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Article abstract

The goal of this paper is to explore aspects of the work of mathematics teachers that students consider problematic and in need of improvement. By using an inductive thematic analysis, we present three themes generated from interviews conducted with 15 students in Alberta, Canada who were participating in high school mathematics upgrading courses. The three themes are: 1) responsiveness, 2) contextualizing the mathematics, and 3) empathy. Our findings show that the majority of the students felt a need for teachers to value the social and emotional dimensions of students’ learning and to listen to students’ concerns rather than adhering to pre-planned or standardized lessons. Students had conflicting views on the extent to which teachers should contextualize the mathematics they are teaching.

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"They know how to navigate … but they don't know where to go": Students' Feedback on Mathematics Teachers' Practices

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The goal of this paper is to explore aspects of the work of mathematics teachers that students consider problematic and in need of improvement. By using an inductive thematic analysis, we present three themes generated from interviews conducted with 15 students in Alberta, Canada who were participating in high school mathematics upgrading courses. The three themes are: 1) responsiveness, 2) contextualizing the mathematics, and 3) empathy. Our findings show that the majority of the students felt a need for teachers to value the social and emotional dimensions of students' learning and to listen to students' concerns rather than adhering to pre-planned or standardized lessons. Students had conflicting views on the extent to which teachers should contextualize the mathematics they are teaching.

L'objectif de cet article est d'explorer les aspects du travail des enseignants de mathématiques que les élèves considèrent comme problématiques et devant être améliorés. En utilisant une analyse thématique inductive, nous présentons trois thèmes générés à partir d'entretiens menés avec 15 élèves de l'Alberta, au Canada, qui participaient à des cours de mise à niveau en mathématiques au secondaire. Ces trois thèmes sont les suivants : la réactivité, la contextualisation des mathématiques et l'empathie. Nos résultats montrent que la majorité des élèves estiment que les enseignants doivent valoriser les dimensions sociales et émotionnelles de l'apprentissage des élèves et être à l'écoute de leurs préoccupations plutôt que de s'en tenir à des leçons préétablies ou standardisées. Les élèves ont des avis divergents sur la mesure dans laquelle les enseignants devraient contextualiser les mathématiques qu'ils enseignent.

Teachers receive many kinds of feedback to improve their teaching. School leaders offer suggestions on instructional practice based on various kinds of evaluation of teaching (Tuytens & Devos, 2017). Professional learning and mentoring programs provide insights into pedagogical attitudes and collaboration practices (Jaworski et al., 2017). Colleagues can encourage partnerships and inspire one another to pilot new lessons (Horn, et al. 2020), and parents' inputs can serve as a source to adapt teaching for understanding students' specificities and needs for learning (Darragh & Franke, 2022). Although these insights are helpful, they often aren't focused on what teachers identify as most useful for helping students to learn the content (Balyer & Özcan, 2020).

Teachers generally acknowledge feedback that enhances the learning of students. They tend to look for ideas that help to refine their teaching or expand their perception of learning (Helmke, 2015; Rösch, 2017). Although some teachers might prefer receiving information about classroom management and methods and tools on how to convey complex competencies (Blazar & Kraft, 2017; Yorke, 2003), others prefer advice on how to engage students in learning (Sullivan et al., 2014; Walk & Handy, 2018) or make their explanations more clear for the students (Guskey & Link, 2022). In most cases, teachers tend to value feedback that is specific, realistic, and nonjudgmental (Cherasaro et al., 2016; Guskey & Link, 2022); such feedback is preferable to blindsiding them with generalizations and partiality (Hattie & Timperley, 2007).

Over the years, research has shown that students can also provide constructive feedback for improving teaching (Ravanavar et al., 2014; Rollett et al., 2021; Seldin, 1997). For instance, the work of Bijlsma et al. (2021) and Gaertner (2014) showed how students' perceptions of teaching can be used as a formative evaluation of teaching activities in the classroom. Similar studies also showed how students' feedback on teaching has been used as a source for teachers to be aware of "blind spots" such as speaking time or frequent repetition (Wisniewski et al., 2020; Zierer et al., 2019). Despite concerns about reliability and validity in using students' evaluations of teaching as a source of information to improve teaching, Kyriakides (2005) showed that students are capable of providing reliable data about teachers' performance and that their feedback can be considered practical and a valid way for teachers to identify areas for improvement. Bourke and Loveridge (2016) expanded those findings by showing that students' feedback on teaching can facilitate dialogue, reduce misconceptions, and contribute to the development of schools as democratic communities.

Although student feedback on teaching has been investigated previously (Hascher et al., 2004; Rollett et al., 2021; Spooren et al., 2013), there is a need for further examination of the kinds of feedback students can meaningly provide, especially those who have struggled in traditional classroom settings, and particularly in relation to mathematics classrooms. In this paper, we add our voices to others who have argued that student feedback can be informative and formative for teachers (Jeffs et al., 2018; Jeffs & Piera, 2022; Shute, 2008), particularly those who want to make mathematics learning more meaningful for students. Our goal is to examine students' perspectives on teachers' work in mathematics classrooms, particularly the elements needed to facilitate lines of communication between teachers and students about what is and what is not working to promote student learning.

Methodology and Methods

The data presented in this paper were collected as part of a large-scale research project that received ethical clearance from the University of Calgary Conjoint Faculties Research Ethics Board and from relevant school board authorities. In the study, we explored students' emotional experiences learning mathematics and adopted a narrative inquiry methodology that allowed for a focus on the meanings students ascribe to their experiences. Through the medium of mathematics autobiographies, we aimed to understand students' experiences learning mathematics in Canadian schools. As Riessman (1993) has stressed, "a personal narrative is not meant to be read as an exact record of what happened nor is it a mirror of a world 'out there'" (p. 64). Students' personal narratives reflect "not only on [those] individuals' experiences but also on the social, cultural, and institutional narratives within which individuals' experiences are constituted, shaped, expressed, and enacted" (Clandinin & Rosiek, 2007, pp. 42–43). Hence,

many of the students' autobiographical narratives in our study offered insights into the social and cultural environments in which their learning took place, especially classrooms, and the significant players in those environments, such as teachers. Elsewhere, we have reported on research participants' emotional relationships with mathematics (e.g., Towers et al., 2017, 2018), the images they had for mathematics (Plosz et al., 2015), the mathematical identities they developed (Hall et al., 2018), and the contextual and cultural environments that impacted their relationships with mathematics (e.g., Takeuchi & Towers, 2015; Towers et al., 2018). Here, we draw on a sub-set of participants' reflections on the teaching they experienced and we synthesize their advice for teachers of mathematics.

Participants and Data Collection

During the study, more than 120 students from Alberta schools participated in individual, semi-structured autobiographical interviews about their views, feelings, and experiences learning mathematics, and approximately 100 members of the general public submitted written and/or multimedia mathematics autobiographies through an online data collection site. During interviews, prompts included eliciting students' feelings towards mathematics and their relationships with mathematics, details of the learning environments they were currently in and had experienced in the past, experiences of learning mathematics at home, and their exposure to mathematics outside school and through media such as movies and books. We also asked participants to represent their thinking and emotions through drawing.

The sub-sample of participants on whose data we draw for this paper were all participating in a mathematics upgrading program, many re-taking Grades 10-12 mathematics content in order to improve grades for university admission or to complete high school graduation. This particular group of 15 students provided significant data regarding the interview question, *what advice would you give to your teacher to improve their math lessons?*, which became the focus of this paper. We have chosen gender-neutral pseudonyms for these participants, as they were not explicitly asked to declare a gender identification during data collection.

Thematic Analysis

The analytic process was based on an inductive thematic analysis approach (Braun & Clarke, 2013). This form of thematic analysis is a non-linear process—a movement back and forth between phases of analysis, conducted without aiming to fit the emerging analysis into a preexisting coding frame or analytic preconception (Braun & Clarke, 2006). Such an approach differs from other methods as it can help researchers to produce latent themes of analysis with the goal of "identify[ing] and examin[ing] the underlying ideas, assumptions, and conceptualizations—and ideologies—that are theorised as shaping or informing the semantic content of the data" (Braun & Clark, 2006, p. 84). After carefully reading and familiarizing ourselves with the data, we searched for meaningful narratives relevant to our research question. We grouped these narratives together into 13 analytic categories/groups, which we later organized into three themes/sub-themes using NVivo software. These themes were revised and refined to ensure that the themes appropriately represented the data. The following section shows the results of this analysis by focusing on three latent themes, each of them pointing to problematic elements of teachers' work in mathematics classrooms from the point of view of students.

Findings

The themes highlighted in this section synthesize the students' feedback on problematic elements of teachers' work in mathematics classrooms.

Responsiveness

The first theme captures the way teachers' responsiveness was described by students. Some students pointed out that mathematics teachers tend to focus more on what they do in the classroom rather than trying to promote students' active participation. This idea suggests that students believe that mathematics teachers need to become more open-minded about incorporating students' perspectives in their teaching. For example, one student, Jules, noted:

> Every student is different. I had friends who were awesome at just sitting down with their textbooks, and just shooting off questions. But it is different for every student, so I guess my advice [to teachers] would be to have a more open mind when it comes to different learning techniques. I am a very hands-on person, I am very much trying out new ways, trying out new paths, seeing what works, and what does not work. Just be more open when it comes to learning in different ways; every student is so different, and we all pick up knowledge in such different ways. Just keep in mind that there might be one way in your mind, but there are one hundred different ways to do something.

Other students made specific suggestions for teachers to become more active listeners in order to attend to students' needs. Two upgrading students studying Grade 11 material, for instance, pointed out that mathematics teachers need to ask students about the processes that take place during learning, and about the students' preferences for learning mathematics.

> Probably ask students how they're doing to get an understanding of how the students are coming along in their lesson and what they need to learn. (Blair)

> I'd ask students how they like to learn and whether they like taking all those notes, whether they like being in a group, whether they like to ask questions, whether they like being alone, whether they need all their certain accommodations, whether they learn differently or what works for them. I think that would pay off a lot because it works for the teacher because they need to know how the student learns and what worked for them, but also the student because they're fulfilling their accommodations. They learn how they want to learn and how they want to work, independently of what is right or wrong. It just would work so well for everybody, I think. (Morgan)

This sort of feedback suggests that students favour a more student-centered perspective that recognizes students' needs and voices in learning. Morgan pointed out that, by listening to students' thinking, teachers can adapt instruction by asking questions and can structure tasks based on what they discover about the students' existing understandings and learning preferences. However, such advice is not always welcomed by teachers. Another upgrading student, who acknowledged having a negative experience with mathematics teachers in the past, suggested that there may be an attitude of resistance on the part of some teachers to receiving ideas from students:

> For some of them, I honestly don't think I'd be able to tell them anything. I don't think they would listen at all to improve their lessons. Even when I tried to engage myself in learning the content, I couldn't get them to do it, so I don't think that would change their thinking over these years. Some people are stuck in their own ways and don't move on. (Jordan)

Another student wanted teachers to recognize the trouble spots in the curriculum and slow down the pace of instruction when it is obvious that students are struggling:

> I would say slow down a bit and spend more time on certain topics. If more of the classroom is having trouble with a certain topic, then slow down. If certain students are having trouble, then hold tutorials for them so that after class or before class they can come in to get help. (Nic)

Similarly, Jamie appealed to teachers to slow down, explain their mathematizing, and give time for students to make their own meaningful notes:

> Everybody had to learn the same way and that was she would go super fast on the smartboard. She wouldn't care to explain the steps that she was doing and there were no notes that she would give out. You have no notes and then you'd try and write the notes, but she doesn't really give you any time to take any notes. It jumbled up!

Sam, on the other hand, had an idea for how they could take agency in supporting their own learning, but recognized that such an approach implicates the teacher in re-designing lessons to supporting this kind of student agency:

> Maybe I could write down a lot of questions or things that I have at home so they could help with or maybe use it to complement [their lessons]. But I'll have to do it in a list and give it to them.

Contextualizing the Mathematics

A number of extracts contributed to our second theme. Although the students' responses in the first theme emphasized including students' perspectives in teaching, the responses in the second theme represented conflicting views about whether teachers should contextualize the mathematics they were teaching. For example, Gerry found it frustrating when teachers digressed into supposed connections between real life situations and the mathematics being studied:

> Maybe we try to stay on topic more because I know that some of my teachers are/ just started talking, it will be like half an hour of them just talking … they start talking about math, and then they try to relate it to, I don't know, different things that they think it relates to, but it doesn't really. … Sometimes it can be interesting, but it has nothing to do with it [the mathematics].

In contrast, Nat lamented that teachers "know how to navigate the ship, but they don't know where to go" and suggested that teachers infuse more practicality, relevance, and connections with students' daily lives into their mathematics lessons: "Probably more visual and more examples of what they are saying. Hands-on kind of, they're just easier to understand the point."

Empathy

Some students described a need for teachers to have more empathy for students in their teaching approaches, while others articulated the importance of teachers' social and emotional capacities in building teacher-student relationships. For example, Jordan reported that most of their teachers had given up on them and begun ignoring them in the classroom. They believed teachers should have an awareness of students' difficulties and help when they see students struggling:

> Engaging in the classroom is really good. If you see someone struggling, if it's possible, I know everyone doesn't have an unlimited amount of time, you know, just do your best to help out the students that are struggling behind, it's not just you that … has limited time in the classroom, and even in your life. … Yeah, they're young [the students], they have quite a while in their life to even grow up, but if they're missing these pieces and they have to go back and they've learned everything wrong, to reform that, it's like sculpting clay. You have to keep putting water on it until it's soft and malleable, while if you know something, let's call that hardened clay, you have to break it down, and you have to re-teach them in a way that they understand.

Elsewhere, Jordan described the teacher's role as not only managing students' learning but also knowing how to assess it in ways other than examinations, which are stressful for many students:

> I would say that maybe it could be more, they're working on it, but maybe more balanced in terms of the way that they do examinations. I do think that too many tests are stressful for everyone. I mean, I could tell you, all my friends, that's their main concern in school, tests, as well. Tests are what are intimidating really. … Yeah, a balance between tests and assignments you can hand in, and maybe different ways of doing math.

Students also drew attention to gaps in some teachers' abilities to read students' body language or emotional cues: "Just because I don't like to speak to you doesn't really mean I don't need your help. I was just shy talking with them and didn't ask questions." (Alex)

Alex suggested that teachers need to have an intuition about students who are shy and are struggling with social engagement in the classroom. Terry, on the other hand, gave some advice to teachers who are shy: "I would probably tell them to not be shy and just teach, I guess, normal. It would be less stressful if they explain and tell us what they're doing instead of just doing it."

The lack of enthusiasm for teaching students with poor performance was also seen as a problem in mathematics classrooms. Jac, for instance, described their teacher's preference for working with high achievers as favouritism:

> Our teacher really didn't like our class because out of all their classes our class was somewhat, I don't know, in her eyes they weren't as good, or was not doing as well. … A thing she would do that really brought down some people in the class … she got people who had very high marks and she would put them in a corner all by themselves and they would do their thing and leave the rest of the kids all in their own desks. It's kinda like, do you know how bad this makes us feel? This makes us feel like we're failing something we're just trying to learn from you. Favouritism should not be added in math. To me it's something that does not add up. Pun intended!

Although Jac's math teacher seemed to hold implicit biases that caused her to dismiss some students' as learners, Jac's proposed solution—to think of every student equally—shows a significant level of maturity and is an important consideration for teachers working with youth who appear disengaged:

> How about we say this to all my math teachers and teachers alike? The way to get to most people is through conversation. If they, if they see something that they can share with you, like an emotion, how they act, a story that happened in their life, if you can just strike up a small conversation you will get ten times more out of that student [than] if you just said, "Here, do this. Get it done. I want to see it tomorrow or there will be consequences." Because … if you make this student *enjoy* what they do they will do so much better. And that's what the teachers here [the upgrading program] do so well. They're not afraid. They know there's a point to the class but they're not afraid to, say, like, burst out into a little bit of conversation but then get back on track. Stuff like that. And if you think of every student equally, you'll get, you'll get more of a hive mind than anything—they'll be willing to share with each other.

Although the call to treat all students equally is widespread in the professional literature for teachers and is a foundational component of many teacher education efforts, Jac's rationale for this mandate is not just about equity but about developing a hive mind in the classroom such that students will be willing to share with one another and therefore break down barriers between those who teachers see as high-achieving and those they might be tempted to relegate to the category of "less able." For Jac, teachers with no empathy tend to focus on moving efficiently through the content instead of on students' learning needs, but teachers with compassion might be able to reach the whole class, including those at the margins and those who appear to be disengaged. For Jac, then, teachers' and students' pathways in the classroom should be reciprocal, with teachers feeling empathy for the students' experience and students responding to the teachers' invitations. In this way, the teacher may be able to support students to cope with negative emotions in stressful interactions, and, as such, temper students' negative emotional experiences. Jac's comments also suggest that willingness to engage in genuine conversation is one way in which teachers can reach out to all students to create a more inclusive learning environment.

Discussion and Conclusion

A growing body of evidence has suggested that feedback can be particularly useful for informing efforts to promote students' learning and outcomes, but there remains a lack of research specifically on students' views and feedback on teaching and how it can be improved (Mandouit, 2018; Rollett et al., 2021). Students in the component of our study reported here were all participating in an upgrading program to improve grades for university entry or to complete high school graduation as adults. As such they represent a particular body of learners, ones who have struggled in one way or another with mathematics in regular school classrooms. Many of the students suggested that their teachers needed to become more active listeners and develop awareness of instructional strategies that favor vulnerable students' learning needs. Promoting inclusive learning environments that meet the needs of such students is an important step towards equity for all students.

Our findings also support the idea that a lack of empathy from teachers can lead to poor relationships with students, lessening the sense of belonging for students in the classroom (Brown et al., 2012). Strained or weak interpersonal relationships with students can also have a significant

impact on the quality of teachers' experiences in the classroom. In this context, Hagenauer et al. (2015) documented the impact of interpersonal student-teacher relationships on teacher's emotions and concluded that such relationships "play … a particularly important role in teachers' emotional experiences in class" (p. 385) and that "teachers' ability to connect well with students can be regarded as an important skill to target in professional development" (p. 398). Additionally, they reported that "the ability to manage classrooms … and to form positive interpersonal relationships with students can … be regarded as important factors of teacher emotional wellbeing in the job" (p. 397).

Of course, students are not necessarily privy to the complexities of teachers' work. As Willms and Friesen (2012) noted, a major challenge for teachers during classroom instruction is to manage and carry out the tasks of teaching while addressing students' interests and learning. Although the importance of creating a healthy environment that fosters students' learning and social/emotional well-being in classrooms has been acknowledged (Flook et al., 2013), rigid curricula and high-stakes testing undermine the autonomy that teachers feel in the classroom (Klassen et al., 2012) and may prevent teachers from taking advantage of opportunities to expand their relationships with their students. These complexities sometimes mean that teachers and students are not on the same page when it comes to the importance of student agency in determining how they will learn. Our data reflected this discrepancy, with findings suggesting the existence of a general idea among students that teachers have different views of students' roles in the classrooms than do students. Students reported that some teachers avoid engagements and initiatives that give students autonomy for learning. For example, Jordan described their mathematics teacher as disengaged and unwilling to put in the time time to build connections with them while they learned the subject matter. These results are in line with the findings from Vaughn (2018) that show that teachers don't necessarily understand how to support student agency. "Teaching for student agency requires taking risks and adopting an adaptive stance toward instruction" (Vaughn, 2018, p. 63), an approach that many of the students in our study had found lacking in their educational experiences.

Our research also suggests that upgrading students can give valuable and highly actionable feedback to teachers and that their insights could help teachers better understand how mathematics teaching is experienced by struggling students. Our research also adds support to previous findings that student feedback can serve as a source for examining aspects of instruction to which teachers might not pay attention while teaching (den Brok et al., 2004; Shuell, 1996).

Finally, a critical aspect of our findings relates to how students positioned the feedback they offered. None of the students seemed to be deliberately trying to expose teachers' biases or weaknesses simply for the sake of complaining or passing the blame for their own failures to succeed. Instead, they sought to value the possibilities to share with teachers their motivations and ideas, seeking to make teaching and learning a more shared social practice. Our findings therefore show that the students with whom we spoke are seeking a space of cooperation and relationship with teachers without the limitation of being required to follow one correct or pre-determined path for learning.

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