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Theorising power in classroom assessment of mathematics

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Classroom assessment has received little attention in the socio-political studies in mathematics education. This is surprising given how profound the role of assessment is in the contemporary landscapes of mathematics education. In this paper, we propose that classroom assessment deserves to be theorised in its own right, separate from other factors in mathematics education such as teaching and instruction. We suggest a Foucault-inspired theorisation of classroom assessment of mathematics as a specific site of power; this site is located within wider societal discourses regarding large-scale testing, competition and measurement. While classroom assessment has mostly complemented these prevalent discourses, it also provides the potential for resisting them. We introduce an empirical example of how classroom assessment could create counterspaces to nurture communal values and equity over individualisation and competition in mathematics assessment.

Keywords: Assessment, power, summative assessment, formative assessment, counterspaces.

Introduction

Assessment is all about power. When children enter the educational system, they do not only start learning but their learning starts being *assessed*, graded and numbered. Educational assessment measures, sorts, compares and selects students in the various tiers and positions in our societies. Mathematics assessment plays a key role in these systems. In many national contexts, high mathematics grades provide particular future prospects for students in the educational and job markets, as compared to many other school subjects such as physical education, music or history. Moreover, few other school subjects are tested as frequently and intensively as mathematics. Careful measurement of students' mathematics abilities is commonly portrayed as a necessity for the economic development of states around the world (Nieminen, Bagger & Allan, 2023). Assessment, by its very nature, categorises, divides and excludes (see Cabral & Baldino, 2019). The gatekeeping role of mathematics education in itself has been studied in critical research, yet as Cabral and Baldino (2019) note, the role of assessment in such gatekeeping has not received adequate attention (see also Nieminen et al., in press).

In this paper, we focus on the role of classroom assessment amidst the wider ecosystems of mathematics assessment. We refer to Shepard's (2000) notion of classroom assessment not as the kind of assessment that is used to "satisfy the accountability demands of an external authority" (e.g., standardised tests and high-stakes testing) but rather as the kind of assessment that can be used "as a part of instruction to support and enhance learning" (p. 4). Thus, we focus on summative and formative assessment as designed and conducted by teachers, at all levels of education. We ask: what does classroom assessment of mathematics have to do with power? As Lerman and Adler (2016) note, how mathematics is assessed at the classroom level depends on multiple factors, such as policymakers at the national and local levels, international testing agencies and research communities. Yet how is classroom assessment situated amidst the wider networks of power in mathematics testing,

screening and evaluation? Traditionally, classroom assessment of mathematics has been seen as a way to promote students' scores in high-stakes testing (see Nieminen, 2021), and indeed the washback effect of large-scale testing on classroom assessment has been noted to be particularly strong in mathematics (Barnes, Clarke, Stephens, 2000). This emphasises the 'sidekick' role of classroom assessment in mathematics: classroom assessment is commonly seen as something that may promote students' performance in other, *more important* forms of assessment, such as in high-stakes exams, summative performance tests or national and international rankings (e.g., Kyaruzi et al., 2019; Schoenfeld, 2015).

We argue that classroom assessment has an identity in itself - or at least it could have! This is even more so when it comes to the mechanisms of power in mathematics assessment. While the questions of power have been studied in terms of large-scale testing regimes (e.g., Lewis & Hardy, 2015), classroom assessment has received much less attention in such research - in mathematics education and beyond (Nieminen, 2021). Up to date, socio-politically oriented studies have remained at the margins in mathematics assessment research. Issues of power and equity were only mentioned in a handful of studies in a recent review of 127 studies on mathematics assessment (Nieminen et al., in press). Notably, Heritage and Wylie (2018) propose that "AfL [Assessment for Learning] can address the structural inequalities in access to knowledge and resources that create barriers to educational opportunity" (p. 732). Nortvedt and Buchholtz (2018) suggest that "equity within mathematics assessment means that all students should have the same opportunities to demonstrate their mathematical competence." (p. 562) What such crucially important contributions have underplayed is a further understanding of how power operates in and through classroom assessment. In this study, *we will thus provide a brief theorisation of both power and resistance in classroom assessment of mathematics*, providing an example of how to design counter-spaces to challenge the prevalent relations of power.

Theorising power and resistance in classroom assessment of mathematics

The functioning of power in mathematics assessment is, at the same time, hidden and right in front of us. Even though the stakes of classroom assessment are low compared to high-stakes assessment, it still has particular power over students' learning, identities and inclusion. It is indeed a commonly repeated mantra in assessment research that *assessment drives learning*. Even low-stakes assessment practices necessarily lead to splitting moments as Cabral and Baldino (2019) phrased it: moments of dividing the student cohorts into winners and losers, ones and zeros, A's, B's, C's and D's.

Yet, perhaps the relations of power are not straightforward as may seem. Power in classroom assessment cannot only be understood in sovereign ways; as if teachers would possess "more power" than students. Instead, power is intertwined in the daily practices and interactions of classroom assessment in mathematics (Nieminen, 2022; Nieminen & Lahdenperä, 2021). In this section, we examine a conceptualisation of power by Michel Foucault that we find intriguing for understanding classroom assessment: the one of disciplinary power. This framework enhances our understanding of how classroom assessment is positioned within the wider ecosystems of mathematics education and assessment.

Disciplinary power: classroom assessment as a mechanism to internalise individualised values

Michel Foucault's (1979) concept of disciplinary power refers to the way in which institutions and systems of control, such as schools, prisons, and hospitals, operate to regulate and shape the behaviour of individuals. According to Foucault, disciplinary power is a form of power that operates by normalising individuals and making them conform to established norms and standards. This power is exercised through various mechanisms, including surveillance, examination, classification, and hierarchical observation, which together work to produce docile and obedient subjects. Disciplinary power is not just exercised by the state or by individuals or institutions but is deeply embedded in the social relations and norms of society as a whole. The result is a society in which individuals internalise the norms and values of the institutions that regulate their behaviour, and in which the power of these institutions is largely invisible and unquestioned.

Foucault argues that disciplinary power operates in society through a series of micro-processes that are incorporated into the everyday operations of institutions. For example, in a school setting, students are subjected to a regimen of schedules, rules, and procedures that regulate their behaviour. The whole ecosystem of assessment - summative and formative assessment, diagnostic assessment, exams, screenings of mathematical learning disabilities, self-assessment forms, and peer feedback sessions - can be seen as an apparatus that constantly monitors and evaluates students. We will demonstrate this functioning of power in the context of the assessment of mathematical *proofs*. Proof is often framed as the cornerstone of mathematical understanding, and it conforms to a strict genre that is often seen as alien and inaccessible to students (Selden et al., 2014), thus serving to separate “real” mathematicians from those who are seen to have no mathematical future. Assessment of proofs also grounds our analysis specifically in “the mathematical” in mathematics assessment, thus supplementing earlier general investigations of power in classroom assessment (e.g., Taras, 2016).

Classroom assessment, within the wider ecosystem of educational assessments, provides students with the means to understand their mathematical capabilities in everyday classroom situations. This knowledge is commonly presented in individualised and quantified ways: mathematical abilities are seen as something that resides in the individual, not in cultures or communities (Nieminen & Lahdenperä, 2021). Grades in mathematics provide a social mechanism for students for shaping their subjectivities: students may build their whole mathematical identity around the numerical building blocks that grades provide (as hinted in Nieminen, 2022). The mere idea of mathematical abilities may be rendered through a one-dimensional discourse, as “ability” is placed on a graded scale that provides students with a particular way to understand themselves as learners of mathematics. Exams in particular are powerful ways of normalising students into the values and ideologies of mathematics: summative exams ensure that even highly collaborative and communal learning processes are, ultimately, returned to individual markers of learning.

These are only some examples of how mathematics assessment normalises and divides. Overall, classroom assessment may come to promote a *culture of compliance*, as put by Nieminen and Atjonen (2022) in which the neoliberal values of individual achievement, productivity and competition are valued over critical thinking, reflexivity and communal values. Such ideals may run contrary to the value of mathematics education as something meaningful for wider communities and societies.

Theorising resistance: counter-spaces

While a complete account of resistance towards disciplinary power is out of the scope of our brief paper (see Lilja & Vinthagen, 2014, and Nieminen, 2021, for elaboration), we provide a two-fold conceptualisation of how students and teachers – the primary stakeholders in classroom assessment – might resist it. Overall, according to Foucault, resistance to disciplinary power is not only a reaction to power but is also an integral part of the power-knowledge nexus, as it is through resistance that individuals and groups are able to challenge and question the dominant norms and values of society. Such resistance can take many forms, ranging from individual acts of resistance, such as breaking rules and regulations, to more collective and organised forms of resistance, such as social movements and political activism. In order to resist disciplinary power, Foucault argues that individuals must be critical of the power relations that operate in society, and must question the norms and values that are imposed upon them by institutions and systems of control. This requires a certain degree of self-awareness and self-reflection, as well as the ability to connect with others who are also seeking to challenge and resist power.

For the purposes of understanding power in classroom assessment, we are interested in understanding wider societal changes (which are usually out of the power of individual teachers!) *and* understanding resistance on a grass-root level – in actions available for teachers and students in everyday situations. We refer to Webb’s (2018) theorisation of *utopian thinking* and *bolt-hole approaches*. Utopian thinking, for us, would mean that the ecosystems of mathematics assessment would change so much that the relations of power could be completely renegotiated. This may seem utopian indeed. However, any mathematics educator may promote *counter-spaces of assessment* in their classrooms (see Ruttenberg-Rozen & Hynes, 2022). These spaces offer “scope for fleeting, transitory, small-scale experiences of utopian possibility, they function more as bolt-holes, breathing spaces, and places of refuge” (Webb, 2018, p. 99). Counter-spaces may enable other values of mathematics assessment to emerge, beyond the common ones in mathematics assessment: individualism and competition.

How to design and implement such counter-spaces in practice? Next, we provide an empirical example of this in the context of mathematical proof. Given both the importance and rigidity of mathematical proof, we argue that this example of using proof as a tool to create a counter space can serve as a paradigmatic example of resistance through classroom assessment in mathematics.

Peer-assessment: communal counterspaces in mathematics assessment

Peer-assessment is a set of practices that involves students working together as partners in the assessment process to provide meaningful feedback to one another that serves as a source of learning and to guide classroom activities. Reinholz (2016) offers an example of how communal participation was seen as an important skill in its own right, rather than as a tool for increased academic performance of individuals: “Drawing on the metaphor of learning as participation, student explanations must be seriously considered as an outcome of interest in their own right, not merely an intermediary to developing “understanding.” (p. 36).

Here, we describe an example of peer-assessment in the context of a mathematics content course in real analysis that was designed for in-service teachers to develop more robust conceptions of

mathematics and new ideas for teaching in K-12 schools (Reinholz 2018; Reinholz & Pilgrim, 2020). This classroom adapted the method of Peer-Assisted Reflection (PAR) for mathematical problem-solving (Reinholz, 2015). In the basic PAR cycle, students are responsible for working independently on a difficult homework problem, and then they bring their partially completed solution to class so that they can trade work with a peer, silently read and provide written feedback, and then conference on their solutions. After the conference is completed, students are able to revise their work before they turn it in for a grade. Moreover, spreading out the process of working on a problem, receiving feedback, and revising, is largely consistent with principles of assessment for learning and iterative improvement.

A key feature of this cycle is that it decouples the feedback and grading process, which is important given empirical evidence that when grades and feedback are given simultaneously, the grades may undermine the value of the feedback (Koenka et al., 2021). We do not see such a devaluation of feedback as a result of students' psychology, but as a symptom of the overall functioning of power in mathematics assessment: if the assessment culture pushes students to primarily focus on grades, such assessment behaviour seems rational (Nieminen & Atjonen, 2022). PAR aims to challenge such prevalent cultures of mathematics assessment and the power relations within.

In this particular iteration of the approach, the students had a single PAR homework problem each week, which was based on mathematical proof. The students completed their proofs using a two-column format, in which the left column was used for formal mathematical writing, and the right-hand column was used for annotations. In the annotations column, an author could include relevant definitions, diagrams, an explanation of their argument, or even wonderings they had about how to solve the problem. During the peer exchange, a peer could respond to these comments or write additional comments in the annotations. The purpose of this approach was to disrupt the idea that only "complete" mathematics could be communicated in a proof, and to model the messiness of mathematics in the making (Hersh, 1997).

To understand the student experience in this context, a variety of data were collected. All student PAR assignments were scanned, peer conferences between students were recorded, and all students wrote a reflective essay at the end of the semester. These data have been analysed previously from the perspective of reflective apprenticeship (Reinholz, 2018) and sensemaking through epistemic, rhetorical, and ontological distance (Reinholz & Pilgrim, 2020), but never through the lens of power and resistance. As such, the current analysis provides a deeper conceptualization of peer assessment activities and how they can support students to renegotiate their roles as mathematics learners and teachers.

Here we offer an in-depth analysis of the reflection of one particular student in the class, John, who was also a middle school mathematics teacher and a white man (Reinholz, 2018; pg. 71).

There seems to exist a disconnect between the constructivist tenets and leanings of math education research and the traditional instruction of proof. Students are to make their own meaning of mathematics based on prior knowledge, yet when it comes to proof they are to conform to rigid conventions and opinions of elegance as defined by now dead white men.

Here, John contrasts his expertise as an educator with the “rigid conventions” of mathematical proof. On one hand, John recognizes that students learn by authentically engaging with material in a way that teachers are able to draw out their prior knowledge and use it as the basis for instruction (i.e., constructivism). Simultaneously, John frames the traditional way of working with proof as in opposition to what he knows about teaching and learning. Notably, he describes “rigid conventions” of “now dead white men,” even though he himself is a white man. John is drawing attention to the power of something that is far removed and distant from his current context, yet exerts considerable power over him as a teacher and also over his students who are expected to be assessed in a particular way. As John continues, he contrasts this with his experiences with the PAR cycle (Reinholz, 2018, p. 72).

This diatribe, born from past frustrations, sheds some light on why I remain so pleased with my experiences with proof in this course (and in this school, really). I don’t feel like the crazy person in the room for saying, “Copying it off the internet doesn’t mean anything,” and I’m no longer negatively reinforced for refusing to turn in “work” produced in this way. Proof has begun to feel personal – I feel as if I have some say in how I might structure certain problems or at least present my work. Additionally, the PAR process has completely changed the way I approach proofs and the way I teach. I feel as if the annotations column and its free form have given me a voice and choice in proof that didn’t exist prior.

As John continues, he sheds light on his frustration of producing “work” by “copying it off the internet,” because throughout his schooling experiences, a correct proof was something that could be *created* by him, but rather, could only be *found* from an external source. Yet, with the addition of the annotations and peer feedback, he now had “voice and choice that didn’t exist prior.” Other students in the class also emphasised how this approach allowed them to “create and write a proof” (Dana, pg. 72) and “think about proving rather than the proof itself” (Melvin, pg. 72).

As we take these student comments together, it becomes evident that the PAR activity helped students construct a counter-space in their peer conferences. As students worked through both formal mathematical arguments and their own personal annotations, it allowed them to make proof *personal* in a way that they had previously been denied: personal experiences and epistemologies are usually not seen as compatible with the epistemologies of tertiary mathematics (Nieminen & Lahdenperä, 2021). Thus, rather than severely purely as a rigid set of conventions that denied the students access to identities as mathematicians, instead, the revised process created space where students could think about proof and mathematics differently, and do so in a way that included their own voices in the mathematical processes. As this example highlights, a reimagining of assessment practices afforded students opportunities to reauthor their mathematics identities. As such, assessment became both a vehicle for learning and identity development, rather than solely a mechanism of rigidity and exclusion. This fundamentally shifted power relations within the assessment context, affording new forms of power and choice to the students.

Final words

We have proposed that classroom assessment of mathematics demands further theorisation from the viewpoint of power. We believe that classroom assessment has much more to offer for mathematics

education than its current form as a “sidekick” for large-scale assessments and economic development does. Currently, classroom assessment largely complements the prevalent relations of power, yet it also provides substantial potential for turning classroom assessment practices into counter-spaces. This, we propose, is a hopeful agenda: a project in that any teacher could take part. Considering the power and politics of assessment provides an intriguing way to rethink the already existing approaches to “student-centred” assessment, such as formative assessment, sustainable assessment, ungrading, and feedback.

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