Deafness in the mathematics classroom: perspectives on classroom talk

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Through semi-structured interviews with 19 deaf and hearing teachers and other school staff, I explored the narratives formed and developed around identity and education in the mathematics classroom. Using inductive content analysis I found that classroom talk was an activity that all participants considered to be important for teaching and learning, but that led to particular challenges for deaf people. Mathematical discussion has the potential to be an inclusive practice where pupils and staff can contribute to understanding in the classroom, or one where some participants are excluded. Some challenges were common to both deaf pupils and staff, and other experiences were particular to the participants' role in school. Holding the two possibilities of inclusivity and exclusivity in tension, participants found their own ways of making mathematical talk useful and inclusive for themselves and their pupils.

Keywords: Deafness; classroom discussion; disability; inclusivity.

Introduction

This article presents findings on classroom talk and discussion, arising from a narrative inquiry into deaf experiences in the mathematics classroom. Throughout this study, classroom discussion was raised in interviews by every participant as an activity that held the potential to allow for learning and reflection, while holding in tension ideas of inclusivity and exclusivity for deaf pupils and staff.

This project explored some of the factors that make the mathematics classroom inclusive, and some of the persistent barriers to inclusivity. The purpose of the study was to gain deeper insight into the experiences of teachers and support staff, as well as those who work with deaf pupils, to better understand the mathematics classroom as a site of inclusivity and exclusivity for deaf people.

The research methods used in this study were based on three key concepts: that disability is socially constructed; that the impairment effects of deafness should be acknowledged and discussed; and that an understanding of the interactions between deafness and socially constructed disability is essential for creating inclusive classrooms.

In this article I use the terms deaf and hearing impaired interchangeably. It is worth noting that one (hearing) participant preferred the term 'hard of hearing' but all other participants used 'hearing impaired' to describe themselves and their colleagues/pupils. Some participants with hearing impairment did not describe themselves as deaf but did use hearing aids or rely significantly on lipreading. For the purpose of analysis, they are categorised with other hearing impaired/deaf participants.

Background

Deaf students underperform throughout their primary and secondary education and leave school with mathematical skills two and a half years behind their hearing peers' (Swanwick et al., 2005; Gervasoni & Lindenskov, 2010), but hearing loss is not itself a cause of mathematical difficulty (Nunes & Moreno, 1998). In fact, some research suggests that deaf and hearing pupils find the same mathematical content and tasks challenging (Healy & Powell, 2012). This suggests that while deaf pupils may have more obvious difficulties with these elements, pedagogical and school practices that benefit deaf pupils and staff may also benefit their hearing peers. Inclusive classrooms, therefore, should not be an addition but central to how we run our schools.

Underachievement in mathematics

Wood et al. (1986) researched the mathematics age of 465 hearing and 414 deaf school leavers. They found a statistically significant difference of 3.2 years between the deaf and hearing pupils. They found a small significant negative correlation between a child's level of hearing loss and their mathematical ability, but only for girls; level of hearing loss was not a significant factor in deaf boys' mathematical ability. They also found no statistically significant difference between the mathematical ability of deaf boys and deaf girls.

Kluwin and Moores (1989) explored the impact of school setting type on pupil attainment in mathematics. Pupils in integrated mainstream classes appeared to perform better academically than those in special schools (also Lynas, 1986). However, this was primarily due to the school selection process. The setting itself had little impact, but the quality of instruction was the main factor in contributing to the child's achievement. Strong and supportive teachers, regular comprehensive revision of content, direct instruction, high expectations and praise and encouragement all contributed to deaf students' success in mathematics.

Teaching and interaction with hearing impaired pupils

Easterbrooks and Stephenson (2006) conducted an extensive review of hundreds of internet-based and literature articles to find and evaluate common practices used in teaching deaf students in science, maths, and literacy. They found that teachers' knowledge of subject content correlated highly with student success (Easterbrooks & Stephenson, 2006). The authors reference works focused on students of a range of ages from infants to adults. While they found that the impact of teacher qualifications on student achievement was inconclusive, students of more experienced teachers generally performed better in examinations. Teachers' subject knowledge enabled them to make informed pedagogical decisions (Kanes & Nisbet, 1996) such as how to model content effectively, plan for misconceptions, assess understanding, and set students appropriate work. Deaf pupils had academic input from maths teachers, but also support staff or a Teacher of the Deaf trained to support deaf pupils with accessing education in general who may not necessarily be maths specialists, so are less likely to have strong mathematical subject knowledge.

Deaf children receive a lot of communication, particularly when teachers attempt to provide content in a range of formats to reverse (or at least limit) the effect of the student struggling to understand spoken language through sound only. However, receiving instructions, modelling or questions through a range of formats can be counterproductive if the format is not appropriate for the student's needs or the task at

hand (Gallaway & Woll, 1994). Indeed, all students can benefit from sometimes receiving information in fewer ways such as without sound at all, to reduce cognitive load. It is therefore easier for deaf pupils when the teacher can communicate fluently in the students' first language (spoken or signed) (Easterbrooks & Stephenson, 2006).

Deaf students performed better when they engaged in 'active learning' tasks which required critical thinking skills leading to greater student understanding. (Easterbrooks & Stephenson 2006). By building on students' prior knowledge, allowing students to practice with appropriate teacher intervention, and asking students to explain their methods, students are forced to engage cognitively with material in a deeper way that improves their understanding (Hiebert, 1999).

There is little existing literature on support staff working with deaf pupils in the mathematics classroom, but Stylianidou and Nardi (2018) conducted a study into a year 3 (ages 7-8) mathematics classroom episode to explore discourses on inclusion and disability with visually impaired pupils. Their study, like this present one, endorses that "inclusion can be achieved when pupils' academic and social needs are considered and met in lessons" (p.167). Through observations and interviews, they found that there can be both academic and social inclusion/exclusion of visually impaired pupils when teachers "consider, or not, the visually impaired pupils' perceptual needs in a lesson activity" (pp.167-8). The present study explores experiences of such academic and social inclusion/exclusion for hearing impaired pupils, teachers, and support staff.

Methodology

This project investigates perspectives on deaf people's experiences of classroom-based mathematical learning. While other studies exist that explore factors influencing deaf pupils' mathematical learning and performance (Wood et al., 1984;1986), this project explores the narratives that students and staff create around this experience. It is hoped that insights from this study could provide a starting point for more inclusive practice within the mathematics classroom.

This project explores the narratives adopted by people with experience in the mathematics classroom, and so is based on interviews with 19 UK adults who work with deaf pupils in mainstream classrooms. Eight of the participants were deaf or hearing impaired themselves, and many had deaf children or other people in their family or household. The participants had a range of roles including Maths teachers, primary school teachers, Communication Support Workers (CSWs), teaching assistants (TAs), Special Educational Needs Co-ordinators (SENCOs), Teachers of the Deaf (ToDs), and teachers of other subjects with leadership roles overseeing teaching and learning across their school. Participants worked in various mainstream primary, secondary and all-through schools across England, some with a resourced Hearing Impaired Provision. Some worked with pupils at more than one school.

Some participants commented on how their thinking had changed during the interview as they reflected on their answers to particular questions. They had remembered training they had had previously, or had an idea to try something different in the classroom, as a result of taking part in the study. They benefited from taking part in the study as it became a reflective exercise in their own practice.

Social interaction: perspectives

Maths teachers spoke of the value of talk and discussion in the maths classroom, particularly when discussing methods to reach an answer. Verbal communication was seen as important to both the mathematical learning itself and to feeling included in the

classroom. Many participants spoke about verbal processing of mathematical ideas, either through discussing with a partner, engaging in structured class discussion, or being encouraged to develop an answer through targeted questioning.

Deaf teachers and support staff valued these discussions, but they often found it difficult to hear and lipread in these discussions due to the layout or structure of the classroom, or pupils or other staff not speaking clearly and facing them when they speak. Some deaf adults spoke positively about the ways in which their schools were inclusive spaces for them, where they could seek additional support if needed or ask for site management teams to arrange their classrooms in a way that would make it easier for them to see others. However, others said that there were actions that other staff could take that would help them to facilitate positive mathematical discussions such as supporting with classroom management and pupil behaviour, or making it easier for the deaf adult to lipread them.

Deaf pupils were also often excluded from these discussions through their own speech and language needs, the high noise level in the classroom during pair discussion, or simply by sitting next to a support worker instead of another pupil. This is supported by Jarvis' (2003) research into UK deaf pupils' views on school support: pupils in her study found support helpful in general, but sometimes excessive and unhelpful, particularly when they preferred to communicate with their peers instead. There should be support "both inside and outside the classroom, to foster contact between deaf and hearing pupils" (Gregory et al., 1998, p.138).

Support staff also noted the 'ping-pong' style of taking answers from the class in maths lessons that provides a range of viewpoints, but can be harder for deaf pupils and staff to hear and lipread, as teacher of the deaf Emily commented on "that kind of forward and back conversation which is really useful in maths", saying that it can be particularly difficult for deaf pupils "if they can't hear student contributions and the teacher doesn't repeat them".

Some maths teachers also used 'turn and talk' activities in their maths lessons which were harder for deaf pupils to hear as this is when the classroom was loudest. For pupils who sit next to a teaching assistant or communication support worker, this means they are less likely to engage in meaningful discussion in these activities, as captured in this quotation from maths teacher Ida:

> it gives students the opportunity to kind of sort through their ideas… it is important for students to have that, that section where they're thinking through their ideas… I think that students with a hearing impairment are most disadvantaged at that moment… they're missing out on the opportunity to assimilate the knowledge of their peers with their own understanding to be able to further their own understanding.

Student talk in classrooms supports the development of students' mathematical thinking and communication (Prediger & Erath, 2014). Ingram et al. emphasised the importance of creating a classroom where students are more likely to offer mathematical explanations (2018). They noted that mathematical talk can allow teachers to assess and develop the meanings that students associate with words, helping them to connect words with their meanings. It is a process that is both inclusive for pupils in general as they are included in the discussion as participants rather than just passive listeners, and exclusive for those who don't hear.

One particular challenge that many participants spoke about was the fatigue that came with struggling to hear or lipread, an issue reported in both academic and experiential articles across disciplines (Wolter, 1999; Noon, 2014). The fatigue was raised much more by deaf participants and those who work with secondary aged pupils

than those who work with primary school pupils. This may be because English primary pupils usually have maths lessons in the morning, when they will be more alert and less tired. Deaf participants spoke of the challenges of engaging with departmental meetings or training after a day of teaching. If deaf teachers find these after-school meetings and training difficult, they may not benefit from them as much as their hearing colleagues.

Findings from this study revealed that while many deaf participants were keen to meet the needs of their deaf pupils, their own needs were often unmet in training and around the school. Perhaps schools are not deaf-inclusive enough in general, and perhaps deaf pupils might agree with deaf adults that they find their needs are not well met, despite staff attempts to create accessible lessons. Maybe some staff do not know how to meet the needs of their deaf pupils and need more guidance. Powers (2002) writes that even when basic needs are met, confusion can arise when educators do not have a clear shared understanding of what it means to be included.

Or perhaps there is a discrepancy between how school staff see their responsibility towards deaf pupils and deaf adults. This might be because schools exist primarily to educate pupils, so they advocate more for the needs of pupils. Deaf staff, on the other hand, may be seen as able to advocate for themselves. There is very little literature on this area, and further research is necessary to explore this further. The issue is interesting because most participants in this project lost a significant amount of their hearing after they started primary school, meaning that they were coming to terms with their level of hearing loss as an adolescent or adult.

Deaf participants spoke, as staff members, of missing out on training, or only hearing parts of training sessions; of being excluded in conversations or being unable to socialise in the staffroom; and of finding it difficult to hear pupils in particular situations or to detect who had spoken. Although not every deaf participant struggled in all these areas, the overall impact of these factors on their professional life is potentially significant. Not having the same access to training opportunities, social exclusion and challenges in classroom communication or behaviour management were all areas that participants felt their schools could support them in, but had had varying success in doing so.

Conclusion

Classroom talk is a useful tool for teaching and assessment, as well as for allowing all members of the mathematics classroom to be included in meaning-making and understanding. It is essential that school staff ensure that classroom discussion is inclusive for all their pupils and staff through the architecture and layout of the classroom, and the structure of the activity itself.

This project revealed a particular discrepancy between approaches to inclusivity for deaf pupils and those for deaf and hearing impaired staff. This leads to lack of awareness of staff needs, limited access to training and professional development, and challenges in teaching and communicating with pupils and other staff. Further research is essential to understanding the reasons behind this gap, and approaches that schools can take to address it. Both deaf and hearing pupils benefit from having deaf teachers and support staff, and school leaders must take steps to ensure their deaf staff are valued, trained, and included in decision-making as much as their hearing colleagues.

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