers working in these domains and those working in formative assessment.

Teachers and Classroom Assessment

Despite the research evidence, assessment is still not widely used by teachers to promote learning. Reasons for this include factors external to schools, such as international and national testing regimes, school-level factors such as parent community expectations, and teacher personnel factors (Carless 2005; Tierney 2006).

Juggling Competing Imperatives

Teachers face competing demands in their classrooms. On the one hand, there are the imperatives to support the learning of *all* the students in their classes. On the other hand, teachers are expected to collect evidence that demonstrates the efficacy of their work for system and school accountability purposes. These two competing demands play out in the tensions between formative and summative assessment. In contrast to formative assessment, for which the intention is to enhance learning (assessment for learning), the purpose of summative assessment is to sum up and make a judgement about student learning (assessment of learning). This distinction explains why continuous summative assessment is not formative assessment. A key question for teacher workload is whether or not a task can be used for formative and summative purposes. Paul Black et al. (2003) found that data from a summative task could be reinterpreted to meet a formative function. Formative data can be summarised and synthesised over time to produce a summative assessment that encompasses the 'how' and 'why', as well as the 'what', of student learning (Anderson et al. 2007; Cowie et al. 2008). Unfortunately, student sensitivities to the difference between teacher evaluation of their learning and teacher interest in their ideas pose a challenge to suggestions that teachers can exploit the synergies between formative and summative assessment (Cowie 2005b; Reay and Wiliam 1999; Tunstall and Gipps 1996).

Teacher formative assessment is also a site where the dynamic tension between teachers' responsibilities towards the curriculum and the class, and for individual students, plays out in practice. Beverley Bell and Bronwen Cowie (2001) emphasise the dynamic responsive and dilemma-driven nature of formative assessment. Their research indicated that teachers undertook planned and interactive formative assessment, which focused on teacher-intended learning outcomes and students' actual interests and ideas, respectively. Interactive formative assessment involved the

teacher in noticing, recognising and responding to assessment information in a manner congruent with Royce Sadler's (1989) claim that formative assessment requires connoisseurship: teachers called up science and student self-referenced criteria and actions that were salient in the moment. Adding complexity, Beverley Bell and Bronwen Cowie (2001) found that primary teachers were concerned about fostering student personal, social and science learning. Student personal development related to students' learning about themselves as learners and learning-to-learn. Students' social development related to the skills that students needed to participate in group work and discussion. Students' science learning related to their learning of science content, science processes, and the ways in which science linked to their everyday lives (Cowie et al. 1996). Teachers claimed that both the planned and interactive forms of formative assessment and the switching between them were hallmarks of a competent teacher.

A Knowledgeable and Skilled Activity

Knowledge of a range of assessment practices that complement the curriculum and inform teaching and learning has come to be seen as a core competency. Teachers need to be knowledgeable about and able to use various strategies to find out about student ideas, to be able to recognise the point of development reached by their students, and to have strategies for developing student ideas. Teachers need a deep understanding of: the subject matter to be taught; a clear idea of the progression of ideas and skills that are the goals of student learning; and of the pathways that students are likely to take in this development. Formative action is enhanced if a teacher is able to take into account a student's prior understandings, effort, progress and particular circumstances at the time. A teacher's knowledge of when and where students can do something enriches, rather than biases, their interpretations. In addition, teachers need to be able to identify and communicate their learning goals and criteria of quality, while taking note that tightly specified criteria can foster a culture of compliance rather than learning (Torrance 2007).

It takes time for teachers to embed formative assessment into their classroom (Black et al. 2003; Webb 2009). Studies by Dylan Wiliam et al. (2004) and Alister Jones and colleagues (Cowie et al. 2008; Jones et al. 2001) provide evidence that a focus on teacher planning can enhance teacher formative practice. Jones and colleagues show that the use of a science-specific planning framework can enhance teacher pedagogical content knowledge (Shulman 1987) and this leads to enhanced teacher formative assessment interactions and enhanced student learning. How to scale these gains is a key question for policy makers and researchers alike.

Considering synergies across the field of science education, a first step in teacher formative assessment involves teachers in generating information on student learning. Research on student alternative conceptions and teaching for conceptual change has contributed a substantial body of tools and tasks that can be used to elicit student ideas in context. There is research that explores and seeks to exploit the formative

potential of strategies such as concept maps, predict–observe–explain tasks, and the use of different contextual and material prompts and probes. The area of teacher inference is under-researched and key to the validity of teacher assessment (Gitomer and Duschl 1998). However, knowledge of student alternative conceptions can inform teacher interpretations of teacher actions. Work on student learning progressions is being developed to inform teacher assessment interpretations and feedback (Wilson 2009). Science education research also has a contribution to make to teacher feedback and actions to guide student thinking. Teaching approaches involving development and cognitive conflict have the potential to inform teacher's feedback actions once they understand student thinking.

The Role and Importance of Teacher Beliefs

Teacher beliefs about teaching, learning, assessment and curriculum and their inter-relationship influence teacher formative assessment practice (Bell and Gilbert 1996; Sato et al. 2005). Teacher realisation that teaching and assessment can be integrated activities is important (Treagust et al. 1999). Teachers who implement the recommended formative assessment strategies (such as wait-time) without a concurrent focus on student agency achieve what Bethan Marshall and Mary Jane Drummond (2006) describe as the 'letter' rather than the 'spirit' of formative assessment or assessment for learning. As Paul Black and his colleagues note, formative assessment is not necessarily or inevitably a benign or expansive process, nor is it one that always promotes 'learning autonomy' (Black and Wiliam 2006). For example, professional development that focuses on questioning and strategies for giving feedback alone is not enough. How teachers react to students' responses to their questions plays a role in opening up, or restricting, interaction and consequently teacher and student opportunities in assessment for learning. Heather Smith and Steve Higgins (2006) propose that teacher reactions are grounded in teacher understandings of the relationship between the talk that they use for teaching, and the talk that they hope their students will use for learning. Understandings of these linkages may need to be challenged if teachers are to genuinely engage students in formative assessment.

Students and Classroom Assessment

The principles of formative assessment converge with socio-cultural views of learning in foregrounding the need to consider students as active and intentional participants in classroom assessment practices. Although very few researchers have sought students' views about their classroom assessment experiences, those who have done so have found students to be critical and constructive commentators on their experiences. Student commentary has highlighted the multiple consequences of classroom assessment for them, the importance of trust and respect, the influence of their goals and learning motivations, and equity issues (Cowie 2005a).

Multiple Consequences

Student commentary about their experiences of classroom assessment, foreground the issues of consequential validity (Messick 1994). From an assessment perspective, this is a key criterion of quality for formative assessment that gains authenticity when action is taken by teachers and students to enhance student learning. Classroom assessment impacts on student learning, interpersonal relationships and students' sense of self-efficacy, self-esteem and motivation (Black and Wiliam 1998; Cowie 2005b; Crooks 1988; Hickey and Zuiker 2005). From a socio-cultural perspective, students' descriptions of their experiences construe classroom assessment as a social process that plays a key role in the ongoing construction and reconstruction of students' public identities and perceptions of themselves as a competent, or not, learner and knower of science in both the short and long term. A student might identify as someone who enjoyed and learned science in the classroom or as someone who was 'useless' at science, and all the variations in between (Cowie 2005a). Continuity of teacher–student relationships is important in this. The messages about what is considered important to learn, how to learn and who is important are interpreted in context.

The Importance of Trust and Respect

Teachers and students have not only a shared past but also a shared future, with the future that they anticipate influencing their actions. This continuity of relationships can contribute to and or constrain student participation in assessment. Mutual trust and respect are central to students' active participation in formative interactions when they are working at the edges of their understandings. Student trust that teacher responses to their questions are likely to be beneficial and not harmful is important. They also need to trust that teachers' advice will be helpful. Conversely, teachers need hold high expectations and trust in students' desire to learn if interactions are to optimise student learning.

Student Goals and Learning Motivations

Students' engagement in formative self-assessment that is aligned with teacher goals for their learning requires that they share and value these. Classroom research indicates that students are motivated to achieve social as well as academic goals and that these are often intertwined. In terms of social goals, students work to develop positive social identities and to maintain and establish positive interpersonal relationships with peers and teachers. With respect to student achievement motivation, it appears that, when students pursue learning goals (i.e. they seek to understand

ideas), they tend to view assessment as a joint teacher–pupil responsibility. In the study by Bronwen Cowie, students who intimated that they were interested in understanding ideas advocated teacher feedback in the form of suggestions that provided an active role for them in making sense of ideas. Conversely, when students intimated that they had been pursuing task completion (a performance learning motivation Carol Dweck 1986), they expressed a preference for the teacher helping them to do this. They viewed as unhelpful teacher actions involving eliciting information about their thinking because this took time away from their working on a task. On these occasions, students described assessment as a teacher responsibility; students saw no role for themselves in seeking to help to extend their understanding. Paul Black and Dylan Wiliam (2006) note that students can change their learning identity from passive to active in classrooms that focus on assessment for learning.

Equity Issues

Given that different task formats offer different opportunities for students to express what they know and can do and that different students respond to the same task in different ways (Lokan et al. 1999), it is important that the students have a variety of opportunities to demonstrate what they know. Bronwen Cowie, Judy Moreland, Alister Jones and Kathrin Otrrel-Cass (2008) argue that providing students with multiple and multi-modal assessment opportunities goes some way towards meeting the needs of the diversity of students now in science classroom. Teresa Crawford (2005) provides a detailed description of how providing a student with an opportunity to choose between multiple ways of presenting his work led to his success in demonstrating competence. Nevertheless, providing students with multiple opportunities and a selection of modes to represent what they know does not necessarily remove the representational challenges faced by students or their teachers. To be successful in representing their ideas, students need to be able to identify and engage with the affordances of different tasks and modes of representation (Wyatt-Smith and Cumming 2003). In the case of science, students must manage, sometimes simultaneously, the demands of ‘integrating verbal, chemical-symbolic and mathematical meaning systems across genres that depend as much on visual layout as on linguistic syntax or vocabulary meanings for their sense’ (Lemke 2001, p. 175). Students need instruction to support the development of the knowledge and skills that they need to be able to select and to use the most apt representation/mode or combination of modes (Newfield et al. 2003). At another level, there is some evidence that teachers target particular students (Tobin and Gallagher 1987). Given the demonstrated benefits of formative feedback, it is important that all students have equitable access to occasions when they are able, and feel willing, to interact with their teacher about their learning.

In classrooms where the student group is diverse, the cultural validity of assessment tasks is a consideration (Lokan et al. 1999). Cultural validity issues extend

beyond a concern with language. Students might not only lack familiarity with particular task formats and contexts, but their cultural values, beliefs, experiences and communications styles could influence both their willingness and ability to engage with assessment. For example, Desmond Hung (2009) found that, because of student reticence to ask and answer as part of a cultural norm of respect, students benefited more from written than oral feedback. When teachers work with students from diverse cultures, it is also important that they respect the various world views and understandings that students bring to class whilst they are guiding students to see the relevance and value of scientific ideas, attitudes and values (Aikenhead 2001; Glynn et al. 2008).

Conclusion

Curriculum, pedagogy, assessment, learning and what counts as achievement are inextricably linked and mutually influential. On the basis of evidence of its efficacy, formative assessment/assessment for learning is being advocated as a means of increasing student learning motivation, achievement and agency, which are all important qualities if students are to become active participants in knowledge-rich democratic societies in which science plays an important role. However, assessment in support of learning is still not common practice in science classrooms. The knowledge and skills demands associated with responding to student learning in the moment mean that formative assessment is no easy task for science teachers. The expansion of the goals for science education, to include a concern with developing student conceptual knowledge, student understanding of the nature of science and student appreciation of the role of science in society, only add to this challenge.

Research on formative assessment from within a socio-cultural perspective locates assessment within classroom interaction and directs attention to the active role that students need to play within assessment. When formative assessment is embedded in a classroom, what it means to be a student/learner changes: teacher-student assessment opportunities and relationships are based on power with, rather than power over, students (Gipps 1999). Student intellectual agency is important because this relies on students having multiple and multi-modal opportunities to demonstrate and debate what they know and can do, as well as access to the feedback and resources that they need to move their learning forward. This conception of classrooms and student engagement resonates with science research on classroom discourse, augmentation, multi-modal pedagogies and learning environments that supports the active engagement of a diversity of students. Seen this way, formative assessment provides another tool for helping teachers to reflect on and revise their teaching; this tool has the potential to be the Trojan horse (Black and Wiliam 2006) than opens up new possibilities for teachers and students. This said, a socio-cultural view of assessment raises some questions which have not been fully addressed. These include questions about the appropriate unit of analysis for assessments when learning and knowing are seen as context dependent (situated) and

distributed across the resources, routines and people in a particular setting. It leaves moot questions about the appropriate time scale for assessment, including assessment for learning: How might teachers track and support student learning over time and contexts? This question is salient at this time when the goal is to promote the development of students as lifelong learners who have an affiliation with science and the understandings and skills that they need to engage with scientific ideas as part of life in the twenty-first-century. This chapter has set some of the insights and opportunities for researchers and teachers adopting a socio-cultural view of formative assessment and illustrated some of the potential for synergy across fields of research. These are worthy of further investigation.

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