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Teachers' Conceptions of Assessment for Learning: What are the Implications for Children?

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ABSTRACT

This paper describes a multi-case study which linked conceptions and practices of assessment for learning to developing learner autonomy within UK primary mathematics classrooms. The project explored the use of assessment for learning in mathematics lessons with Year 5 (9–10 years old) children and their teachers. Four cases were studied in depth to understand how conceptions and practices impacted upon autonomy and control for teachers and learners. A typology of assessment for learning in mathematics is proposed, along with what this might mean for both teachers and learners in terms of the balance between control and autonomy. One case in particular, that of teacher Alex, is highlighted as it exemplified the expert teacher through the conceptions and use of assessment for learning, which led to the children becoming expert learners of mathematics. The class ethos was one of value for personal autonomy. Responsibility and control of learning was a shared endeavour within a community of learners. Community in this respect was broadened to include the environment and resources within the classroom and so demonstrated learners working within an expert classroom. This article was developed from a paper first presented at the ICME 13 conference (O'Shea, 2016).

KEYWORDS:

assessment for learning, formative assessment, self-regulation, learner autonomy, case study, learning as inquiry, compliance

Introduction

Assessment for learning is often used synonymously with formative assessment, but assumptions of equivalence are mistaken. Formative assessment refers to the function

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it serves only if it is subsequently used to adapt teaching to meet the needs of learners (Black & Wiliam, 1998). Perrenoud (1998) argued that formative assessment necessarily required the regulation of ongoing learning processes. In the UK, however, many definitions of formative assessment have abounded and metacognitive reflection by the pupils has not necessarily been assured. Stiggins and Chappuis (2005) advocated refocusing assessment towards engaging students in the processes of addressing perceived learning gaps.

Defining the purpose of assessment for learning

Assessment for learning has the purpose of promoting learning and suggests that learners are ultimately responsible for their own learning. Assessment for learning provides students and teachers with immediate information that is crucial for enabling them to control and direct their own efforts. The immediacy of assessment for learning is an important distinction from formative assessment which might take place over short, medium or long cycles to remain effective (Wiliam, 2006). Assessment for learning as short-term, everyday practice involving students and peers as well as teachers in the processes of reflection to enhance learning, became a part of Black and Wiliam's (2009) and Klenowski's (2009) definitions. The focus is on identifying the next steps in learning and how best to achieve them (Thompson & Wiliam, 2007). Crucially, assessment for learning must involve teachers, learners, parents and their peers in a partnership through reflection and dialogue about their own learning (Klenowski, 2009).

The primary purpose of assessment for learning is therefore to develop learner autonomy through metacognitive self-regulation. This has not, however, been a consistent conception in the UK. Within English primary school mathematics education in particular, criteria compliance has become a matter of meeting discrete sets of national curriculum objectives, with often surface level understanding, disconnected from real world contexts (Hodgen & Wiliam, 2006; Torrance, 2007). The purposes and principles behind assessment for learning have been misinterpreted and distorted, often being conflated with programmes to adopt and add into practice (Swaffield, 2011). Dialogic reasoning has the potential to engage with specific mathematics language and the metacognitive aspects of addressing personal misconceptions. Assessment for learning that promotes student autonomy can therefore involve reasoning through misconceptions, thus drawing deeper connections between aspects of mathematics.

Swaffield (2011) argued that to achieve this ideal requires a fundamental transformation in the traditional roles and cultures of the classroom. Student autonomy is achieved through a learning partnership that focuses on what is being learned, rather than which level has been achieved. The quality of discussions and classroom

relationships are essential for promoting autonomy with assessment for learning. This conception of assessment for learning within mathematics education requires a 'connectionist' teacher, which Askew et al. (1997, p. 31) argue is more effective because they create links across different areas of mathematics and draw together aspects of learning to solve genuine problems. Such teachers are concerned with enabling children to understand these connections and explicitly identify their own misconceptions and difficulties. However, with so many competing ideas and definitions within England, there is an important question to answer regarding the teachers' own conceptions and practices of assessment for learning and their understanding of autonomy.

Exploring conceptions of assessment for learning

Hargreaves (2005) proposed two distinct categories of conceptions in assessment for learning: measurement and inquiry. Assessment as measurement is concerned with performance, accountability and teacher control (Hargreaves, 2005). Learners might be aware of their learning but are less likely to have control, since this rests mainly with the teacher. Assessment as inquiry, though, is focused on the construction of knowledge to achieve a 'deeper understanding of individuals as learners, not just performers' (Hargreaves, 2005, p. 219). Pupils are expected to assume more control of the learning processes. Harris and Brown (2009) suggested a third conception: that of compliance. This negative conception views assessment as only serving the purpose of meeting mandates or directives with no direct link to improving teaching and learning. Although it is a conception associated with general assessment, it is possible that some teachers might also view assessment for learning in this way. It should be considered that not all teachers will conceptualise or even value assessment for learning as promoting learner autonomy through inquiry. If teachers' assumptions about pupils and their learning are implied within their conceptions of assessment, then these beliefs might influence their practices and ultimately the outcomes for the learners and their personal autonomy.

The role of learner autonomy

The 'Bergen definition' of autonomy (Dam et al., 1990) stresses the importance of active engagement with the social processes in autonomous learning, both independently and in collaboration with others. Willis (2011) similarly argued for a sociocultural perspective of assessment for learning where student identities are crucial to their involvement within a community of learners. Most definitions of autonomy have motivation,

self-regulation and metacognition as key facets, with the primary purpose to encourage learners to become expert in regulating their own learning, both alone and interdependently. These cognitive, behavioural and affective aspects of autonomy are interrelated. Self-regulation involves learners in the processes of setting, monitoring and controlling their own goals (Pintrich & Zusho, 2002). However, in order to be self-regulating, learners require the motivation to act metacognitively but also the self-efficacy to believe that learning outcomes are affected by their own efforts and agency (Bandura, 1993). Personal beliefs about ability are important because learners who assume that intelligence is fixed and learning is not improved with effort are more likely to focus on performance related goals and external rewards, or give up altogether rather than risk appearing to lack understanding (Dweck & Master, 2008). Those pupils who believe that intelligence and learning are related to effort are more likely to focus on learning goals and take responsibility for their own assessment and learning (Cowie, 2005).

Autonomous learning is sometimes taken to mean little more than pupils working alone. In this study, however, autonomy must involve the pupils taking responsibility for their own learning so that they develop strategies that enable them to work alone or interdependently (James, 2007). Sinclair et al. (2000), though, raised the point that there might be degrees of autonomy. With this, there must also be the possibility of no autonomy, or 'heteronomy', where regulation is controlled by others and not endorsed by the learner (Ryan & Deci, 2006). For Ecclestone (2007) there is also a difference between true personal autonomy, such as children choosing their own learning goals, and the 'procedural or technical autonomy' of meeting set learning targets, levels or goals (Ecclestone, 2007, p. 321). For James (2007) and Stobart (2014), autonomous learning stresses the need for students to become expert learners. This leaves the question of to what extent teachers' conceptions and practices of assessment for learning in mathematics lead to expert learners and what this might look like with primary age children? Therefore, the role played by teachers in promoting autonomy through their conceptions and practices within mathematics remains a crucial one.

Methodology

The purpose of this research was to explore conceptions and practices in assessment for learning with four teachers of mathematics and their year 5 (9–10 year-old) classes within a single English mainstream school. This study also drew connections between those conceptions and practices with what this meant in the mathematics classroom, and particularly how they might influence the development of autonomous learning. While this study focused on four teachers as different cases within the same school,

this paper will also describe the results of one teacher, referred to pseudonymously as Alex, in order to exemplify possible outcomes for an expert classroom.

The study used an interpretivist, multi-case approach to analyse four cases within one school in England. The school had four parallel year 5 classes, each with a separate teacher and 30 children. The exploratory nature and interpretivist approach meant that the experiences of the participants could be studied in depth, revealing rich data about their conceptions, practices and autonomy. Taking four cases in one school implied a similar context for each case and therefore a theoretical replication design (Yin, 2014). Each case was analysed holistically, with the whole class as the unit of analysis and the teachers and pupils acting as embedded participants within it (Yin, 2014). The full ethical principles of BERA (2018) were followed, including guarantees of anonymity, confidentiality and the right to withdraw for all participants and the school.

The chosen school was a mainstream school deemed to be good in overall effectiveness by Ofsted. They had begun the process of embedding assessment for learning within classroom lessons through school development planning. All teachers received the same programme of continuing professional development in the underlying principles and procedures of assessment for learning. As is common with many primary schools in England, mathematics was taught by non-specialist teachers with varying levels of experience from three to 20 years. It was an expectation for all lessons to share objectives and success criteria with the learners. How the objectives and criteria were to be shared, though, was not part of these expectations. Consequently, this did not necessarily mean that all teachers believed in the ethos of autonomy or even shared its values. It also did not necessarily mean that all teachers truly understood and practiced these principles of promoting autonomy.

From each case, six mathematics lessons were observed. The observations focused on how the principles of assessment for learning and autonomy were enacted within the practices of the classroom. Each case teacher was interviewed using a semi-structured approach to ascertain their conceptions of assessment for learning and autonomy, as well as the underlying principles behind their practices in the classroom.

All children in each case completed questionnaires at the beginning and end of the study so that a class overview of autonomous strategies for learning could be explored. 12 children from each case were then interviewed using a semi-structured interview schedule in smaller groups of two or three. This meant that children could discuss their views together and feel more comfortable and confident with expressing their ideas about their learning. The pupil questionnaires and interviews were focused on gaining an understanding of their strategies for learning mathematics, approaches to setting and monitoring their own learning goals, their motivation and self-efficacy for learning.

Mathematics lesson observations, questionnaires and interviews with the teachers and children gave rich data that were analysed to highlight the major themes of each

case. Other data from children's work samples and school documents were also used. All of the observations, questionnaires and interviews were transcribed and kept on a data base to enable an audit trail from the data to its location in the coding. The data were analysed using an analytic approach (Yin, 2014) to derive the major themes through an iterative process of successive coding and review (Bassey, 1999). This process started with open, rather than a priori, coding, because the project was exploratory in nature. The analysis became more focused and structured through successive draft frameworks and reviews accommodating different data sets (Saldaña, 2009). An audit trail of the data and analysis was created using a coding tree with systematic links to the data.

In this paper I draw together a cross-case analysis of the conceptions and practices in assessment for learning within the cases to propose a typology. I further discuss one particular case, teacher Alex, who displayed what I argue is an expert practitioner acting within an expert classroom.

Findings 1: Conceptions, practices and implications for learners

Analysis of the data suggested three main conceptions of assessment for learning which are outlined below. For each of these conceptions, teachers' and learners' beliefs about their own roles were particularly evident and are discussed below.

Conceptions of assessment for learning as inquiry and the construction of knowledge

In this conception the teachers' role was that of a facilitator, rather than a director of learning. Accountability pressures were balanced against the fundamental belief that children can and should control their own learning. There was an ethos of a community of learners which included teachers.

> Teacher: My role is as a leader and motivator to steer them into developing their talk, rather than me telling them this is what you are going to think… putting things in place where they can find things out for themselves… The most important thing is that [the children] realise that you can make mistakes too and that it is human nature to make mistakes and that their mistakes mean that they are learning… I quite like it when they come in and challenge me and say 'you know such and such, is it this or is it really this?' And you sometimes say in return 'I really don't know, why don't you see if you can find it out. Come on we'll turn on the computer and have a look'.

Children here recognised and valued highly the opportunities offered to discuss and reflect on their learning as a shared endeavour, believing in the efficacy of effort and the importance of tenacity.

> Child: We need to be able to find things out for ourselves using other people and ourselves and different resources because it gives us a bit of independence… If I don't understand something I would never let it go.

Learners here viewed their learning as ultimately controllable by themselves rather than only by their teacher. The children had strategies for seeking help in learning that included peers and other adults as well as their teacher.

Conceptions of assessment for learning as measuring, monitoring and accountability

Here the main role for the teacher was as a controller and director of learning. Pupils were regarded as recipients of learning rather than active constructors of their understanding. The belief was that pupils should be actively engaged, more critically, in their own learning, but the emphasis on monitoring and measuring progression for accountability did not enable this.

> Teacher: it's constant assessment because pupils in the classroom are constantly learning, and for me, you need a tool to discover the pace that they're learning, what they are comprehending and what they need to look at again… The role the pupils have is for us to assess them. They'll be active as part of it, but it is still really for the benefit of the teacher to benefit the child. It is for me to improve and follow the current ways of teaching and a massive element of jumping through hoops and ticking boxes, so if I'm ever observed I can show that I'm doing what I'm meant to be doing.

Learners were encouraged to use procedures to monitor and record their grades and gaps in their understanding. However, this was essentially procedural autonomy for the pupils. They were more likely to view the teachers' role as the director of learning, with themselves as listening and trying their best. Most learners still valued opportunities to work together to help each other understand mathematics. The children might monitor their own marks against objectives and success criteria, but did not necessarily view their learning as directly controllable by themselves. Pupils emphasised controlling their behaviour and listening more, rather than their learning.

> Child: The teacher's job is to make you learn so you get a good job… the pupils' job is to listen and making sure you know what the teacher is saying and know what to do and make sure you understand.
> Child: My [learning target] would be to work a bit harder and don't let people talk and distract me. It is hardest sometimes to work with friends because they can distract you easily and you get in trouble for it.

Conceptions of assessment for learning as compliance

Here there was little perceived value given to assessment other than to fulfil the needs of external procedures and to respond to teacher-led control of learning. Negativity

was expressed about extra work with little benefit for the learners. There was a belief that many of the children were not capable of controlling their own learning and that highlighting their gaps might be detrimental to their self-esteem.

> Teacher: for me assessment for learning means looking at what they do in the lesson, making sure that they realise what I want them to get from the lesson and what they have achieved. My role is to find out what the children understand from the lesson and adjust things so they make the progress they should. With this group they are not yet at the point where they can think about their own learning… It is just constant changes with the way we have to do things and show that we are doing them. In the end it is just overload. It hasn't made any difference to what the children have achieved. It has just been extra stress bringing it in and the children don't really understand what it is. For them it is just about getting things right or wrong.

The teacher might comply with school directives, such as sharing learning objectives and criteria, but only because it was expected within the school policies rather than a belief in their efficacy as learners. Teachers with this conception believed that assessment for learning was irrelevant to learning and their pupils. Compliance was only viewed as necessary because of the school accountability and monitoring procedures that ensured policies were followed.

Learners themselves were compliant recipients of teacher control in their learning. Most did only what was asked of them and saw their own role as needing only to listen to the teacher. Their belief was that the teacher held the role of being responsible for their learning. These children were, though, astute at perceiving their teacher's assumptions about their own abilities in mathematics:

> Child: I think the teacher thinks our brains only hold a certain amount of information in what we have to do in year 5 and then when we get into year 6, then the teacher thinks we might have forgotten what we did in year 5 so the teacher will do it again before we do the new things.

These children did not necessarily believe in their own capacity or their responsibility to control more than their behaviour. Some held fixed views of learning and many were defensive when discussing their work with other learners apart from close friends.

Findings 2: Exemplifying the expert classroom with the case of Alex

Alex's conceptions of assessment for learning

In this second findings section I further discuss one particular case, teacher Alex, who displayed what I argue is an expert practitioner acting within an expert classroom. This in-depth exploration of a single case is intended to elicit a depth of analysis.

Alex fully understood the perceived need to comply with the school's expectations regarding providing evidence of children's progress with 'what is in the exercise book' and understood the need to 'make sure the evidence ties up' against National Curriculum objectives and levels. However, Alex's dominant values and beliefs were focused on 'what the children can explain and the language they can use behind it' rather than what their books show. While some teachers found the balance between discussions and book-work difficult to negotiate considering the need for evidence, Alex's belief and desire to empower children to take control of their own learning was a central theme in this teacher's pedagogy.

Sharing control with the children as equal partners in learning was central to Alex's conceptions of assessment for learning. Alex expressed a desire to empower the children to take control of their learning by 'travelling their own road'. This conception of shared control underpinned Alex's pedagogy for using assessment for learning in the classroom and was the guiding principle behind the related conceptions of the roles and responsibilities of the teachers and pupils.

For Alex, the role of teacher was as a 'facilitator' or 'motivator' of learning with the responsibility to provide the 'right atmosphere and opportunities'. There was an overall responsibility and accountability for the children's progress, with the need to make 'instant judgements throughout the lesson' and understand their misconceptions in order to adjust learning. However, sharing this control was paramount for Alex. Thus balancing the competing needs of accountability and sharing control was regarded as 'like walking a tightrope'.

Alex fundamentally believes in the capacity of all children to take control and exercise critical autonomy regardless of perceived ability. Autonomy was viewed as enabling children to construct their own understanding and Alex was explicit in encouraging pupils to address their misconceptions with peers as part of a wider community of learners. This community included the teacher who valued being challenged by the children and was unafraid to say in response: 'I am not sure… come on we'll turn on the computer and have a look'. Overcoming the children's resistance to confronting their own misconceptions was perhaps 'the biggest hurdle that you have to get across'. So enabling the children to understand that misconceptions and misunderstanding are useful and no-one is infallible, including the teacher, was an important step.

Alex's classroom practices in assessment for learning

For Alex the role of the teacher is to 'steer' the children to reflect and reason through their misconceptions, with each child encouraged to analyse, discuss and argue their ideas. So one lesson on parallelograms began with the children identifying what they already knew and what they did not. Personalised investigations ensued where children used any resource to hand to explore the properties of parallelograms. Children

viewed themselves, their peers, the teacher, display boards, their school diaries and models of shapes as resources. The children subsequently chose their own learning objective and success criteria which they discussed, critiqued and refined, with Alex challenging the children to become more specific:

> Alex: what do you mean "must know the basics of parallelograms?" How would you define what you mean by basic?

Sharing lesson objectives and success criteria was an expectation, but in Alex's class they were explored, analysed and related to prior and new learning. Alex constantly challenged the children to discuss and demonstrate what they had learned:

> Alex: remind me what you did yesterday. Discuss with your partner… be more specific… show me on your boards- what did you find out?

Critically discussing and reflecting on the objectives and criteria were a feature of Alex's lessons, whereas in other cases objectives and criteria tended to be shown or mentioned but not explored:

> Alex: if the objective is to find percentages of given amounts… ask your partner and discuss what I mean by percent… what does that objective tell you?

Alex's purpose was to make the learning explicit and to draw connections between prior learning and new learning. The aim was to enable the children to think strategically about mathematics and their own learning. A dialogic approach ran throughout all lessons, encouraging the children to analyse their understanding and remaining misconceptions in mathematics:

> Alex: tell your partner how you found that answer. Did you get the same answer? If it is different, who is right and how do you know?

Alex was explicit with the children in this intention to build understanding across lessons and make connections with different aspects of mathematics, so the children fully understood the purpose behind Alex's questioning. Self and peer assessment were used to promote autonomy as explicitly reflective, metacognitive and related to mathematical learning. Children wrote messages on their work to each other and their teacher, explaining what they had learned against the objectives and criteria, but also asking questions when things were not clear:

> Child (in exercise book note to teacher): I couldn't work out how to do this, but (a friend) helped me… I think we did it a different way to in the book. Are we right or wrong?

The quality and analytical level of the classroom dialogue was evident in all lessons and ran through all aspects of work, both oral and written. However, it was evident that this was clearly not something that just occurred without a concerted and sustained effort from Alex in terms of giving the children strategies that enabled exploratory and analytical talk. Alex reflected on the need to set and enforce the ground rules for talk from the very beginning of the school year. This was not an easy process since it was clear from Alex that there was a need to overcome initial defensiveness over misconceptions and that these processes were continually being reinforced throughout all lessons. Some children had become much more confident in those processes of challenging and questioning personal understanding, while others still needed some support. But for Alex, teaching and learning began and ended with the children; with empowering them to reflect on their own learning.

Learners' developing autonomy

The children in Alex's class viewed their own roles in terms of taking responsibility for their own and each other's learning by 'having the right attitude' and 'respecting other people's learning'. They strongly valued opportunities to discuss and develop their learning by themselves and together:

> Child: it is quite effective when the teacher gives us a rough explanation and then sets us off in groups… it's like there is someone else to catch you before you fall and then you learn from other people.

The children still valued getting high marks and school rewards or merits, but were also beginning to associate effort with goal-directed action, rather than just working harder, since 'you can see where you have gone wrong and learn by your mistakes'. Extrinsic motivation still existed, but there was also a genuine intrinsic desire to learn and improve understanding.

Self-belief in mathematics was high with all of the children firmly believing they would 'do well' or 'very well'. For a few children, this success was attributed to being 'very intelligent' or achieving high levels. However, these children, as with all of the others in the case, still firmly believed in their capacity to improve their own understanding even if this took time and tenacity:

> Child: if you don't get it then that makes you want to find out more about it… so I speak to my friends and they might help me to do it… then I would go home and try learning it again… I might go onto the next question and then at the end go back to that one, but if you mark it when the teacher tells you the answer, you can see where you have gone wrong and you learn by your mistakes.

The children thus made connections to effective strategies for addressing their misconceptions, with many sources for self-help. Their chosen targets became increasingly specific and short-term, with greater emphasis on learning rather than presentation. There was an evident difference in the children's metacognitive target setting strategies over the period of time from January to July with an increasing awareness of specific strategies for learning, rather than focusing on presentation or behavior:

> Child in January: I will improve my presentation by making sure I put everything where it needs to be and I will know because I will look at my work at the end and know if I have had a good idea
> Same child in July: I will make sure I check my answers with the inverse operation. I will look back on my answers without an inverse operation and do the inverse on a piece of paper. I will know I have achieved this because I will have used the inverse to check my work.

Self and peer assessments were recognised as ways to demonstrate their understanding and the children became increasingly reflective and metacognitive in their focus on gaps in learning. The children enjoyed the recognition of extrinsic rewards, but what really motivated them to try extra personal study outside school was the desire to understand a personally difficult aspect of mathematics. Having seen that learning was ultimately under their own control, they were now beginning to accept this challenge with their own learning goals.

Discussion and conclusion

The two conceptions of assessment as learning inquiry and assessment as measurement were similar to those suggested by Hargreaves (2005). When assessment for learning is conceived of in terms of measuring or monitoring progression, then responsibility for learning is concentrated on the teacher as a director of learning. Learners held similar views to their teacher, with the control of learning and prime responsibility for progression residing with the teacher. Children saw that their own responsibilities lay in controlling their behaviour and listening, rather than exercising autonomy over their learning.

Greater learner control and autonomy is afforded by the conception which has learning inquiry at its heart, as has also been suggested by Hargreaves (2005). For this to become a reality, though, there has to be a strong faith in the ethos and principles of promoting autonomy as a shared responsibility in learning. When teachers espouse

this conception, then the locus of control is more likely to be shared as pupils and teachers accept complementary roles and joint responsibility in learning.

With all conceptions of assessment for learning, learners appear to adopt similar assumptions and beliefs regarding themselves as learners of mathematics as their teachers. Moreover, the results also made clear that some teachers do not value or believe in assessment for learning as a link to learner autonomy. This compliance is a similar conception to that of Harris and Brown (2009) but related to assessment for learning, rather than summative assessment. Also similarly with Harris and Brown (2009), assessment for learning was viewed as negatively focusing on achievements and a wish to protect learners from this information. Assessment for learning, therefore was conceived of as entirely a teacher-tool to adjust learning for the children. Children were there to be compliant recipients. If there is an antonym to autonomy, it is the heteronomy that was evident within the conceptions, practices and learner outcomes in assessment for learning as compliance. Considering the possibility of heteronomy within assessment for learning, there are important implications here for teachers and learners of mathematics.

Assessment for learning for Alex was focused on inquiry and the construction of knowledge in a way that is similar to that described by Hargreaves (2005). As suggested by Hargreaves (2005), the conception of assessment as an inquiry into learning is more likely to be associated with personal agency for children working within a community of learners. Alex typified this conception of assessment for learning by the evident focus on empowering the children to take increasing control. Having those conceptions and values, though, might not be sufficient when faced with the pressures of accountability. However, in the case of Alex, this teacher had reconciled the balance between meeting accountability concerns while promoting learner control and autonomy. This teacher found that balance where others had not. Strength of belief in the efficacy of using these practices were partly the reason for this 'tightrope walk' between competing needs and values. Alex acted as 'a guide' so those conceptions were realised within practices of assessment for learning in mathematics that adopted the spirit of promoting personal autonomy (Marshall & Drummond, 2006; Ecclestone, 2007).

Where this research builds on current thinking is in demonstrating a consequential development in autonomy for the learners. Expert teaching led to expert learners as suggested by Stobart (2014). However, I argue that taken together as a whole, those elements were inseparable and acted to form an expert classroom where the people and resources combined in a wider community. The children were encouraged and challenged to unpick their own mathematical understanding. Children saw ways to address those misconceptions by flexible means, turning to physical resources, such

as books, computers and displays, but also each other, teachers and their parents. Talk and dialogic reasoning were key in these processes.

References

Askew, M., Brown, M., Rhodes, V., Wiliam, D., & Johnson, D. (1997). *Effective Teachers of Numeracy: Report of a study carried out for the Teacher Training Agency*. Report for University of London (London).

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*(2), 117–148.

Bassey, M. (1999). *Case Study Research in Educational Settings*. Maidenhead: Open University Press.

BERA (2018). *Ethical Guidelines for Educational Research* (4th ed.). Retrieved from: https://www.bera.ac.uk/ethical-guidelines-201

Black, P., & Wiliam, D. (1998). *Inside the Black Box: Raising Standards through Classroom Assessment*. London: King's College School of Education.

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability*, *21*(1), 5–31.

Cowie, B. (2005). Pupil commentary on assessment for learning. *Curriculum Journal*, *16*(2), 137–151

Dam, L., Eriksson, R., Gabrielsen, G., Little, D. Miliander, J., & Trebbi, T. (1990). Autonomy-steps towards a definition. In T. Trebbi (Ed.), *Third Nordic Workshop on Developing Autonomous Learning in the FL Classroom*. Bergen: University of Bergen.

Dweck, C.S., & Master, A. (2008). Self-Theories Motivate Self-Regulated Learning. In D.H. Schunk & B.J. Zimmerman (Eds.), *Motivation and Self-Regulated Learning: Theory, Research and Applications*. New York: Lawrence Erlbaum Associates.

Ecclestone, K. (2007). Commitment, compliance and comfort zones: the effects of formative assessment on vocational education students' learning careers. *Assessment in Education: Principles. Policy & Practices*, *14*(3), 315–333.

Hargreaves, E. (2005). Assessment for learning? Thinking outside the (black) box. *Cambridge Journal of Education*, *35*(2), 213–224.

Harris, L. & Brown, G. (2009). The complexity of teachers' conceptions of assessment: tensions between the needs of schools and students. *Assessment in Education: Principles, Policy & Practice*, *16*(3), 365–381.

Hodgen, J., & Wiliam, D. (2006). *Mathematics inside the black box: Asssessment for learning in the mathematics classroom*. London: King's College School of Education.

James, M. (2007). Unlocking transformative practice within and beyond the classroom: Messages for practice and policy. In M. James, R. Mccormick, P. Black, P. Carmichael, M. Drummond, A. Fox, J. Macbeath, B. Marshall, D. Pedder, R. Procter, S. Swaffield, J. Swann, & D. Wiliam (Eds.), *Improving Learning How to Learn: Classrooms, schools and networks*. London: Routledge.

Klenowski, V. (2009). Assessment for learning revisited: an Asia-Pacific perspective. *Assessment in Education: Principles, Policy and Practice*, *16*(3), 263–268.

Marshall, B., & Drummond, M.J. (2006). How teachers engage with Assessment for Learning: lessons for the classroom. *Research Papers in Education*, *21*(2), 133–149.

O'Shea, A. (2016). Exemplifying the Expert Primary Mathematics Classroom: The Case of Alex and Assessment for Learning. *13th International Congress on Mathematical Education*. Hamburg, July 24th–31st: ICME.

Perrenoud, P. (1998). From Formative Evaluation to a Controlled Regulation of Learning Processes. Towards a wider conceptual field. *Assessment in Education: Principles, Policy & Practice*, *5*(1), 85–102.

Pintrich, P.R., & Zusho, A. (2002). What Do I Need To Succeed? The Development Of Academic Self-Regulation: The Role Of Cognitive and Motivational Factors. In A. Wigfield & J. Accles (Eds.), *Development of Achievement Motivation*. California: Academic Press.

Ryan R.M., & Deci, E.L. (2006) Self-regulation and the problem of human autonomy: does psychology need choice, self-determination, and will? *Journal of Personality*, *74*(6), 1557–1585.

Saldaña, S. (2009). *The Coding Manual for Qualitative Researchers*. London: Sage.

Sinclair, B., McGrath, I., & Lamb, T. (Eds.). (2000). *Learner autonomy, teacher autonomy: Future directions*. Harlow: Longman.

Stiggins, R., & Chappuis J. (2005). Using Student-Involved Classroom Assessment to Close Achievement Gaps. *Theory into Practice*, *44*(1), 11–18.

Stobart, G. (2014). *The Expert Learner: Challenging the Myth of Ability*. Maidenhead: McGraw Hill Education, Open University Press.

Swaffield, S. (2011). Getting to the heart of authentic Assessment for Learning. *Assessment in Education: Principles, Policy & Practice*, *18*(4), 433–449.

Thompson, M. & Wiliam, D. (2007). Tight but loose: A conceptual framework for scaling up school reforms. Paper presented at a Symposium 'Tight but loose: Scaling up teacher professional development in diverse contexts' at the annual conference of the American Educational Research Association, Chicago, IL, City, April 9–11.

Torrance, H. (2007). Assessment as learning? How the use of explicit learning objectives, assessment criteria and feedback in post-secondary education and training can come to dominate learning. Assessment in Education: Principles, Policy & Practice, 14(3), 281–294.

Wiliam, D. (2006) Formative Assessment: Getting the Focus Right. *Educational Assessment*, *11*(3–4), 283–289.

Willis, J. (2011). Affiliation, Autonomy and Assessment for Learning. *Assessment in Education: Principles, Policy & Practice*, *18*(4), 399–415.

Yin, R.K. (2014). *Case Study Research: Design and methods* (5th ed.). Thousand Oaks, CA.: Sage.