ASSESSMENT FOR LEARNING: PERCEPTIONS OF ENGLISH AND PORTUGUESE SCIENCE TEACHER STUDENTS

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Abstract

Assessment and learning are understood as closely interrelated, assuming that assessment is an integral part of the learning process. Assessment for learning is seen furthermore as serving the purpose of promoting pupils' learning.

This study examines the perceptions of six science prospective teachers in England and Portugal about assessment by replying to an open self-report questionnaire, constructed for this purpose. The English students were enrolled on a postgraduate certificate in education (PGCE) course, focused on developing their teaching skills. The Portuguese students were attending a master degree in education also aiming the same goals. All the participants already had a degree on science and were in practice at schools (either basic or secondary).

A qualitative analysis of students' responses was made in order to comprehend their understanding about assessment, assessment strategies they perceive to be the most effective for learning and the relationship between learning and formative assessment.

The results show that despite the difference of contexts assessment is not easy to define and raises many questions when put into practice, leading to a variety of understandings and solutions in the classroom. Nevertheless, they all tend to a summative perspective rather to a really assumed formative assumption.

Keywords: Assessment for learning, assessment strategies, perceptions, science teacher education.

1   INTRODUCTION

Institutions of higher education are struggling with the issues of quality and accountability. With regard to pre-service teacher training it is expected to prepare good professionals capable of providing a high quality education to their future learners. For this preparation it is very important a good knowledge about assessment as this is a critical issue of teaching, including for university colleges.

Assessment is nonetheless used for many purposes. Teachers use it to inform decisions, to change teaching strategies, to help students, to classify or even to control student behaviour. Students use assessments to determine what they shall study, how to study, what they think they have learned and how to prepare for the following assessments [1]. Moreover, both teachers and students often see assessment as something negative they have to do. Most teachers also tend not to share information about the tests, both the content and the criteria or to discuss the scores obtained. Students end up not taking much advantage of the feedback to improve their work [2].

There seems to be a clear gap between what is known about assessment and what is being applied by teachers in classrooms. It is not assumed, for instance, that assessment for learning is determinant as it has a very big impact on student outcomes, unlike other areas of research [3].

With this in mind, and in order to make an episodic diagnosis of what is happening today, though at a micro level, this article aims to highlight the perceptions that students, prospective teachers of sciences (of the Institute of Education in London and of the Department of Education at the University of Évora in Portugal) are constructing on assessment as a result of their initial training.

2   ASSESSMENT AND CURRICULUM

In England, the Assessment for Learning Strategy (AfLS), published in 2008, announced the government support to teacher professional development in assessment for learning. The given reason was the following: "By investing in assessment, schools can ensure that learning is meaningful for all pupils, teaching is effective and attainment of outcomes are improved" (p.3) [4].

This strategy is meant to build on assessment practices, already established by Assessing Pupils' Progress (APP), a nationally standardized approach to assessment that teachers can use in order to make judgments about the standards of pupils' work, in the context of National Curriculum levels. The APP materials are designed to be used so that a National Curriculum level can be assigned to each student and levels of achievement can be reported to parents. The APP guidelines also suggest that leaders can look to the general framework provided by assessments to evaluate and, if necessary, review the teaching strategies, pupil groupings and student work. In the analysis of Swaffield [5], these "may be laudable practices, but they are not assessment for learning. Most of APP is about summative assessment and the formative use of summative assessment" (p. 444).

The focus was in summative assessment and Assessment for Learning (AfL) seen as a better use of tests, an assertion of AfL that distorts, in the opinion of the author, the real meaning of AfL. Thereby this misrepresentation affects the way students, parents, learners, and other actors see the assessment process.

In fact, the Department for Education [6] seems to be concerned with the subject, since it published The Framework for the National Curriculum. A report by the Expert Panel for the National Curriculum review which mentions the following:

> We are concerned about the ways in which England's current assessment system encourages a process of differentiating learners through the award of 'levels', to the extent that pupils come to label themselves in these terms. Although this system is predicated on a commitment to evaluating individual pupil performance, we believe it actually has a significant effect of exacerbating social differentiation, rather than promoting a more inclusive approach, that strives for secure learning of key curricular elements by all. It also distorts pupil learning, for instance creating the tragedy that some pupils become more concerned for 'what level they are' than for the substance of what they know, can do and understand. This is an unintended consequence of an over-prescriptive framework for curriculum and assessment. (p. 44)

In Portugal, the law clearly defines, at least since 1992, that formative assessment should prevail in classrooms, with the purpose of improving learning and teaching. Summative assessment is meant to classify and certify students and occur only as a balance of what students know and are able to do.

The Portuguese assessment system recognises then that formative assessment is a key process in the development of educational success, at least in terms of legislation. However research has been showing that in many classrooms assessments are more oriented and organised to classify and to rank pupils' achievements rather than to help them to learn, so the balance between formative and summative assessments seems to be difficult to achieve [7] [8] [9].

However, teachers and schools have autonomy to re-design the curriculum so to best suit each class, including internal assessment and they have a significant power on pupils' academic progress and certification within the majority of grade levels - that is why the Portuguese government made a recommendation to improve the quality of education at all levels of schooling, in order to improve learning in the classrooms through the appropriate use of formative assessment, i.e., "one might say that more needs to be done for internal assessments to become more consistent with reform efforts to improve the quality of teaching and learning" [9].

In fact, the social impact of summative assessment at the different actors is higher than formative assessment because, ultimately, it is the summative one that people associate with the decisions related to students' academic progress or their certification. Under these conditions, summative assessment seems to predominate in classrooms, whose first purpose is to gather information to classify students rather than to help them to improve and overcome difficulties.

3 ASSESSMENT FOR LEARNING

Black and Wiliam [10] defined formative assessment as "encompassing all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" (p. 7). The terms formative and summative assessment should be regarded as processes not as tools and as "descriptions of the function that assessment data serve, rather than of assessment themselves" (p. 39) [11].

The meaning of formative assessment has changed over time, which is why some authors suggested the use of another expression to show the difference of meaning. Stiggins [12], for instance, used the

term assessment for learning for the first time in USA to establish the difference between the historical and the current understanding of formative assessment:

> Assessment for learning is about continuous (...) about informing the students themselves (...) tells them what progress each student is making towards meeting each standard, while the learning is happening – when there's still time to be helpful. (pp. 1-2)

An important idea of this understanding is its focus on the direct participants in the present or in an immediate future [5]. It should be noted that the assessment includes the teacher, individual learners or their peers and that, in this sense, the term instruction relates to the combination of teaching and learning and not to training or transmission approaches to teaching, as one might wrongly assume.

Assessment for learning is then "any assessment for which the first priority in its design and practice is to serve the purpose of promoting pupils' learning" p. 8) [3]. It involves clarity over "where learners are in their learning, where they are going, and the steps needed to get there" (p.11).

It is important that teachers share learning intentions and success criteria with students. In fact, research shows that students in reflective assessment classrooms do better but the low-achieving students are those who benefit the most from the process because they remain with an adequate idea of what quality work can be.

Teachers tend to forget to plan how to find out where students are in their learning. Asking questions is one way of doing that but it is necessary to explore students' thinking before assuming that they understood the concepts, as Wiliam [11] states, it is a matter of "listening interpretively", and he adds: "I suggest there are only two good reasons to ask questions in class: to cause thinking and to provide information for the teacher about what to do next" (p. 79). In fact, classroom environments of high-engagement have shown to have great impact on pupils' performance and participation must not be optional, because it makes people more accurate. Discussion can also be improved, if students talk over in pairs or small groups before answering.

Providing effective feedback is not an easy task and only works if it is used by the learner to improve his or her performance; in other words, it "must provide a recipe for future action" (p. 121) [11] and has to cause thinking, not an emotional reaction. To be effective, it should be focused and related to the learning goals.

Cooperative learning has also proved to be successful because it motivates students, creates social cohesion, personalizes learning and forces cognitive elaboration. For that to happen there must be group goals but also individual accountability [11]. Students as learning resources are then a good way of increasing student learning, because when students feedback one another they have to understand learning intentions and success criteria. Using self-assessment may also improve the rate at which pupils are learning and this has to do with metacognition, an important process in which they should be trained. .

In short, the key assumptions of AfL are that learning is: a) an active, social process; b) in which the individual produces meaning; and c) which is best done by building on what is already known [13] [14]. It can be said that AfL implies a vision of active and self-regulating learners, who strive to give meaning to what they are learning and have been given the means to become increasingly able to assess their own performance [15] [16]. It implies a collaborative learning based conception, which includes the sharing of learning objectives and success criteria. The feedback, self-assessment and peer-assessment also have a role to play in this process of self-regulation [17].

4   PURPOSE OF THE STUDY

Given the promise of assessment to enhance better learning outcomes, the purpose of this study was to understand future teachers' perceptions about assessment, and their views on their future role as evaluators. As we had access to English and Portuguese students in training, we were interested in finding out how students of both countries faced this issue when time came to implement it in school.

Specifically, this study was guided by the following research questions:

1. What perceptions of assessment do university students have?
2. Which assessment strategies do students perceive as being the most effective for learning?
3. How do students understand the relationship between summative and formative assessment?

5 METHODOLOGY

5.1 Participants

The students participating in this study were enrolled in the academic year of 2011/2012 in student teacher training courses. The English students were on a postgraduate certificate in education (PGCE) course at the Institute of Education (IOE), focused on developing their teaching skills. The Portuguese students, from the University of Évora (UE), were on a master degree course also aiming the same goals. All the participants already had a degree on science and were in practice at schools (either basic or secondary ones).

5.2 Instruments and Procedures

To examine the perceptions of students about assessment, there was implemented a questionnaire, constructed for the purpose of this study, based on literature review, considering several studies on the area [1] [18] [19] [20].

The questionnaire consisted of 12 questions, mainly open-ended, with a few items on an answer scale, seeking to know the perceptions of students about assessment and assessment practices. The instrument also includes some issues of socio-demographic characteristics.

Data collection occurred between the months of February and March 2012 and the questionnaire was applied online, having previously obtained the necessary authorizations.

A qualitative analysis of students' responses was made in order to comprehend their understanding about the concept of assessment in an attempt to address the questions raised by the research.

As only three questionnaires were returned by the IOE students and there were only three UE students attending the correspondent science education training course, the answers are explored in terms of examples to illustrate the thinking of student teachers. No generalizations are done and the respondents are not regarded as constituting a representative sample of students from the two schools.

5.3 Dimensions of analysis

First we analyze the profile of each student (and each group by country) taking into account the following framework: formative/summative, individual/group and informal/formal emphasis. Subsequently, these three axes will then serve to interpret the answers, in order to draw a profile of all the respondents.

5.3.1 Formative/Summative

The distinction between the two poles of the formative/summative continuum is that assessment is used by most instructors to determine the learning that has occurred, and it serves as the basis for the assignment of grades. Such assessment is summative, as it closes the teaching sequence. Assessment is formative when the evidence is used as an on-going process within the class, to adapt the teaching to meet student's needs, as well as providing feedback to the students [21]. The difference is more about purpose, as the formative assessment is concerned with future development of learners, helping them to progress, and is more process orientated, while summative assessment has a more evaluative focus, making a judgment about the extent to which the student has reached in terms of goals [22]. The criteria used in formative assessment are student-referenced, specific to the individual development. For summative, the same criteria are used for all learners and the differences in the class are exposed.

Formative assessment is more focused on improving learning than to classify, more integrated in teaching and learning, more contextual and where students have a role to play. It is meant to promote students responsibility and self-assessment. Some of its outstanding features are: a) assessment is deliberately organized in close relationship with high quality feedback; b) feedback is important to activate the students cognitive and metacognitive processes, which, in turn, regulate and control learning, as well as to improve their motivation and self-esteem; c) the nature of interaction and communication between teachers and students is central; d) tasks reflect a closer relationship between teaching and assessment, which has an important role in the regulation of learning processes; and e) classrooms assessment environment induces a positive culture of success, based on the principle that all students can learn.

5.3.2 Individual/Group

Individual/group dichotomy is either linked to the formative and summative assessments. Summative tends to be carried out with all students in the class, whereas formative tends to be carried out with some individual students or small groups. As a matter of fact, individual circumstances must be taken into account if the assessment is to help learning and to encourage the learner.

More than assessment for other purposes formative assessment "requires that pupils have a central part in it; pupils have to be active in their own learning and, unless they come to understand their strengths and weaknesses, and how they might deal with them, they will not make any progress" (p. 372) [23]. Black and Wiliam [10] stated that summative assessment had to do with "consistency of decisions across large groups of students, so that the over-riding imperative is that meanings are shared by different users of assessment results". Moreover, "formative functions of assessment prioritize desirable consequences, either for small groups of students or for particular individuals" (p. 54).

Formative assessment has therefore underneath a philosophy focused on learners taking responsibility for their learning by developing understanding of what and how they are learning [24]. In addition, even socio-cultural perspectives that involve thought and action in context, with [25] or even [26], the collective knowledge has to be internalized by the individual [27].

5.3.3 Informal/Formal

Informal/formal emphasis is also linked to the main purposes of assessment, for learning and for certification. Assessment for learning is mainly informal, frequent and integrated in teaching and learning, whereas assessment of learning has formal constraints, because the results must be reliable to the public [28] [29]. In general, certification assessments are necessarily structured and formal to ensure comparability across school settings. Within classrooms, both are used and the balance between them shifts with the students' age [30]. A qualitative analysis of the responses is made in order to comprehend their understanding about the concept of assessment in an attempt to address the questions raised by the research.

6   THE ANSWERS OF THE STUDENTS

6.1   Student's profile

6.1.1   Interpretive dimensions – individual analysis

Beginning with the definition of assessment, the English respondents showed their diverse assumptions of assessment, despite the identical input as they all are PGCE students, showing the complexity of the concept and, probably, the influence of the policy followed in each student's school, since they were interning at different schools in London.

Student-teacher UK-1 (male, 21 years old) seems to value formal processes of assessment, more concerned with the amount of what is learned by his pupils (*finding out how much someone has learned*). Thus, it can be deduced that he values summative assessment (*I use schemes of work, past exam questions, text book questions, post-it notes*), although his answers show that he knows that both processes are necessary (*I have done quite a bit of self-assessment).* He also seeks to know what is not going well, understanding the importance of formative assessment, especially when he emphasizes the individual aspect of student work (*Make it individual so you can spot who has and hasn't understood*). In fact, he considers individual work and oral presentations as the most effective assessment strategies for learning.

For him, the assessment is timely, occurring at certain moments of the class, especially at the beginning of each class, and also in the tests. As Swaffield replies: "Assessment for learning´s prime concern is with the here and now of learning. It occurs in the flow of activity and transactions occurring in the classroom" (p. 441) [5]. If we understand that summative assessment is a summary of what students know and are able to do at a given time, we are in the presence of an assessment of learning practice.

Student-teacher UK-2 (female, 41 years old) links the concept of assessment to learning but ends up not defining assessment. She focuses in terms of class rather than with an individual concern and defends quick and easy techniques to give her a perspective of what students know (*Lollypops*

wooden sticks, traffic light questioning, board work quizzes and Collin test books questions). Even the reliance on individual work has a summative perspective; using the written work and homework to identify the levels of Assessing Pupils Progress (APP), in which students are to be included (*I make sure they know their levels and targets*). As Swaffield [5] stresses: "Most of APP is about summative assessment" (p. 444) or ARG [31] (2006): "Assessing pupils, frequently in terms of levels or grades, means that the feedback that they receive is predominantly judgmental, encouraging them to compare themselves with others. In such circumstances, there is little attention by teachers or pupils to the formative use of assessment" (p. 10). This is a formal understanding of assessment and eventually related to educational policy that the school where she is working has adopted. It can be assumed that this prospective teacher appears not to have a deep understanding about assessment, not putting too much emphasis on how students learn and using techniques to classroom management rather than actually to lead students to more and better learning (*Time and classroom management,* as the most important factors influencing the way she assesses). However, in terms of assessment definition, this teacher places emphasis on guaranteeing learning and apparently defends that assessment activities should occur throughout the lesson and considers portfolios and peer-assessment as very effective assessment strategies for learning.

Student-teacher UK-3 (female, 50 years old) uses a clear and sophisticated definition of assessment (*The qualitative or quantitative measurement of a thing against certain criteria*). However she also seems to focus her attention more on class level than at the individual level (*Make objectives of lessons clear and review throughout and at end with summings-up*). She does not reveal a great concern with formative assessment, showing that in her classes the emphasis is eventually placed on summative assessment (*Use info about levels as available if using questions from tests or course-books*). The formal and occasional perspectives are also present on the concern with APP levels (*Would try to take in books once every 3 weeks or so to make comments about level and improvements*). It seems that instead of guiding the students in order to make progress with their learning the moments of assessment are meant to classify and balance (*quick-check; questions from tests or course-books; summings-up; quick topic review work*).

The same questions were posed to the UE student-teachers.

Student-teacher Pt-1 (female, 26 years old) uses a definition of assessment where she stresses the connection to learning and understands it as a process and as a continuum (*a process with the potential to generate learning; a necessity for successful learning; I always try to carry out continuous assessment*). Nevertheless, she shows a formal perspective about the assessment process, when she says: *In an organized way; Using various forms of assessment as summative tests, formative tests, written work; I use varied tools, such as textbooks, after testing and correction of work is done*. These examples also illustrate an emphasis on the class rather than in the individual work (*feedback in the classroom to the written and oral summative tests*). Most of the discourse of this student-teacher shows a concern for summative assessment, as the following assumption reveals: *alerting students to that situation, so that they can always be prepared for possible evaluation*.

Student-teacher Pt-2 (male, 35 years old) defines assessment in a very sophisticated way (*Assessment can occur during learning and after teaching; the distinction has to do with the objectives pursued, i.e., the regulation in the case of the first and classification for the second*) and all his speech sounds very formal. He probably has an understanding of the importance of the formative (*during learning; regulation; constant feedback*) and summative (*after teaching; classification*) modes and tries to use both of them with his students, as he says he uses individual grids to fill in with information from each student and even conducts questionnaires to collect data, apparently using a variety of instruments. Nevertheless, when he explains how his students know how they are learning and what they need to do to improve, he says: *I correct (the homework) clarifying and classifying their performance*. He does not seem to be considering a major involvement of students, with intense dialogue or promoting learners´ thinking, and he even says: *Formative assessment is to prepare students in a gradual and stepwise way for summative assessment*.

Student-teacher Pt-3 (female, 23 years old) has an assumed formal perspective about assessment (*Assessment is a formal moment*). That is probably why she projects also a summative tendency, as she says: *Different assessment moments, homework, question/answer during the lecture, test, exercises; Correcting homework or an exercise; check success*. We can assume that she concerns about the individual process for her most effective assessment strategies choice: *Individual work, oral presentations and homework assignments*. As she says: *Formative assessment allows greater collection of data and information about a student*.

She makes much of the climate of the classroom, in any situation and therefore also with respect to evaluation: *I think teaching relationship is extremely important, I consider it essential to develop a good and friendly relationship with students*. As Stobart [17] emphasizes, assessment for learning focuses on the quality of the interactions and relationships in the classroom.

In fact, if we see assessment for learning as a learning process itself, pupils must be involved in the process and "exercise agency and autonomy" (p. 443) [5]. This is a not so much developed perspective in the participants' responses.

Regarding the question "Do you connect data from formative and summative assessment?" the IOE students all responded differently: one said yes, another said no and the other said not yet. Portuguese students all responded affirmatively, probably because they stay in schools for longer periods and they share the moments of final assessment with the teacher of the school.

In fact, the question of the relationships between formative assessment and summative assessment continues to attract the interest of researchers, in what has to do with reflection and theory or with empirical research, as well as in practice and curriculum planning and it is not yet fully solved [8] [32] [33].

6.1.2 Interpretive dimensions – group analysis

The three interpretative dimensions of analysis will now serve to interpret the answers, in order to draw a profile of all the respondents.

Formative/Summative – Summative assessment is actually predominant in the assumptions of the student-teachers, as they seem worried about classification, levels, grades, tests and the use of results for accountability. Actually, if you defend a formative assessment perspective, you have to be aware of the knowledge, attitudes, abilities and development of students, in order to give clear indications about what to do in order to progress. Teachers and students will have to share ideas about quality to be achieved. In fact, as Biggs mentioned [32], we can only say that an assessment is actually formative if students are made aware of the differences between its present state and the one they are meant to reach and what is needed to reduce or even eliminate that difference. Perrenoud [16] fits this view, by stating that any assessment that contributes to regulation of learning is formative.

Individual/Group – The tendency of student science teachers as a whole was to answer almost entirely in terms of group (students, they, them, children, class). The development of the responses taking account of the individualization or individual feedback was residual (make it individual). In science education it is important to value meaning making and developing deep understanding in these subject areas, bearing in mind, however, the individual learning as a transaction between the individual and the social environment [25].

Informal/Formal – Students seem to be very attached to a formal view of assessment. In general, the suggested tasks are very structured and often designed to classify the learners. There are several formal means reported by students, such as tests, past exam questions, text book questions or Collin test books questions. Although, in the practice, it appears that the assessment of learners is formally conducted, the student-teachers reported that they equally use informal means, such as discussions, suggestions during instruction and feedback based on self-evaluation and peer-assessment and comments.

Nevertheless, as Hadji [15] and [33] Harlen refer, there will still be other undifferentiated assessment practices, which result from combinations that teachers can make between formative and summative assessments, with different degrees of structuring and formalization.

Indeed, as in this study, the literature has allowed identifying problems and weaknesses in how teachers understand the assessment process, such as Fernandes [7] states:

a) Many teachers expect tests to assess deep learning outcomes, but research shows that they test in general routine and algorithmic procedures.

b) Tests and any other evaluative tasks give, in general, little or no guidance for students to improve.

c) Teachers think that assessment in classrooms is essentially formative, although reality shows that only a few times it will actually be so.

d) Formative assessment is considered unrealistic in the schools and classrooms contexts and the difference from summative assessment is decreasing.

e) The confusion between formative and summative assessment is a problem that seems to indicate that there will be few genuine formative assessment practices and/or that teachers are overwhelmed with too many assessments to meet the needs of both.

f) The tendency to compare students with each other, causing them to believe that one of the main purposes of learning is the competition rather than personal growth. Accordingly, the evaluative feedback turns out to strengthen the idea that students are not competent.

The results may also show that students' understanding of assessment terminology and relationships reflects the fragmented theoretical and practical frameworks available in present and the need of constructing an evaluation theory in the domain of student learning. In fact, according to Fernandes [34], the construction of theoretical knowledge in this area has not received much attention from researchers, although it is recognized by many as a necessary condition, though not sufficient, for supporting school practices [7] [10] [12] [17] [21] [35] [36] [37].

7   FINAL CONSIDERATIONS

In this study, we found that student-teachers emphasized different aspects of assessment, as they live in diverse contexts. English students talked about the target levels and the information they need to give to the pupils, in terms of APP grids and, on the other hand, Portuguese students make use of the expression continuous assessment as it is present in formal documents and probably because of that they also use formative and summative assessment in their talks more often than their English colleagues. The connection of assessment-learning-teaching is more obvious in the UE students' talks but self- and peer-assessment are only mentioned by IOE students.

English student-teachers work in different schools, with different teachers and supervisors and Portuguese student-teachers work in the same school with the same teacher, same pupils and same supervisor.

Although the contexts are so different, we reach the same conclusion: assessment is not easy to define and raises many questions when put into practice, leading to a variety of understandings and solutions in the classroom. Nevertheless, they all tend to a summative perspective rather than to a really assumed formative assumption, as the examples provided can show. It seems that there are difficulties in changing the paradigm and the practices towards a formative assessment and the improvement of learning; using differentiation and individualization of education are still far from becoming the rule, as Harlen [22] stresses: "Many teachers recognize the values of formative assessment, but feel unable to make the changes in their teaching style that it requires, when struggling to improve test scores" (p. 145). Current practice is often driven by pressures to show evidence that the pupils have made regular and visible progress and most of the times teachers tend to respond with frequent summative assessment in the form of tests. The same idea is presented by Stull *et al.* [20] (p. 30): "it is very difficult for instructors not to focus on summative assessment measures since the prevailing pressures for improved learning drive them inevitably in this direction".

Finally, it is worth remembering that for assessment practices to be formative it is necessary that assessment is an integral part of teaching for understanding, related to progression in learning, towards an action that leads to more learning, involving children in assessing their performance and deciding on the next steps of the learning process [38].

Today it can be within reach of schools, teachers and students to enhance what is learned and how it is learned. Formative assessment is not a panacea for the educational systems, but it is certainly an essential educational process for supporting all the children and young people, who experience discouragement, school dropouts and even social exclusion. That is the reason why it is essential to explore and deepen the idea of assessment for learning, if we are to tackle the most pressing issues of contemporary education. And this necessarily involves more empirical research and continuing theory building. We have therefore a long way to go in schools and in school science.

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