Technology in support of formative assessment in pedagogy

Mary Webb

1 King’s College London, UK, mary.webb@kcl.ac.uk

Abstract By drawing on findings from two distinct strands of research this paper addresses the question: How can technology support the interactions and feedback processes of formative assessment? The first strand focused on case studies of primary classes where teachers had embedded formative assessment practices into their teaching. The second strand was a study with 48 pre-service teachers that set out to investigate how a range of technologies could be integrated into pedagogical practices that emphasised formative assessment and how the technologies supported and enabled these approaches. Methods included structured lesson observations, structured teacher interviews, student focus group interviews, informal discussions, questionnaires and scrutiny of lesson plans and students’ work. Findings were analysed using a framework derived from activity theory. The findings revealed that technologies provided a range of tools that can be deployed by teachers as they engineer situations for students to learn and to develop as autonomous learners. The tools mediate the feedback processes and can extend and support teacher and peer feedback. Planning and engineering these sequences of activities and deployment of these mediating tools requires sophisticated pedagogical reasoning by the teachers using a range of types of knowledge. The classroom time of the teacher that can be freed up by students taking more part in their own and each others’ learning through these feedback process can be usefully deployed in more focused interactive regulation based on better understanding of students’ needs.

Keywords: pedagogy, pre-service teachers, formative assessment, feedback, classroom teaching, primary education, teaching methods, teacher education
1. Introduction

This paper aims to address the question: How can technology support the interactions and feedback processes of formative assessment? by drawing on findings from two distinct strands of research. The first strand was part of the programme of the assessment research group at King’s College London who were researching formative assessment practices in schools. This strand focused on primary teachers who had embedded formative assessment practices into their teaching. The research was conducted in the State of Jersey that undertook a major professional development programme, referred to as Jersey Action for Formative Assessment (JAFA), to develop formative assessment. This research, over four years between 2004 and 2008 aimed, to understand classroom practices in formative assessment, the nature of interaction and feedback and how formative practices were related to pedagogy. Although this work had no particular focus on technology some of the participating teachers were experienced users of technology and integrated ICT use into their teaching. The second strand was a study with beginning teachers and their lecturers that set out to investigate: How can technology facilitate interaction and collaborative learning between beginning teachers within the classroom and beyond in an integrated and coherent way? The author worked on the JAFA Project as a researcher and on the second strand as director of the secondary ICT PGCE course, tutor and as a participant researcher. Therefore the author was able to build on findings about formative assessment and pedagogical practice from the JAFA Project in planning and teaching the PGCE course. Thus the second strand, in respect of the ICT students who were learning to be specialist teachers of ICT at secondary level, focused on how a range of technologies could be integrated into pedagogical practices that emphasised formative assessment and how the technologies supported and enabled these formative approaches.

In 1998, Paul Black and Dylan Wiliam published Inside the Black Box, which summarised their review and meta-analysis of research into classroom assessment practices (Black and Wiliam, 1998). Their principal findings were that, when teachers implemented formative assessment strategies, the learning gains of the students in these teachers’ classes were significantly greater than those of control groups (Black and Wiliam, 1998, 1998).

For Black et al., the term ‘formative’ applies not to the assessments themselves, but to the functions they serve in supporting students' learning and providing evidence that is used to adapt the teaching to meet learning needs (Black, Harrison, Lee, Marshall, & Wiliam, 2003).

More recent research has demonstrated that working at improving the teacher-student interaction through formative assessment and particularly focusing on feedback can catalyze changes in both the teacher’s role and those adopted by that teacher’s students (Black and Wiliam, 2006).
The JAFA professional development programme followed similar principles and built on methods used previously (Black, Harrison, Lee, Marshall and Wiliam, 2003). The programme aimed to enable the lead teachers who were chosen by their headteachers to develop their own classroom practice by experimenting with formative assessment techniques and ideas and evaluating the change through reflection and discussion with the King’s team and with each other. This was facilitated by workshops, lesson observations and discussions. As the lead teachers developed their own practice, they were expected to encourage experimentation and to share their experiences with other teachers in their own and other schools, especially those involved in subsequent phases of the project. The research on which this paper is based, focused on six primary school teachers and their classes who had taken part in the first phase of the professional development project.

The second strand drawn on for this paper consisted of research and development over the last three years that was initiated at a time when the Post Graduate Certificate in Education (PGCE) secondary programme was being redeveloped to accommodate European requirements for all postgraduate programmes to incorporate masters-level modules. Therefore a priority for the PGCE was to enable students to focus more on reflection on the relationship between theory and practice as well as drawing on evidence from empirical research to inform their developing practice. In order to encourage students to reflect, the pedagogical approach emphasised collaboration between students and was designed to model the kinds of approaches that they might adopt in their own teaching including peer and self assessment. Funding from the UK Training and Development Agency for Schools (TDA) and King’s College Teaching Fund provided equipment, technician support and development time to examine how mobile devices including Tablet PCs and UMPCs together with wireless technology and Web 2.0 facilities such as wikis and application sharing could support and enable these pedagogical approaches.

2. The nature of feedback for formative purposes

The particular focus of this paper is on the interactions and feedback processes of formative assessment. Various computer and network technologies can enable interactions and thus could support feedback processes but a first step is to clarify the meaning of the term feedback in these contexts.

There is evidence of dissatisfaction with feedback but also lack of clarity or consensus about the nature of feedback. For example, in the National Student Satisfaction Survey in the UK in 2008 as only 54% of undergraduate students, agreed that feedback had been prompt and had helped to clarify points they did not understand (Tahir, 2008). Furthermore recent research based on interviews with thirty five students and staff from three institutions of higher education, suggested that students and teachers lacked clear understanding of the nature of what constitutes
feedback and had no shared understanding of its purpose (Price and O’Donovan, 2008).

A number of meanings of feedback are in regular use in every day language as well as in specialised fields and the term can be used both as a noun and a verb. A useful definition of feedback with origins in systems theory is: “the return of part of the output of an electronic circuit, device or mechanical system to its input so modifying its characteristics” (Collins English Dictionary). This definition incorporates the concept of modification which is obviously also crucial to learning and formative assessment. It is also very different from the definition used by Hattie and Temperley in their review of feedback for assessment where they regard feedback purely as information:

“feedback is conceptualized as information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding” (Hattie and Temperley, 2007 p. 81).

On a range of professional development and research programmes carried out by members of King’s College London Research Group, feedback was one of the four aspects of formative assessment that were implemented successfully in classrooms and led to learning gains (Black, Harrison, Lee, Marshall, & Wiliam, 2003). The feedback processes in these studies included oral and written feedback between teacher and student(s) and between students in pairs or larger groups. Oral feedback obviously formed part of classroom discussions and interaction but written feedback was also developed into interactive processes by means of, for example, diaries and feedback sheets on which a student and their teacher conducted a written dialogue. Thus feedback in these contexts was a process involving information rather than just the information itself. The feedback was also part of a larger set of pedagogical processes in which the teacher regulated the learning through the two levels of management described by Perrenoud (1998, 92) as:

1. the setting up of situations which favour the interactive regulation of learning processes
2. interactive regulation of these situations.”

Planning of these pedagogical processes required teachers to use a range of curriculum, subject and pedagogical knowledge for their pedagogical reasoning processes (Shulman, 1987).

Evidence that for feedback to be effective students need to receive information both about the task and about how to perform it more effectively comes from Hattie and Temperley’s (2007) meta-analysis of feedback studies. They obtained high effect sizes where students received information about the task and about how to perform it more effectively, lower effects for interventions which focused on target-setting, and much lower effects where only praise, or rewards were given. Their subsequent categorisation of types of feedback also took account of factors affecting students’ responses to teachers’ feedback including the commitment and confidence of the students. However their categorisation focused on teacher-student interactions rather
than peer, group and whole class interactions where feedback processes are also in operation. These more complex settings are the main focus for this paper.

3. Methods and Data Sources

In order to examine changes in classes, teachers’ pedagogical decision making, the challenges they experienced in developing their own practice and changes in the students’ learning approaches and attitudes, on the JAFA project, a combination of structured lesson observations, structured teacher interviews, student focus group interviews, informal discussions and scrutiny of lesson plans and students’ work was used. Findings were analysed using a framework derived from activity theory and are reported more extensively elsewhere (Webb and Jones, 2009). During 2007 and 2008 Jones and Webb focused on interaction and feedback through analysis of transcripts of group and whole class discussions as well as focus group interviews with students.

On the PGCE research strand reported here, two successive cohorts of approximately 24 secondary ICT students were studied over two years. Students participated in discussions with teaching staff about which technologies to use and how to deploy them in their learning. Various pedagogical approaches with different combinations of hardware and software were explored in a variety of taught sessions as well as being available to students for use in study time and group work. In order to investigate the students’ learning approaches and how technologies could support this learning, a combination of peer observations by lecturers, structured group interviews, focus groups, informal discussions, scrutiny of students’ assignments and online questionnaires was used.

4. Results and Discussion

The primary teachers identified formative assessment as providing a philosophy of learning focused on learners taking responsibility for their learning by developing understanding of what and how they were learning through complex feedback processes. These processes involved combinations of group and whole class interactions and incorporated both teacher and peer feedback and student self assessment. The teachers encountered difficulties in developing their formative assessment practices including: specifying learning intentions; designing good questions; following questions up with appropriate responses to support thinking and discussion and establishing appropriate learning behaviours and attitudes in their classes. However they persisted and succeeded in embedding formative assessment in their classrooms because they believed that this would bring important improvements in their students’ learning.
A particular focus of the PGCE strand was on enabling students to work collaboratively, to review evidence from research in formative assessment, to jointly plan and evaluate their teaching and to develop their own formative assessment practices with their own classes. Assessment of students’ work was through a series of linked formative assignments that combined individual and group work. Students were required to develop group portfolios on a wiki incorporating several assignments: joint lesson evaluations focused on how technology had supported learning; joint evaluations of ICT-based resources; electronic resources they had developed themselves and a paper compiled from their online discussion contributions.

A number of themes emerged from our analysis and those that are particularly crucial to understanding the nature and context of feedback processes and how they can be supported by technology are discussed below.

4.1. The importance of classroom culture

An important theme that emerged from the research with primary classes was the necessity for a change in the classroom culture to enable the formative processes. This new culture was characterised by the following (Webb and Jones, 2009):

- a shared belief in taking responsibility for one’s own learning
- learning orientation rather than performance orientation (Dweck, 2000)
- an acceptance that mistakes and getting it wrong are an essential part of learning
- mutual support for each others’ learning
- trust that others’ would be supportive
- honesty about understanding, mistakes and feedback
- willingness to take risks in trying new ideas
- willingness to give and receive criticism
- a shared language of assessment and feedback
- an emphasis on dialogue and exploratory talk to support thinking

Development of such a culture is also necessary with beginning teachers. For example, I have found that it is not only necessary to explain, discuss and model collaborative and peer support processes but also to counsel individuals who find difficulties in group work particularly during the early stages of the course.
4.2. Students’ views of the importance of group work

The primary school students developed firm beliefs in the value of group interaction for feedback processes as illustrated in these extracts from a focus group discussion by Year 6 students following an English lesson:

- When you work in groups you see how different people learn and how they really think of their views of their ideas, and maybe, like, their opinions of your ideas.

- I felt it (group discussion) went very well, because, like, there were two of us in the group that had a good idea that we wanted to tell, and people were thinking yeah, but what if, and they were putting in their own ideas and then we made it into one.

- I feel it went good because all of us got to do something and we all learnt quite a lot because we have been doing play scripts for quite a while. And in my group, Toby and James, sometimes they just drift off into their own little world, but they actually really came together.

- Like Miss Elliot says we are all little teachers and we can help each other, and then we learn.

In the focus group discussions with the PGCE students nearly all agreed that collaboration and peer feedback is important for learning both for themselves and with the students they were teaching. It is worth noting and may be a focus for future research that despite a strong focus by the primary teachers and by myself with the PGCE students to use group work and to enable collaborative learning where we felt it was the best approach to achieve the learning intentions there were a small minority of students who were quite resistant to these approaches. In each year of the PGCE there were a very small minority (one or two students) who failed to participate to the required level in the collaborative work and clearly preferred to work alone or cooperatively rather than collaboratively. Likewise with the primary students, in spite of the strong culture of collaboration and peer support there were still a small minority of the primary students who said that they always preferred to work on their own.

4.3. Using technologies for collaboration and feedback

All of the primary teachers used computers and interactive whiteboards in their teaching to some extent but only two of them were observed making use of the technologies to facilitate feedback processes. These processes that were observed are characterised in the following scenarios:

1. Use of the interactive whiteboard enabled whole class interaction in which the teacher and students demonstrated making changes and annotations to a piece of
work dynamically while explaining those changes to the whole class. Thus the teacher would model a feedback discussion with a student while annotating their work electronically. The teacher would encourage and support other students to participate in this feedback discussion. The actual changes on the interactive whiteboard were sometimes made by the teacher following suggestions from one or more students and sometimes by a student.

2. Use of word processing software by students working individually on computers enabled students to respond to annotations on their work that had been made previously by the teacher. In some cases the students also added further annotations in response to the teacher’s comments but generally this interaction was through oral dialogue during the lesson.

3. Use of word processing software by students working individually on computers enabled students to electronically annotate their own work as a self assessment process.

4. Use of word processing software by students working in pairs on computers enabled students to electronically annotate each others’ work as a peer assessment process. They discussed their annotations as they proceeded.

The facilities of the technology that enabled these processes can be summarised as:
- Being able to return to previous versions of a piece of work and review and compare previous annotations.
- The interactive nature of the display screen
- Highlighting using a word processor through a “traffic light system” where red highlighting indicated parts that were wrong or definitely needed improving, orange indicated uncertainty and green indicated parts that were good because they met the success criteria.

On the PGCE research strand a range of technologies were used in a variety of ways to support feedback processes and for other aspects of learning. Some uses were deemed to be more successful than others and some technologies failed to perform as expected. The successful functions performed by the technologies in feedback processes are summarised in Table 1.

All the PGCE students preferred face to face discussion where possible as a means of peer interaction and feedback. Where face to face discussion was difficult when they were out in school placements their preferred methods of electronic communication were:
- Mobile phones for arranging meetings and discussing ideas
- GoogleDocs for collaborative work
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- Wiki for presenting finished work and resources
- Blackboard VLE for course documents and sharing resources

They reported that GoogleDocs was reliable and generally accessible in their schools whereas other facilities including the College VLE on Blackboard were blocked by some school firewalls.

<table>
<thead>
<tr>
<th>Nature of the feedback processes</th>
<th>Technological innovations that enabled processes</th>
<th>Specific Product used</th>
<th>Functionalities that were crucial for process</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher or peers Create and store electronic feedback comments or feedback discussion notes for later review</td>
<td>WIKI</td>
<td>PBWKI</td>
<td>Easy web editing Joint creation of web pages</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Online discussion board</td>
<td>Blackboard discussion board</td>
<td>Asynchronous threaded discussion</td>
<td></td>
</tr>
<tr>
<td>Several peers simultaneously create written feedback for subsequent review and discussion during whole class work</td>
<td>application sharing</td>
<td>Google docs</td>
<td>Cursor jump, wireless Internet access</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TabletPC</td>
<td></td>
<td>Handwriting to text, Make notes rapidly while moving</td>
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<tr>
<td></td>
<td>Data projector</td>
<td></td>
<td>Present web-based material to class</td>
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<tr>
<td>Review video in conjunction with feedback</td>
<td>Digital video</td>
<td></td>
<td>Asynchronous threaded discussion</td>
<td></td>
</tr>
<tr>
<td>Discuss work in progress over distance / time</td>
<td>Online discussion board</td>
<td>Blackboard discussion board</td>
<td>Asynchronous threaded discussion</td>
<td></td>
</tr>
</tbody>
</table>

Feedback as part of wider pedagogical processes

The previous section including Table 1 summarised the feedback processes in which technologies were deployed but it is important for these processes to be part of a series of pedagogical processes. These uses of technologies were always incorporated in a sequence of activities that may include group discussions with handwritten notes or diagrams, annotating printouts etc. Sequences of pedagogical processes often comprised of complex sequences of activities alternating between whole class and group work. In order to analyse this complexity consideration was given to the temporal aspects of talk in learning (Mercer, 2007) and the interrelationships between sequences of activities using frameworks derived from Activity Theory (Wells, 2007, Wells and Mejia Arauz, 2006). An approach to analysing these pedagogical sequences was developed based broadly on Wells approach and various sequences were analysed. An example analysis of one sequence is shown in Table 2. It shows the various roles of the tutor, students and technologies and the nature of the activities in a pedagogical sequence designed to develop voice and presentation skills.
<table>
<thead>
<tr>
<th>Episode</th>
<th>Duration</th>
<th>Learning Purpose</th>
<th>Object</th>
<th>Nature of activity</th>
<th>Participants</th>
<th>Situation</th>
<th>Role of technology</th>
<th>Role of Students</th>
<th>Role of Tutor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 minutes</td>
<td>Understand task</td>
<td>Task specification</td>
<td>Explain and discuss task and purpose</td>
<td>whole group</td>
<td>face to face</td>
<td>Access to task specification and reference material on VLE and Web</td>
<td>Listen, question, check understanding</td>
<td>designed task, set and explained task and provided reference</td>
</tr>
<tr>
<td>2</td>
<td>30 minutes</td>
<td>know content requirements on chosen topic</td>
<td>Slide presentation</td>
<td>identify appropriate content and plan slides in outline</td>
<td>ICT Portfolio group (4 or 5)</td>
<td>face to face in groups</td>
<td>Access to reference material on VLE and Web</td>
<td>Research GCSE course requirements, discuss, identify content, plan presentations</td>
<td>Monitored discussion and intervened</td>
</tr>
<tr>
<td>3</td>
<td>1 hour over 1-2 weeks</td>
<td>be able to plan delivery</td>
<td>One or two slides and related interaction</td>
<td>Develop a 2 minute explanation and class interaction</td>
<td>individuals</td>
<td>Individual work</td>
<td>Access to reference material on VLE and Web, Presentation software</td>
<td>Research GCSE course requirements, identify content, plan and create presentations</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>2 minutes (repeated 4 or 5 times)</td>
<td>be able to explain concepts, assess and interact</td>
<td>oral presentation and whole group interaction</td>
<td>group of individuals present one at a time, 2 of remaining groups interact, 2 other groups write assessment notes for feedback -1st on strengths, 2nd on areas to work on,</td>
<td>whole group and teacher</td>
<td>face to face discussion</td>
<td>presentation device, video, multiple simultaneous assessment and feedback notes on Googledocs</td>
<td>explain concepts, assess and interact, electronic assessment notes</td>
<td>Electronic notes on voice for assessment of specific voice support needs</td>
</tr>
<tr>
<td>5</td>
<td>10 minutes</td>
<td>Understand ways of improving voice and presentation skills</td>
<td>Assessment and feedback discussion</td>
<td>Review and discuss peer assessment comments</td>
<td>whole group and teacher</td>
<td>face to face discussion</td>
<td>View multiple assessment comments from different authors simultaneously, view video</td>
<td>Explain assessments, discuss feedback</td>
<td>Monitored discussion and intervened</td>
</tr>
<tr>
<td>6</td>
<td>Variable</td>
<td>Review and consolidate understanding</td>
<td>self and peer assessment</td>
<td>Review feedback comments, plan further development of voice</td>
<td>individuals with support from peers, mentors, tutors as requested</td>
<td>individual work and peer support</td>
<td>presentation device, review of multiple assessment comments and feedback</td>
<td>Practise voice skills, peer assess and discuss</td>
<td>check that each individual BT has planned appropriate followup</td>
</tr>
</tbody>
</table>

Episodes 4 and 5 were repeated 5 times
The combination of whole class, group and individual activities is typical of many sequences both in the PGCE work and in the primary classes. Our ongoing research aims are to examine and characterise the interrelationships between the activities as they are clearly interdependent in various ways. The analysis presented here is intended to explore the structures of the sequence and the roles of technologies. Thus Table 2 provides one example of how the types of feedback processes listed in Table 1 are integrated into one particular sequence. Thus in this one pedagogical sequence the technologies can perform a variety of different functions as listed in Table 1.

4.4. The roles of teacher, students and technology

An important aim of formative assessment practices is to enable students to learn how to learn and to become autonomous learners (Black, McCormick, James and Pedder, 2006). As Black and Wiliam (2009) argue learner autonomy is achieved neither by the teacher doing the learning for the learner nor by the teacher stepping right back and acting alongside the learner but by the teacher *engineering* opportunities for learners to learn and to develop learning autonomy. The pedagogical sequences in the primary schools and that shown in Table 2 were clearly engineered by the teachers. In none of the terms observed could the teacher be described as a mere facilitator or chair of learning discussions. Rather the activities and overall sequence structure required detailed planning and engineering using the knowledge and pedagogical reasoning described by Shulman (1987) and the interactive regulation discussed by Perrenoud (1998). The sequence of activities shown in Table 2 was particularly heavily engineered to enable several different learning intentions. Within one half day session (with some directed preparation and follow up) the following were intended: 1) to introduce the key issues about use of voice and non-verbal communication for teachers; 2) to enable twenty four students to each perform two minutes of teaching and 3) to enable all to engage in feedback dialogue about their own and each other’s performances. Therefore the whole-group activities especially were tightly controlled by the teacher. The intention was that in addition to beginning to evaluate their own voice skills, students would be enabled to carry out peer feedback. The final activity in the sequence shown in Table 2 was much more open-ended and it was expected that students would be able to continue their development using peer support rather than tutor support. The electronically-stored feedback information, together with links to Web-based material supported this autonomous learning.

Sequences of activities in the primary classrooms were also highly planned and engineered. Furthermore, as with the PGCE course some activities were designed to enable students to work together using peer feedback with only the minimal teacher input required to achieve the learning intentions. Typically this meant that
the teacher was still kept completely occupied supporting students but was able to devote more time to those who were finding difficulties.

There is no suggestion in our research that technologies could actually generate feedback or become actors in these feedback processes in the near future. Development of e-assessment has made great strides in recent years and fully computerised assessment systems incorporating some useful aspects of feedback have been developed in some areas, notably maths and aspects of science in higher education (Whitelock and Watt, 2008). However there is still a long way to go before e-feedback systems, in most subject domains, can participate in feedback processes in any pedagogically sound way. As can be seen in Table 1 the role of the technologies is to provide a range of tools to support and mediate the interactions and feedback processes between students and between the teacher and students. In this role technologies can extend opportunities for learning through feedback processes by making it easier to generate, store, retrieve, combine and review feedback information. Thus feedback processes can be more efficient. Teacher feedback to one student can be more easily observed and reviewed by that student and others. Many to one feedback between students is made more efficient and many to many feedback can be achieved asynchronously.

Thus the tools mediated the feedback processes in the classroom activities systems so that as students progressed through a sequence of activities on a particular topic they were able to increasingly share the role of teacher in relation to that particular topic. The use of technological tools for feedback, together with increasingly effective peer support freed the teacher to focus their effort on other important teaching tasks. In particular there is a possibility that teachers may be able to devote a little more attention to the complex tasks of interactive regulation as described by Perrenoud (1998). Furthermore as teachers are observing students they are building their knowledge of students’ skills and understanding as well as their own pedagogical content knowledge (Shulman, 1987).

5. Conclusions

This study has begun to characterise the range of facilities and opportunities provided by technologies for improving feedback processes associated with formative assessment. These opportunities have been examined in relation to our developing understanding of feedback processes in formative assessment and in wider pedagogical processes. Technologies provided a range of tools that can be deployed by teachers as they engineer situations for students to learn and to develop as autonomous learners. Specifically, of the tools available, wikis and
shared word processors were easily accessible while providing important additional affordances for the feedback processes of formative assessment. These tools can mediate the feedback processes and can extend teacher and peer feedback from one to one feedback discussions to one to many and many to one at the same time and many to many through asynchronous processes. Whilst these tools are easy to use, planning and engineering these sequences of activities and deployment of these mediating tools requires sophisticated pedagogical reasoning by the teachers using a range of types of knowledge. Thus the greatest challenges are pedagogical rather than technological.

Enabling students at all levels to participate in feedback processes so that they understand the nature of feedback and how it can support learning may help to prevent students’ poor perceptions of the feedback they receive (Price and O’Donovan, 2008, Tahir, 2008).

Establishing a classroom culture that supports and enables these formative practices including feedback processes is challenging. The primary teachers had worked hard to develop their culture. The approach they had adopted bore many of the characteristics of the relational approach (Blatchford, Baines, Rubie-Davies, Bassett and Chowne, 2006).

Even greater challenges are inherent in the interactive regulation of learning in classrooms where teachers make split second decisions about how to respond to students based on a large range of knowledge types including their knowledge of students. The classroom time of the teacher, that can be freed up by students taking more part in their own and each others’ learning through there greater participation in feedback processes, can be usefully deployed in more focused interactive regulation based on better understanding of students’ needs. Developing understanding of these interactions and how they can be supported by technological tools is an important goal of our ongoing research.

References