Assessment for Learning and Fostering Student Agency and Autonomy in Technology

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ABSTRACT
In this paper we focus on how assessment for learning (AFL) practices can provide opportunities for students to develop identities as capable and independent learners who are aware of and able to employ a variation of and/or something similar to the accountability systems for knowledge generation and legitimation that are used by technologists. Sadler (1989) argued that the indispensible conditions for improvement are that students move from being consumers to active participants in their own learning and assessment. Carr (2001) adds that learner agency of this kind involves students being ready, willing and able to monitor and progress their own learning. As autonomous and agentic learners, students are attuned to opportunities to learn, to making deeper sense of their own learning and knowing when and how to take strategic action to progress their learning. They have 'a nose for quality' and the inclination and means to pursue this (Claxton, 1995). Using examples derived from a three-year research project undertaken with 12 teachers in New Zealand Year 1-8 schools we illustrate how teachers fostered student learning and learning autonomy through patterns of participation that construed learning as a social practice and collective responsibility. We detail the ways the teachers sought to ensure students had access to a range of opportunities for feedback and supported student affiliation with technology. We conclude that the 'spirit' of AfL (Marshall & Drummond, 2006) is evoked when teachers have a pedagogical mindset that foregrounds the sharing of responsibility with students as the norm, and when they provide students with opportunities, and the means, to exercise responsibility for their learning and learning progress.

Keywords: assessment for learning, autonomy, agency

INTRODUCTION

In this paper we focus on how assessment for learning (AfL) practices provide opportunities for students to develop identities as capable and independent learners in technology. We consider how the classroom culture for learning provides opportunities for students to exercise agency and authority and how teachers can foster student learning and learning autonomy when patterns of participation construe learning as a social practice and shared responsibility. We detail the ways the teachers sought to ensure students had access to a range of opportunities for feedback and how they supported student affiliation with technology.

THE STUDY

The Classroom InSiTE (Classroom Interactions in Science and Technology Education) research project was undertaken in 12 New Zealand primary school classrooms over three years. The overall aim was to explore the nature of effective student-teacher interactions in science and

technology as an aspect of AfL. Data were generated through classroom observations and included videotaping and audiotaping, and photographing interactions and artefacts produced (teacher planning, student work samples). Teacher pre and post lesson/unit interviews were conducted. Student interviews, both individual and group, were undertaken pre and post unit. Informal discussions during lessons with teachers and students were also undertaken. Several teacher-researcher meetings were audiotaped and any artefacts produced collected. Insights from AfL, science and technology ideas, pedagogical content knowledge, and student agency and autonomy were used to focus the data analysis. Data were triangulated through interviews, classroom observations, and student and teacher work. Unit cases were written and cross case analysis undertaken. Teachers and researchers worked in partnership undertaking joint analysis and writing.

KEY IDEAS

The indispensible conditions for improvement are that students move from being consumers to active participants in their own learning and assessment (Sadler, 1989). Carr (2001) concurs, explaining that learner agency involves students being ready, willing and able to monitor and progress their own learning. Students have what Claxton (1995) evocatively described as "a nose for quality" and the inclination and means to pursue it. The exercise of conceptual agency involves students expecting and being able to treat "*the concepts, methods, and information of the domain [or discipline] as resources that can be adapted, evaluated, questioned, and modified*" (Greeno, 2006, p. 539). In technology it "*is about enabling learners to have the confidence, competence and motivation to choose to be the person to take on the design and technology challenge and to* ***do effective and appropriate things*** *to address that challenge*" (Kimbell & Stables, 2008, p. 21 – bold in original). The 'spirit' of AfL can be linked with teachers and students engaging in learning as a shared responsibility where both teachers and students expect to learn. AfL practices, such as self- and peer-assessment, provide a means for students to reflect on and evaluate their developing expertise and understanding of the practices that are valued in the classroom community of which they are part. Jointly-defined learning goals and criteria for quality become tools that students can use to assess and develop their expertise as learners of technology. When students are positioned as both authoritative and accountable there is an entitlement, and expectation, that they will be able to move to access resources and have the authority to use, adapt, and combine these resources. In this paper we focus on how teachers supported student agency and resourcefulness and at the same time held students accountable to the norms of technology.

FINDINGS

(1) Patterns of participation for learning as a social and shared responsibility

Classroom routines and the patterns of participation that students and teachers develop together, shape and frame the extent to which learning is experienced as a social and shared responsibility.

Routines and frequently used task structures: Teachers deliberately set out to establish routines that supported learning as a social process. Lois and her Year 1 to 4 students worked on the technology topic of creating healthy snacks. In an early lesson she wove together several tasks to provide students with multiple opportunities to make and communicate meaning in around 30 minutes: a class discussion of what constituted a healthy snack, a group sort of healthy and unhealthy snacks, a class pooling of ideas where an anomaly was discussed, a revisit of the sorting task, and, a final class pooling of ideas. Lois used familiar classroom routines and task structures to advance the transition from one activity to the next and to help students remain focused on the learning goals of each task. Students were experienced in conducting sorts where a nominated leader acted as a coordinator, but everyone was expected to contribute with everyone's ideas being treated respectfully. In the class pooling of group ideas, students only contributed ideas not already given, a familiar routine to the class. Routines established the classroom as a learning environment in which students were expected, entitled and obligated to work together to support each other's learning (Gresalfi, et. al., 2008).

Recognising and crediting student ideas and suggestions: Teachers recorded student names beside the ideas they offered in group and class discussion, thus providing an enduring record of what was said and by whom. Displaying these records helped everyone build a picture of what was contributed and they were then revisited as a reference source. This technique positioned students as contributors of ideas that were worthy of collective consideration and helped establish a classroom culture that construed learning as a social process. Teachers also displayed student work as a way to accord value and credit students with having interesting and useful ideas. Free access to the displays expanded the time students had to think about the ideas and practices they were learning. Teachers also made floor books of student work. Photographs, text and diagrams helped students to 'see' their engagement with learning. Shared readings of the evolving book gave value to students' previous activities. These books were placed in the classroom library, a strong indication of the worth of student ideas.

Patterns associated with freedom to move and seek out support and resources: As part of a classroom culture for learning students need to be able to move freely around the classroom to access help, knowledge and resources for comparison, elaboration and inquiry (Roth, 1997; Windschitl, 2002). Gail's Year 3 and 4 students established together criteria for designing, making and testing a tong in their first two lessons. In the third lesson, Barry "invented" a spring to improve the functionality of the hinging mechanism in his tong. During this lesson, groups nominated representatives to visit Barry's group to explore his spring. They were very taken with Barry's idea and all adopted it, constructing a spring of some sort. However no students, including Barry, were able to securely attach their spring to the arms of their tong. By the end of the fourth lesson, no group retained a spring as part of their tong solution. This was a telling illustration of the conditions for conceptual agency. The idea of a spring emerged, was judged as valuable, diffused around the class, proved too difficult to operationalise, and so became redundant. Throughout this exploration it was essential that students could move about the classroom to source ideas and take them up in pursuit of understanding and/or task completion. Students also talked about joint responsibility for, and shared ownership of, learning. For example Mike (5 years) commented that: "*if you're stuck the teacher always helps you. Group work is good because the whole group got to make the food… When we are on the mat we can think about lots of things*". Shane (7 years) said: "*we got the jobs done faster and if you needed help doing a job and you can't do it by yourself you've got a buddy to do it with*".

(2) The distribution of authority and sources of knowledge and feedback

To be able to use what they learn beyond the moment and beyond the classroom students need to experience how different disciplines exercise authority over what counts as valued and legitimate knowledge. As well, the authority for developing and attributing worth to ideas needs to extend beyond the teacher.

Fading scaffolding to support agency and to share authority: Teachers designed task sequences where they gradually ceded authority to students. Jane scaffolded her Year 1 students through a kite design and make process. She began by guiding student observation of a simple commercial kite, pointing out the shape, reinforced corners, positioning of the braces, and flying string attachment. She modelled the making of an action plan and kite similar to the commercial one. Students emulated the same series of steps to produce a replica kite. Jane repeated this sequence twice more with different commercial kites on two different days. She was careful to replicate the technical language introduced in lesson one (bridle, flying string, braces, etc.) and used a similar sequence of steps in the action plan. Students followed her steps to also make these kites. Repetition served to increase the opportunities students had to make links between actions/ideas and particular words as well as to use the language. The use of the action plan encouraged students to "stand outside their practice" and helped them to develop a more robust self conscious awareness of what was involved (Kimbell & Stables, 2008, p.223). Finally, students created their own action plan to make their own kite having developed expertise and confidence. Jane was convinced that "*if these children had been given the task of making a kite*

without the scaffolding experiences, they would not have worked so confidently, creatively and successfully with designing their own kite".

Creating opportunities to experience and understand how quality is judged: To help students develop a nose for quality teachers help students develop expectations for learning and the criteria for judging the quality of their work. In Grant's unit on creating outdoor signs for the school, students considered, for example, the fit between the structural size of a sign and its purpose, suitability of materials for outdoor use, and building skills for constructing a stable structure. The consensus factors they distilled from direct observational experiences formed the basis of their specifications, which were used to assess the form and function of their signs. Grant encouraged students to check designs, mock–ups and final products against the specifications. They identified successful elements and where they could make improvements throughout the entire process. For example, after making a mock–up of his sign and before making the real one, David (9 years old) commented: *"My colours stand out and the lettering is clear but I am going to put a black arrow at the end so my sign shows direction. If you look at my mock–up the direction doesn't show. I also need to think, is it [the sign] high enough?"* Self and peer assessment were based on the same specifications. As a penultimate assessment, the class assessed all the signs and decided which ones best met the specifications to fit particular locations in the school grounds, where they were placed. The class development and reflective use of specifications reduced the need for the students to rely on Grant's opinion alone.

Activating peers and others as sources of information and feedback: Students often sought advice from their peers. In Jane's Year 1 class for instance, several students helped out others by explaining, showing, modelling and sometimes taking over some stages of the kite–making process. Ben became the teacher for Joe who had arrived late in a lesson. This provided Ben with an opportunity to further familiarise, practise and embed skills and conceptual knowledge, and Joe with timely help and support. Working together was possible because of the freedom Jane allowed and her encouragement of students to share their expertise. It was also possible because Ben had sufficient confidence in his own knowledge and skills to offer support – he had tested out/flown his kite and knew that it worked. Students often validated their work through a testing process focused on the functional requirements of the product. This meant they could become sources of information and feedback.

Teachers also invited people with expertise as a strategy to lend credibility to tasks beyond the classroom. Grant involved a conservationist in his unit on kiwi and the design of traps for pests found in environments that kiwi inhabit with his Year 5 to 8 students. The conservationist discussed with the students how well their traps would work – the extent to which each trap met criteria particularised for the specified pest. Students valued this affirmation and critique, especially Gary who planned to use his group's trap to catch possums on his family farm. Additionally Gary had persuaded his father to help his group make a working trap that could deal with their possum problem, another example of activating others as a source of information.

Seeding the environment with material resources to support student agency: Teachers can seed the environment with artefacts to be used as sources of information and feedback. During the third lesson on kite making with Year 1 to 4 students Lois had made sequential posters for each step. As she demonstrated each step she referred to the relevant poster, the text and the diagrams. These posters were then displayed on the classroom wall. When groups subsequently made kites they sent delegates to read the posters to check next steps. This allowed for student independence and agency as the students did not need to consult Lois as the only source of authority to find out next steps. Leaving students free to decide when and how they accessed resources was a powerful demonstration that teachers trusted students to pursue learning goals independently of them.

(3) Fostering student affiliation with technology

Teacher AfL practices need to help students participate and find affiliation with the identity of an autonomous technology learner. AfL has a role to play in helping students recognise that their classroom technology learning has meaning for them and their lives out of school, and vice versa.

Attributing students with the identity of technologist: At times, teachers explicitly positioned their students as technologists to help students realise that what they were doing and learning was technology. The attribution of identity projected students into a relationship whereby the criteria for quality for a task were linked to the expected processes experts use to undertake and evaluate their work. For example, Ellie talked with her Year 3 and 4 students about being designers when designing a mask for their forthcoming school production. She led a class discussion to establish the specifications. She showed an architectural drawing of a house elevation, commenting: "*This is a design drawing of a house. Can you see the roof, the walls, the windows, the doors?"* Students nodded "*yes*". She said: *"The designer had to put all those things in his drawing. They were his specifications. You are going to be designers just like him. You need to show in your drawing that you have thought about all of the specifications we've decided... Can you do this?"* Students indicated they could and their subsequent designs addressed the specifications. By identifying the students as technologists (designers), Ellie provided the opportunity for them to engage with classroom learning through another lens. Mostly however, students were positioned as learners and doers of technology. The topic of study was identified as a technology topic, units introduced as technology units and reminders were given over the course of a unit to help students affiliate with technology, to continue to learn technology and to see themselves in technology.

Students talking about technology: Student commentary indicated that over time they formed clearer pictures of what technology was about. Their ideas often extended beyond the current activities and topics of the unit. Younger students indicated that they viewed technology as making things for people. Adam (Year 3) commented: "*It's about other people and how things would work for them and for me. It's about making*." Older student provided a more comprehensive view relating technology to designing and making particular artefacts and activities for specific groups of people. Tim (Year 8) said: *"It's something that helps us do something. For example, the whiteboard is like a pen and paper, but a development. Chairs help us sit instead of sitting on the ground. A cup is to drink water from easier. Glasses help us see better. Technology helps us do things and makes things better."* Student comments on what constituted technology were encouraging. It was seen as a discipline that could make a positive contribution to their own, and others', lives.

Attributing value to student out of school experiences: Teachers routinely invited students to contribute their out of school experiences and ideas in class. They positioned students as authoritative over matters where they had expertise to contribute. Simon commented that it was easy for him to make healthy snacks because he did "*heaps of cooking at home*". Lois indicated that because he could understand a recipe, he would be in a good position to help others. Gary (10 years) commented to Grant that he knew about traps and pests because "*they had lots of possums on their farm. They carry disease and are pests and we have to put out traps to catch them*". Grant thought he would be able to help other students with their trap designs. Students' out–of–school experiences and ideas were viewed as having value in the classroom.

CONCLUDING COMMENTS

Several AfL practices help make tasks meaningful to students and hold them to account for explaining and justifying their ideas. Authentic success criteria are a resource for strategically guiding student learning and for students to use in assessment. Teachers can design and fade scaffolding in a way that cedes authority and transfers responsibility to students so they can make independent evaluative decisions as their expertise develops. As part of setting up the possibility of students' longer–term engagement with a discipline, AfL practices need to support

student affiliation with teacher goals for learning in a manner that also fosters student conceptual agency and motivates students to continue to learn technology, to see themselves in technology. Autonomy and agency are shaped and constrained by the nature of classrooms as social settings in which particular patterns of participation and responsibility have been established. Social aspects shape whose contributions are taken to be of merit and which actions and ideas influence what comes to count as valued and legitimate knowledge in a particular classroom. When students have opportunities to exercise autonomy and agency the teacher is not the sole authority in the classroom: teachers and students share responsibility for learning. The 'spirit' of AfL (Marshall & Drummond, 2006) is evoked when teachers have a pedagogical mindset that foregrounds the sharing of responsibility with students as the norm, and when they provide students with opportunities, and the means, to exercise responsibility for their learning and learning progress.

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