

Junior High Students' Perceptions of Mathematics Learning Experiences

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Purpose, Question and Subquestions

The purpose of this basic qualitative research, operating within a constructivist theoretical frame (Guba and Lincoln 1994), was to explore junior high students' perceptions of mathematics learning experiences.

To facilitate this research, I interviewed four Grade 8 students from one school in an urban central Alberta school district to unveil the challenges associated with learning mathematics, the strategies and supports that increase the likelihood of success, and the impact of assessment in the classroom. I selected

the student participants through convenience sampling (Merriam and Tisdell 2016), choosing the four participants by random selection from the group that returned the required forms. Though there were no criteria for selection beyond participation in Grade 8 mathematics, the participants happened to be diverse both ethnically and demographically and possessed a range of confidence levels and ability in mathematics. I conducted one-on-one, open-ended, semistructured interviews of 17–25 minutes, and had no prior relationship with the participants.

The data analysis involved transcribing, analyzing and interpreting qualitative data attained through the interviews. I sorted raw data from the interview transcripts into a number of open codes and narrowed

those down through axial coding into the emerging themes presented in this article.

The research question guiding this inquiry was, What are the perceptions of four Albertan junior high students about their mathematics learning experiences? To support this key question, I used the following subquestions:

- What challenges exist for junior high mathematics students?
- What learning techniques increase the likelihood of success in junior high mathematics?
- How are students supported in their junior high mathematics learning experiences?
- How do students describe assessment practices that improve mathematics learning experiences?

Findings

After data collection and analysis, four main themes emerged from the central phenomenon of student perceptions of mathematics learning experiences:

- Barriers to student success in mathematics
- Learning supports that increase the likelihood of student success
- Factors affecting student engagement in mathematics
- The impact of assessment on mathematics experiences

Barriers to Student Success

For students, an inequitable mathematics experience can be as debilitating as an equitable experience can be affirming. Numerous factors lead to students' negative perceptions of mathematics and can contribute to the development of mathematics anxiety.

Several studies (Lin, Durbin and Rancer 2017; Núñez-Peña, Suárez-Pellicioni and Bono 2013; Ruff and Boes 2014) have defined *mathematics anxiety* as fear, nervousness, helplessness, anxiety and dread related to learning mathematics and solving mathematical problems, which can lead to the avoidance of mathematics activities altogether.

The participant interviews illuminated several barriers to student success in mathematics that may coincide with the development of mathematics anxiety. After I analyzed the participant data, it became evident that the barriers to student success could be sorted into four subcategories: the content, the teacher, peers and the classroom.

The Content

All four participants—participant 1 (P1), participant 2 (P2), participant 3 (P3) and participant 4 (P4)—indicated that curricular content served as an inhibitor to success in mathematics, an assertion consistent with the findings of prior research (Lin, Durbin and Rancer 2017; Ruff and Boes 2014).

Both P3 and P4 referred to the sequential aspect of mathematics as being a potential barrier. P3 pointed out that success in previous grades has an impact on success in future mathematics. P4 stated, “If you don’t understand the first part, you’re not going to understand the rest of the unit.”

P2 lamented her inability to understand some curricular content, even with repeated explanations from the teacher, and P1 and P3 pointed out the content-related barriers associated with problem-solving question formats, which can undoubtedly be a struggle for struggling readers and English-language learners. P3 explained this in a unique manner, talking about “making questions bigger than they need to be.”

Taken together, the participants’ perceptions of content as a barrier highlight the important role of learning supports in increasing the likelihood of student success in mathematics.

The Teacher

The participants zeroed in on many teacher-centred barriers to student learning.

Both P3 and P4 mentioned having difficulty when the teacher provided too little or no explanation of the content, with P3 elaborating that some teachers “don’t explain” and others “talk too fast.”

P1, P2 and P3 reported that different teaching methods had an impact on their understanding. P1 expressed that she felt confused when the teacher was “teaching one way, but you actually know the other way.” She queried, “If the teacher recommends one [method], but we get the other one, what should we do?” P3 echoed this sentiment and belaboured the problem of learning one method at home and then being expected to use a different method at school. P2 admitted to struggling when one teacher “used to write all around the classroom” and “all over the board.” The first three participants also emphasized that they felt frustrated when teachers struggled to explain something properly.

Research has shown that ineffective teaching practices have a negative impact on student learning (Lin, Durbin and Rancer 2017; Ruff and Boes 2014; Whyte and Anthony 2012). The participants’ views support the idea that aligned with inquiry-based, student-centred mathematical pedagogy, teachers must

embrace various styles and methods of both teaching and learning in order to better accommodate all learners.

P1 highlighted the issue of poorly established teacher–student relationships, disclosing that she was “not really comfortable” with her teacher: “Even if I have questions, I won’t ask.” P2 noted that access to the teacher can be a barrier to student success because “there are a lot of people in our class, so the teacher can’t focus on us individually” and sometimes “everyone needs help with different things, so the teacher gets kind of confused.” These accounts demonstrate how instrumental it is for teachers to build relationships with their students and to make themselves readily available as a learning support.

Peers

The participants noted several peer-related barriers to mathematical success, in both collaborative work situations and project-based learning (PBL) settings.

P3 remarked that working with people who are at different levels of understanding can “bump you down and make you feel different,” and P2 stated that, in group situations, “if it’s a concept I don’t get, it’s going to be tough for me.” She elaborated, “If I’m with people I’m uncomfortable with, I won’t share my ideas. I would just do everything that they say.”

P1 raised issues related to differing ideas about the direction of projects. She also noted the problems of having to work in confined spaces and of the noise level when everyone talked and planned at the same time in PBL environments.

Two participants conveyed their hesitance about depending on other people to complete their work effectively, with P4 claiming, “If they do something wrong and I’ve done all my work, it’s all their fault.” P3 and P4 both said that they preferred independent work to PBL, citing differing personalities, levels of ability, work speeds and quality of work, as well as problems related to meeting outside class time.

Teachers can address these concerns by allowing students to choose their own groups, by allowing flexible project timelines, and by coaching students on group dynamics and productivity.

The Classroom

The participants identified numerous classroom-based barriers to optimal mathematics learning.

P3 and P4 cited noise and distractions as factors that prevented them from focusing on their work.

P1 saw the lack of time given to respond to teacher questions as a barrier, asserting that it “doesn’t give people that many chances to answer questions.” P2

reported that it “brings me down [when] I’m trying to figure out the answer and they already said [it].”

P3 (who had taken three years of math in French before pivoting to classes in English) and P2 both discussed communication as a barrier to learning. P2 sat beside three students who often spoke another language, and she struggled because she “focused less on math and more on trying to figure out what they were trying to say.”

All four participants discussed the downside of technology in the classroom, referring to its distractive nature as a barrier to learning. Participants explained that students “sneak onto YouTube” or other websites and “lie, saying they’re doing their work.” As summarized by P4, “It’s hard to keep a junior high school student focused on the task at hand.”

It would behoove teachers to be aware of the distractive elements in the classroom that serve as barriers to student learning and to mitigate their effects.

Learning Supports

During data analysis, I identified myriad factors that support student learning in mathematics. Within this theme, five subcategories emerged: the teacher, peers, personal strategies, external supports and technology.

The Teacher

All four participants spoke of the importance of having a strong teacher who is willing to help students, who explains material effectively and who allows multiple methods of finding answers. P3 spoke about how her teacher “would explain different [ways] to certain kids” and “write it down if it was a reading question to make it easier for me.”

Three participants insisted on the importance of communicating directly and sharing work progress with the teacher. Teacher–student relationships directly affect student success, and the participants saw teachers who were “encouraging,” “nice” and “understanding” as more approachable and supportive. P3 explained that students should “talk to [teachers] about the way [they] understand,” which is far easier when the student and teacher feel comfortable with each other.

P2 and P3 noted the importance of accommodating students’ individual needs and differentiating learning in the classroom. This is consistent with prior research, which found that it is vital for teachers to have the ability to nurture trusting, caring relationships with and between students, in order to create an atmosphere of safety where everyone feels involved, appreciated and able to communicate openly

(Dunleavy 2015; Griggs et al 2013; Tait-McCutcheon and Loveridge 2016).

Peers

One of the most discussed topics across the interviews was peer support. All four participants mentioned often their strong belief that peer support and collaboration were essential to their success in the classroom, a finding supported by the research (Brenner, Bianchini and Dwyer 2016; Griggs et al 2013; Tait-McCutcheon and Loveridge 2016).

P1 stated that working with peers made learning math “more fun and easy,” a sentiment echoed by the other three participants, who explained that through working together, students could share methods and ideas.

All the participants made it known that they enjoyed supporting their classmates as much as seeking help themselves. According to P4, the collaborative nature of the math classroom created an environment where students were “all very supportive of each other and help each other learn what we need.” P3 specified that sometimes she would ask what the right answer was and work backward to learn how to find it, while at other times she would ask other students, “Which way are you doing it?”

Three participants pointed out that group work in PBL situations could involve idea sharing and helped fill in knowledge gaps for each group member. P2 stated, “Sitting next to people I’m comfortable with is really good for me. They try to explain . . . and go over and over it until I understand.”

The participants unanimously agreed that peer support was extremely important to finding success in math. Thus, teachers should be ever cognizant of the benefits of peer support and should continually promote healthy collaboration in the classroom.

Personal Strategies

Three participants disclosed the personal strategies they employed to help them achieve success in mathematics, noting the importance of practice and completing assigned work.

P1 and P3 both referred to their personal learning style as being visual-spatial. P1 stated, “If I do hands-on stuff, I understand it better.” P3 seconded this sentiment and added, “I have to visually see the pictures.” P1 talked about how supportive it was to her learning to explore different methods before selecting the one that worked best for her.

External Supports

Both P1 and P2 disclosed that they spent time with a tutor outside school, which helped support their

mathematical understanding. P3 noted that regular time spent working on math with parents was helpful, expressing that her mom could “explain it in a smaller way.” Additionally, P3 spoke of private classes she had attended in prior years to augment her learning.

Technology

All the participants confirmed that technology was present in their classrooms and that it supported their learning in mathematics, despite the barriers it presented.

P1 and P2 pointed to the academic benefits of YouTube. Many mathematics help videos are available to explain concepts when other support is not available. P1 and P4 explained that websites such as Mathletics and Math Antics were strong learning supports for them, for both extra practice and video tutorials. P2 shared that her math class used Google Classroom and that the teacher posted notes and support materials for the students. In terms of working collaboratively, P3 said that computers could be helpful “if we’re working on a project.”

All participants indicated that it would be helpful if teachers could figure out a way to ensure that students were responsible when using technology, but they did not seem confident that this would happen.

Student Engagement

The participants were eager to detail the factors that affected their engagement in mathematics learning. Because of the nature of the responses, I have arranged this emerging theme into two sections: engagement and disengagement.

Engagement

The participants mentioned an array of factors that increased their engagement in mathematics.

P1 shared that her teacher told students that “there are no right and wrong answers,” and she noted that this process-based approach made it “nice to participate.”

All four participants agreed that mathematical content could be fun and engaging. P1 and P2 both said that they enjoyed “learning new things,” and P2 spoke of the sequential aspect of math, claiming that students got to “build on what [they] learned about last year.” P4 indicated that he “enjoys the challenge and the subject matter.”

An interesting revelation by P3 was that she would demonstrate her engagement to her teacher not by raising her hand but, rather, by “mouthing the answer to [herself] instead of [saying] it out loud.” Another indicator of student engagement, suggested by both P1 and P2, was attention-seeking behaviour, such as

engaging in class talks and going in front of the class to explain concepts to peers. P2 explained that doing this “shows the teacher that I care.”

Three participants stated that they engaged in and were motivated by math when they experienced success. This is substantiated by other studies, which have found that self-efficacy positively correlates with effort and achievement and inversely correlates with the presence of mathematical anxiety and the perceived difficulty of the content (Çiftçi 2015; Gafoor and Karukkan 2015; Martin and Rimm-Kaufman 2015; Mata, Monteiro and Peixoto 2012). P1 stated, “When people get it, they’re really noisy because they’re confident.”

Based on these participant perceptions, teachers would be wise to facilitate student exploration of curricular content, provide opportunities for meaningful class discussion, and celebrate students’ learning breakthroughs and successes.

Disengagement

Three participants cited the mood in the classroom as contributing to their disengagement from math. P1 clarified that “if it’s too quiet, it gives you a vibe that no one gets it,” which “brings you down.”

For all four participants, content emerged as a source of disengagement, for a range of reasons. P4 stated that the content was sometimes “too easy” and “boring,” whereas P1 and P2 said that they disengaged when faced with an utter lack of understanding.

For P1, P2 and P3, feelings associated with math anxiety were also an impetus for disengagement. This is pertinent for mathematics teachers to consider, alongside several studies that have found that students who find mathematics easier and who have higher self-efficacy are more willing to seek help, whereas those who struggle and have lower self-efficacy tend to quit when the perceived difficulty is too high (Gafoor and Kurukkan 2015; Martin and Rimm-Kaufman 2015; Newman and Schwager 1993). These three participants conveyed a sense of fear associated with giving wrong answers in front of others. Two of them added that they disengaged when other students came up with the answers too fast and were not supportive.

Classroom distractions served as a source of disengagement for all four participants. P4, who claimed to have a high success rate in mathematics, asserted that he found it “very hard . . . to concentrate” when the classroom pacing was too slow. He stated, “I usually end up talking because I get too bored.”

It is essential that teachers become attuned to the factors contributing to student disengagement and

that they work to ensure that classroom practices afford all students the unimpeded opportunity to learn.

Assessment

The participants shared the assessment practices that enhanced their mathematics learning and helped them experience success in the mathematics classroom.

P1 and P4 both expressed the importance of teachers providing review packages for students. P1, P2 and P3 claimed to have no aversion to testing, but they felt somewhat apprehensive about concepts that they did not understand well. P3 said that she preferred assignments and book work to projects and exams, because she preferred “not to work with other people” and feared “not understanding on a test” because one misunderstood concept can “hurt my whole . . . test.” P4 said that he favoured tests over other assessments because he wanted to “just get down to the material rather than spending forever on a whole bunch of tiny projects.” P1 suggested that, with regard to group work, teachers should consider “marking just one person, not the whole group” because “if the group does badly, you get the mark, too.”

The participants did not seem overly concerned about the type of assessments teachers provided; instead, they focused on how they could support themselves in day-to-day mathematics learning to prepare for those assessments, a notion reflected by the significantly lower number of codes in this theme.

Suggestions for Teacher Action

As evidenced by these findings, student perspectives are valuable for informing teaching practices and should be central in conversations of pedagogy. Based on my research findings, I offer the following six suggestions for teacher action, along with other supporting research:

- Be aware of content-, teacher-, peer- and classroom-related barriers that prevent students from reaching their full learning potential and that contribute to the development of debilitating mathematics anxiety (Griggs et al 2013; Lin, Durbin and Rancer 2017; Maloney and Beilock 2012; Núñez-Peña, Suárez-Pellicioni and Bono 2013; Ruff and Boes 2014; Whyte and Anthony 2012).
- Maximize the availability of learning supports in the classroom so that students are best equipped to overcome barriers to learning (Brenner, Bianchini and Dwyer 2016; Dunleavy 2015; Griggs et al 2013; Tait-McCutcheon and Loveridge 2016).

- Build healthy, supportive relationships with students to nurture the development of trust and care, which serve as the foundation of optimal learning environments (Dunleavy 2015; Griggs et al 2013; Tait-McCutcheon and Loveridge 2016).
- Encourage regular, meaningful collaboration between students, including PBL, and promote the benefits of peer support (Brenner, Bianchini and Dwyer 2016; Griggs et al 2013; Tait-McCutcheon and Loveridge 2016).
- Be aware of classroom dynamics (including the notion of productive noise, helpful and harmful student interactions, and the positive and negative impacts of technology) to ensure that students are placed in positions that will enhance their learning (Lin, Durbin and Rancer 2017; Maloney and Beilock 2012; Ruff and Boes 2014; Tait-McCutcheon and Loveridge 2016; Whyte and Anthony 2012).
- Adopt a process-based, rather than a product-based, approach to mathematics that celebrates mistakes as part of the learning process and embraces the idea of productive struggle. Using such an approach will reduce the effects of math anxiety and prevent student disengagement (Brenner, Bianchini and Dwyer 2016; Dunleavy 2015; Núñez-Peña, Suárez-Pellicioni and Bono 2013; Ruff and Boes 2014; Tait-McCutcheon and Loveridge 2016; Whyte and Anthony 2012).

Conclusion

This article has reviewed four themes that emerged surrounding the central phenomenon of junior high students' perceptions of mathematics learning experiences:

- Barriers to student success in mathematics
- Learning supports that increase the likelihood of student success
- Factors that affect student engagement in mathematics
- The impact of assessment on mathematics experiences

The findings suggest that students are attuned to the intricacies of their mathematics learning experiences. Thus, it is evident that the voices of students warrant regular consideration in discussions about pedagogical advances in and beyond the mathematics classroom. Although students seem to be less inclined to weigh in on assessment practices, they are acutely aware of the barriers that prevent them from achieving success, well versed in seeking ways to support and

augment their own learning, and cognizant of the factors affecting their engagement in mathematics.

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