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Examining the Connections between Students' General Perceptions of Mathematics and their Affiliations with Specific Lesson Segments

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Abstract: As students learn school mathematics, they form identities about what it means to be mathematically competent. These identities both influence and are influenced by their general perceptions of school mathematics and their moment-to-moment experiences in mathematics classrooms. This study explores, through lesson observations, individual student surveys, and interviews, the connections that exist among secondary students' general perceptions of school mathematics, their perceived mathematical competence, and how they identify with various lesson segments in their mathematics classrooms. The findings show that although there exists some explicit connections between students' general mathematics identities and their affiliations with various lesson segments, students' identity narratives for specific lesson segments vary based on the value they attach to those lesson segments. Implications for these findings are discussed, including the caution against educators holding a single identity marker for students.

Keywords: Lesson Segments; Identity narratives; School Mathematics
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Introduction

Within mathematics education, scholars (e.g., Dowker et al., 2016; Grootenboer et al., 2008; Ignacio et.al., 2006; McLeod, 1992) have emphasized the importance of the affective domain—the wide range of beliefs and feelings (e.g., satisfaction, frustration, anxiety) that go beyond the cognitive domain—on students' mathematics learning, their classroom experiences, and identity formation. Similarly, organizations like the National Research Council (NRC) (2001) propose that one goal of mathematics education should be to help students develop positive mathematical identities and dispositions. With positive mathematical identities, students are more likely to become autonomous and persistent learners who can persevere through challenging mathematics (NCTM, 2000), find value in doing so, and develop positive dispositions towards their classroom and school experiences (Bishop, 2012).

Students' identities are situated and dynamic (Bishop, 2012; Sfard & Prusak, 2005), that is, dependent on and changeable based on what it means to be, know, and act in a given context. Sfard and Prusak define identities as first-person discursive accounts or the way someone thinks and communicates about themselves, usually through narratives or stories that mirror who one is, or who one is supposed to be, according to oneself and others. Drawing on Sfard and Prusak, scholars (e.g., Wambua, 2024a, Year; Andersson et al., 2015; Bishop, 2012) delineate students' mathematical identity narratives as unstable and malleable stories that change based on their mathematics classroom contexts and the activities in which they engage. For example, Andersson et al., (2015) found that students shift their identity narratives as they engage in different classroom activities that call for varied forms of interacting with the teacher, peers, and mathematics content. Moreover, because schools are political institutions, issues of power relating to race, gender, language, and socio-economic status have a direct impact on students' identities and how they experience school mathematics (e.g., Berry, 2008; Gholson & Martin 2019; Lubienski, 2010). Given this

bidirectional relationship between student identities and their school experiences, scholars have examined the identity narratives students tell as they describe their mathematics classroom experiences. Some of these ideas are addressed below.

Literature Review

Are mathematics classrooms sometimes perceived as boring spaces? Several studies report that secondary school students view their mathematics instruction as monotonous and boring (Andersson et al., 2015; Boaler, 2000; 2002), leading to the students being disengaged. Additionally, Brown and colleagues (2008) found "bored" as the word used most often by 16-year-old students to describe their attitudes in a questionnaire on their affective relationship to mathematics. However, Hall and Sink (2015) found that almost all the students in their study generally held positive attitudes toward their mathematics classrooms, whether the classroom environment was student-centered or teacher-centered. Brought together, these studies suggest that students' perceptions of their mathematics classrooms are not homogenous, or, as articulated by Andersson and colleagues (2015), mathematics classrooms are not uniformly experienced by all students.

Although students may have general perceptions of their mathematics classrooms, when prompted, they disclose varied perceptions about different instructional practices in their classes. For example, Andersson et al., (2015) conducted interviews with two upper-elementary students who identified themselves as "math haters" when asked about their general feelings towards mathematics at the beginning of the school year. Andersson and colleagues followed up with these students over the course of the school year, interviewing them after engaging in various classroom activities. They found a close relationship between students' identity narratives and the contexts in which those narratives were told. For instance, both students expressed a dislike for activities that involved solving textbook tasks, citing that they did not understand where they would employ those concepts beyond school. However, the students expressed satisfaction with group projects that involved solving tasks connected to societal issues like interest rates on student loans, environmental issues, and social justice. Referencing these projects, the students said it was "a good exercise" where they "actually learned something" and were able to "decide for [them]selves what [they] wanted to do" (Andersson et al., 2015, p. 156). This shows that students' identity narratives vary based on their sense of autonomy during classroom activities and the utilitarian nature of the tasks.

Other scholars (e.g., Ellis et al., 2014; Nicaise et al., 2000) reported that students expressed interest in classroom activities where they were actively involved. Nicaise and colleagues (2000) conducted classroom observations and student interviews in three mathematics classrooms where instructional activities included direct instruction, team projects, and simulation activities. They found that most of the students disliked the teacher-directed portions of the classroom because, according to them, the teacher knew what he wanted done and the students had to do it exactly that way. As such, the students saw the teacher as the sole authority and felt they lacked autonomy in this portion of their classroom learning, an aspect they just complied with to meet the teacher's expectations. Despite that, the

students mentioned they enjoyed the real worldliness of their project work. There was, however, a split between students' preferences for how to carry out the class project. Some students preferred working individually and others preferred teamwork. Since the project work was done primarily in groups, students who enjoyed group work perceived themselves as successful during the interviews as opposed to those who mentioned they disliked group work. One interpretation is that these students assessed their success by their ability to complete tasks in a way they identified with. In summary, existing literature on students' perceptions and identity formation suggest that students' identity narratives are not stable across instructional practices and activities. Students identify with some activities over others and respond to them in interesting ways.

Theoretical Framing

This study is guided by two theoretical lenses. First, Cobb and colleagues' (2009) identity framework guided the examination of students' identity narratives. Cobb and colleagues discuss two kinds of identities—normative and personal— that students develop as they engage with their peers and teacher(s) in mathematics classrooms. Normative identity constitutes the communally constructed obligations for what students must do to be considered effective and competent members of the classroom community. These obligations are created and reinforced over time through implicit and explicit classroom discourse, and they consist of things (e.g., actions, speech) students must do to fulfill the expectations of other classroom members. Examples include taking notes during lecture time and collaborating respectfully during class discussions. These normative identities are context-specific and value-laden (Gresalfi et al., 2009; Ruef, 2021). Being context-specific means these obligations vary across mathematics classroom contexts and what is considered a 'normative/competent student' in one classroom context may be different in another classroom. The aspect of being value-laden means there is a moral dimension attached to (non)adherence to the classroom normative identity. In other words, students who act according to the normative identity may be judged positively whereas those who defy them may be perceived negatively.

Personal identity, on the other hand, relates to if and how students identify with their classroom normative identities. Identification involves a process whereby one turns (or not) the communally-constructed expectations of others into what the individual thinks and says about themselves (Cobb et al., 2009; Gresalfi et al., 2009). Students may identify with classroom obligations, merely cooperate with them, or utterly resist them (Boaler, 2002; Cobb et al., 2009). Students who identify with classroom obligations turn obligations-to-others into obligations-to-self. They see value in the classroom obligations, develop commitments to them, and enjoy participating in them. Students who merely cooperate with classroom obligations see minimal or no value in the obligations and instead view performing those obligations as a chore or a way to fulfill others' (i.e., the teacher's or peers') expectations. In other words, obligations-to-others remain as such. Students who resist classroom obligations see no value or a negative value in the obligations and deny performing them. Another integral part of students' personal identity is an assessment of their own and their peers' mathematical capabilities. As students develop narratives for what one should do to be counted as mathematically competent, they characterize themselves and their peers based on their classroom norms for competence. For example, a student who views mathematical competence as equivalent to getting correct

answers would view whoever gets correct answers (either themselves or their peers) as being mathematically competent.

The second theoretical lens guiding this study is a view of learning as a process of coming to participate in the classroom mathematical discourse (Pimm, 1987). For students to meaningfully learn mathematics and be identified (by self and others) as competent thinkers and doers of mathematics, they must participate in the mathematical discourse. It is through participating in the classroom discourse that students get to pose and respond to others' questions, explain and justify their solution strategies, and articulate relationships between mathematical ideas. Extant literature demonstrates close relationships between students' classroom participation and how they identify with mathematics (Andersson et al., 2015; Bishop, 2012; Boaler, 2000; Jansen, 2006; 2008). To conceptualize classroom discourse, this study drew on Grouws and colleagues' (2010) ideas of lesson segments. Lesson segments refer to the various elements of instructional activities that teachers and students devote classroom instructional time to. Grouws and colleagues examined 325 mathematics classrooms and reported seven ubiquitous lesson segments—warm up, homework review, lesson introduction, lesson development, student practice, assessment, and lesson closure. They defined these lesson segments as: warm up involved students working on general mathematical problems that were not specific to the content for that class period; homework review focussed on prior homework; lesson introduction and development involved presentation of new mathematical concepts; student practice was a time for students to solve problems related to lesson's mathematics content either independently or in groups; assessment involved some form of measuring student learning; and lesson closure included wrapping up the mathematical content at the end of the class period.

Research Purpose and Questions

Extant literature shows that the extent to which students identify, merely cooperate, or resist their classroom obligations differ across classrooms and instructional activities (Andersson et al., 2015; Boaler, 2000; Cobb et al., 2009). For this current study, the hypothesis was that even within the same classroom, students' extent of identifying also differ from one lesson segment to another, and different students within the same class can identify differently with the same lesson segment. What was however unclear, and which existing literature does not yet address explicitly is whether there are connections between how students identify with various lesson segments and how they perceive themselves with respect to their general mathematical competence. This wondering is the basis upon which this study is anchored. The three research questions explored were:

1. What are secondary students' general perceptions of school mathematics and their competence at it?
2. How do the secondary students identify with various lesson segments in their mathematics classrooms?
3. In what ways do the students' general perceptions of school mathematics and their competence relate with the ways they identify with various lesson segments in their mathematics classrooms?

Method

Context and Participants

This study was conducted at a public, suburban, combined middle and high school (grades 7–12) located within midwestern USA. According to the National Center for Education Statistics (nces.gov), 88% of the students identify as white, 8% as black, 3% as hispanic, and 1% as asian. These demographics include 42% of students who qualify for free and reduced lunch. The students participating in this study were enrolled in either 8th grade pre-algebra or 9th grade geometry. The pre-algebra class had a total enrollment of 15 students and was taught by two co-teachers, Mr. Tairus and Ms. Chacha. The geometry class had 9 students and was taught by Ms. Belinda. All names are pseudonyms. The perceived demographics of students in the two classes were representative of the school districts' demographics. Eight students participated in the larger study (see Wambua, 2024b), but only four (two from each class) are discussed in this study. Table 1 shows their self-reported identifications.

Table 1

Summary of Participants' Demographics

Pseudonym	Class	Sex	Race
Amanda	Pre-Algebra	non-binary	White
Bonnie	Pre-Algebra	Female	White
Salama	Geometry	Female	African American
Jayden	Geometry	Male	White

These four students were purposefully sampled (Patton, 1990) because they demonstrated diverse participation patterns during various segments of class. The participation patterns were based on lesson observations during the first week of the researcher visits and students' responses on an initial survey (explained later). Selecting students with diverse participation patterns was important for this study because, as mentioned in the theoretical framework, student participation is an integral mark of their classroom learning. Students' participation patterns were evidenced by the frequency and length of their class contributions (Reinholz and Shah (2018) as they verbalized and scripted mathematical ideas, assessed their peer's work, asked questions of, and responded to their teacher and peers during whole-class and small-group discussions.

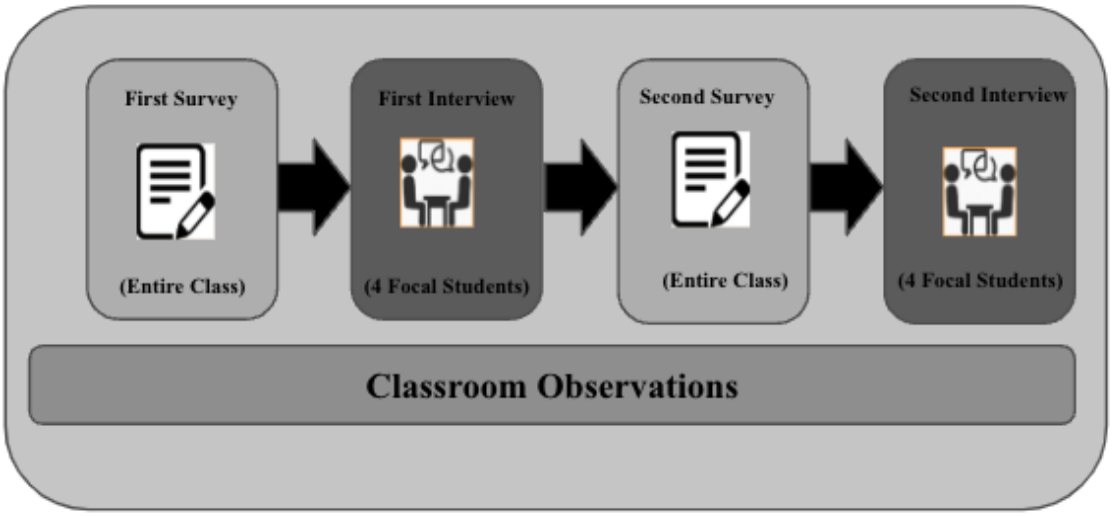
Data Collection

The primary data sources were individual student surveys and interviews. In addition, lesson observations were used to gain an understanding of the classroom contexts where the students worked. Field notes taken during lesson observations focused mainly on the nature and duration of various lesson segments and students' participation

patterns. Data collection lasted approximately 2 months, coinciding with the school's winter quarter. All students completed two short surveys that were adapted from *Practical Measures, Routines, and Representations* (Jackson et al., n.d). They included both open and close-ended questions geared towards understanding what students perceived as their obligations during various lesson segments (e.g., what was the purpose of today's group work) and their identification with those segments. Interviews with the focal students (~ 15 minutes) were conducted twice and occurred immediately following lesson observations. Figure 1 represents the overall design of data collection.

Figure 1

Overview of Data Sources and Data Collection



Data Analysis

The data analysis process was guided by Bishop's (2012) proposal to view identity as a "dynamic view of self, negotiated in a specific social context and informed by past history, events, personal narratives, experiences, routines, and ways of participating" (p. 38). As such, analysis was conducted mainly on data from the individual interviews and surveys to elevate students' personal narratives about who they are in relation to school mathematics. Lesson observation data was used to understand the classroom context (e.g., lesson segments and participation patterns) that then guided interview prompts and served to clarify and triangulate the findings (e.g., in showing evidence of how students participated in a manner that demonstrated affiliation or resistance). Of the seven lesson segments outlined by Grouws and colleagues (2010), only four were ubiquitous in the lesson observation data—homework review, lesson introduction, lesson development and student practice.

Analysis of the transcribed interview and survey data occurred in two phases. Phase one involved reading the entire transcripts and survey responses, flagging any segments where students expressed their mathematical identity narratives, and establishing the unit of analysis. Thematic units (Rourke et al., 2001) were established as the units of

analysis because as participants described how they perceived school mathematics, their competence, and their identity narratives for various lesson segments, there were multiple nested ideas that could not be adequately captured by a talk turn. Examples of thematic units included exchanges in the interview transcripts where students held multiple talk turns focused on a single theme, like their feelings about solving tasks individually. The second phase involved both emergent and deductive coding. Emergent coding (Saldaña, 2016) was used to code for how students characterized their general perceptions of school mathematics and their competence at it. It became readily apparent that students referred to themselves as being either "good at math" or "not good at math." They backed their self-characterization of mathematical abilities with evidence from their experiences like, "I have always struggled with math" or "I am a fast learner …I get good grades." Deductive coding (see table 2) based on Cobb and colleague's (2009) identity framework was used to code students' identity narratives for various lesson segments.

Table 2

Coding Scheme for Students' Identification with Mathematics Lesson Segments

Code	Code Description	Code examples
Identify with	Student develops a commitment to, perceives value in, or enjoys the lesson segment.	• I take notes during lectures because they help me solve tasks.
Comply with	Student perceives minimal or no value in the lesson segment but participates because it fulfills others' expectations.	• I take notes just because it is what the teacher expects of me.
Resist	Student perceives no or negative value in the lesson segment and denies participating in it.	• I do not take notes during lecture time because it is boring.

The data was chunked into different lesson segments (Grouws et al, 2010) before applying the deductive codes. As recommended by Andersson and colleagues (2015), a students' identity narrative was endorsed if the identity builder (the student in question) expressed the stories as being about themselves. Additionally, because personal identities are not static, comparisons were made among students' talk about the same lesson segment during both interviews and in their survey responses to examine if the narrative matched, varied, or became clearer. The analysis concluded by looking at the identification patterns across the four lesson segments to note emerging patterns and themes. Interesting connections between students' general and specific identity narratives became visible and are presented in the subsequent sections.

Findings

Of the four focal students, two of them perceived themselves as being "good at math' and the other two characterized themselves as being "not good at math" (see table 3). All students expressed varied identifications for the four lesson segments that were ubiquitous in their classes.

Table 3

Summary of Students' General Perceptions

Student	Self-Perceived Competence	Data
Amanda	Not good at math	• "I am not very good at math. I don't really understand it, and what we are learning now is confusing to me" (interview 1).
Bonnie	Good at math	• I think I am a good student in math or like, in any of my classes… I am a fast learner, and I will do what it takes to get a good grade (interview 1). • Rated herself as "good at math" in the survey.
Jayden	Good at math	• Rated himself as "good at math" in the survey.
Salama	Not good at math	• "I'm not a fan of math. I have always struggled with math … and it would irritate me …I eventually was just like, okay, I'm not good at math. It is what it is (interview 2).

Identity Narratives during Homework Review

Almost every pre-algebra and geometry lesson started with a review of previous homework. This segment lasted for approximately 7 minutes and was mostly teacher-led. Typically, the teachers selected one or two questions and showed students how to solve them, with a few occasions where the teachers asked students if there were specific items they wanted the teacher to address. The four students expressed varying levels of identification with this lesson segment. Jayden mentioned that he found value in and *identified with* this segment because it "allows [him] to recall how to solve tasks," making him more prepared to tackle similar tasks in the future (e.g., on tests).

However, Bonnie and Salama simply *complied with* homework reviews. For Bonnie, homework review yielded minimal value for her, but she participated in it because it was helpful for her peers. She said:

> Normally, if we go over homework, it's just for people that may not have finished or have questions. But most of the time I have all the questions done. So, I just sit there and just watch or I'll help a friend out.

Here, Bonnie describes homework review as something for other students, particularly those who "may not have finished" their work. She however distanced herself from that group because "most of the time [she had] all the questions done." Despite that, Bonnie would still participate by "sit[ing] there, just watch[ing] or help[ing] a friend out." In other words, Bonnie viewed review of homework as an obligation-to-others (i.e., her classmates). On the other hand, Salama's compliance with homework review was tied to her general dislike for the discipline of mathematics and the lack of student autonomy during this segment. Salama expressed that the norm during homework review is for the teacher to select what items would be reviewed, an aspect that she (Salama) did not like.

She said, “I would prefer to select the problems because I feel like I get more direct help, you know? Because it’s what I’m struggling with. It’s not just what she gets to pick.” As a result, Salama said that although she would perform her expected roles of “following through with the teacher” and ‘fixing wrong answers,” she found the segment “not a pleasant experience all around.”

Finally, Amanda utterly *resisted* homework review, adding that they usually resisted their obligations when going over homework with the whole class because they know there will be a better place (and way)— during group work time— to go over those problems. Consider what Amanda said:

> Most people, if they can’t figure it out, will ask and be like, ‘hey, can we go over this problem’ if they didn’t get it. And you are kind of expected to go over it as well. But I usually don’t because we go over those answers in our small group.

Here, Amanda expressed the obligations that every student in the class should perform during homework review (i.e., asking about the problems they can’t figure out and going over them) but added that personally, they “usually don’t” perform those roles because there will be another opportunity to review them in their small group.

Identity Narratives during Lesson Introduction and Development

In both classes, lesson introduction and development were intertwined and presented as lesson lectures. The students identified differently with the lesson lectures. Jayden demonstrated an ongoing process of identification over the course of the study. He started from a point where he found lesson lectures valuable but not enjoyable. Later in the semester he expressed both enjoyment and value for this segment. During the first interview, he said:

> Taking notes is not my favorite thing. I would like to already know all of it, but I don’t really know. It makes me happy to know that I can learn it later without the teacher, because the notes are there. But I just don’t know how I feel about taking notes. It hurts my hand.

Here, Jayden said he did not enjoy taking notes (i.e., “it’s not my favorite thing”) because “it hurts my hand.” Yet, he perceived taking notes as valuable for his learning outside of class because he “can learn [the concepts] later without the teacher.” During the second interview, Jayden’s narrative shifted. During the lesson prior to the interview, Jayden said, “I better take notes.” When asked why he felt a need to take those notes, he said:

> *Jayden:* Like, power went out the other day, okay. And I can’t reach out to her [teacher] if I want to do something like homework at that time. So, it’s good to take notes. Like, not for just her but for me, so, you don’t always, like, keep texting her or, like, emailing her.
> *Interviewer:* And how much did you enjoy that segment of taking notes?

Jayden: I enjoyed it a lot. I was thinking, it'd be really easy homework. Because I got the notes right here.

Notice this shift from the first interview. Here, Jayden said he "enjoyed [taking notes] a lot" and maintained his perceptions about the value of notes for out of school learning (e.g., when doing homework at home) in addition to his in-class learning. Notice too, Jayden spoke of taking notes as an obligation-to-self, saying that taking notes is "not for just [the teacher] but for me" because they help him whenever he is solving homework problems at home, and he does not have access to the teacher due to distance or in incidents of power outage.

Bonnie and Salama said they merely *complied with* lesson lectures albeit for different reasons. Salama only took notes because the teacher made it a requirement and withheld help from students who don't take notes. She said that whenever a student asks the teacher for help during practice time, "[the teacher] will come over to your table, and be like, why didn't you take notes? Then she is like, I can't help you. So, I take notes." For Bonnie, lecture time, "is boring," adding that "I don't have the most fun with it." Despite disliking lesson lectures, Bonnie said, "if it comes to answering questions, then I'll get involved because otherwise, there's not much to do besides watch." Therefore, for Salama and Bonnie, participating in the lesson lecture was an obligation-to-other, the teacher.

Unlike the other students, Amanda *resisted* lesson lectures and said, "the way he [the teacher] teaches is harder because people are always interrupting him and stuff." Amanda added that they usually find it hard to focus during lesson lectures and showed resistance to the lectures by sitting quietly at their desk with their head bowed down (i.e., not looking at what the teacher was writing on board) and sketching artistic stuff on their notebook rather than taking notes. Additionally, Amanda never raised their hand to ask questions or answer any of the teacher's questions.

Identity Narratives during Student Practice Time

After lesson development, students in both classes solved practice tasks that were similar in nature to those solved during the lesson lecture. In the geometry class, this segment was called 'you try it' and the geometry teacher did not specify if students should solve the tasks individually or in small groups. The pre-algebra lead teacher explicitly told students that they had liberty to either work individually or with peers. The teachers then circulated and conducted one-on-one discussions with individual students or student groups. In the interviews, students expressed that they viewed and identified with these three aspects of practice time differently. As such, the subsections below are devoted to each of these three lesson sub-segments.

Individual Work Time

All students expressed either an identification with or a resistance to individual work. Bonnie and Jayden *identified with* individual work time. Specifically, Jayden said, "I love working by myself" and rated his enjoyment of

individual work time at 3 (enjoyed a lot) on a scale of 0–3 in the survey. Bonnie expressed a similar attitude, adding that this is the time she "learn[s] the most" and gets opportunities to actively do the cognitive work of solving the tasks rather than simply following the teachers' work. Elsewhere, Bonnie added that she loves individual work time because it allows her to prove her mathematical competence to herself and to the teacher:

> I like doing the homework alone because I'm always the first person done and …I feel more accomplished because I'm like, I'm the only one that finished her homework on time. Mr. Tairus, be proud.

For Bonnie, the aspect of being "the first person done," with homework reinforced her sense of mathematical competence ("I feel more accomplished") and her hopes to make the teacher proud. It is worthwhile to note that homework in the pre-algebra class was in the form of the practice tasks that the teacher assigned after the lesson lecture. Many students would complete the tasks in class and only bring home what they did not finish.

However, Salama and Amanda *resisted* working individually and preferred working with smaller groups. They resisted individual work time by always sitting in groups whenever their teachers assigned practice tasks. For Salama, this behavior was influenced by her generally negative perceptions of school mathematics. Consider the excerpt below that occurred after Salama had spent time solving tasks individually and even reported that she had solved them correctly:

> It was not enjoyable…I'm not a big fan of math. Because even if you are right in math, the satisfaction doesn't really outweigh the fact that you are still in math class. It is still boring, tedious, and not fun. And no amount of right problems is gonna change that for me…Math is just mundane… There's only one definite answer. There's not a lot of flexibility, not a lot of variety with math.

Notice that Salama did not just dislike solving math tasks individually. She expressed that she detests math in general ("I am not a big fan of math") and described math as "mundane", "boring", "tedious", "not fun" and rigid because "there's not a lot of flexibility" around what the correct answer can be. As a result, salama had developed generally negative perceptions towards mathematics and that translated to her disliking the whole idea of doing math individually. As a result, Salama created her own norm of working in the format she enjoyed, group work.

Group Work Time

All the four students mentioned that they *identified with* group work. They however gave different reasons for their identification. For Amanda, Jayden, and Salama, the value of group work rested on the opportunities it provided for collaboration and the use of peers as resources. Specifically, Jayden said he values working in a group because, "if I have any questions, I have the other students and I can ask them if they understand it." Salama raised similar sentiments and said:

> I like to work with other people. It's just easier, because you have two minds instead of one. And so, there's different perspectives and people look at it a different way. So, you are more likely to come to the answer.

The idea that group work created ample opportunities for collaborative work was reiterated by Amanda who said that through group work they get to "bounce off of other people's ideas" and "help each other figure out" mathematics concepts until they get the right answer.

Bonnie had varying reasons for identifying with group work. For her, this was a time for her to help or teach her peers rather than to authentically collaborate with them. She said that she prefers to "work individually because it's a lot easier to stay focused" and added that "if someone needs help, I'm willing to help them. Because everyone learns differently, and them being kids and me being a kid, it's a lot easier for me to teach them." Notice that Bonnie implicitly positions herself as being better at teaching her peers compared to the teacher because they are all kids, and so "it's easier [for her] to understand how they learn" and to "teach them." Elsewhere, Bonnie insisted she prefers to work in a group for only "a few problems" and shorter periods of time.

One-on-One Teacher and Student Work Time.

Like group work, all the four students *identified with* the segment they worked one-on-one with the teacher. They gave two reasons for their identification with this segment. First, this segment created opportunities to confirm the validity of their solutions and get help on tasks that are difficult or new. For example, Bonnie said she likes how she just needs to "raise my hand" and the teacher will "come over and check my answers to make sure I got it right or tell me that I did it wrong and help me fix it," thus helping her stay on track. In addition to immediate feedback, students identified with this segment because it allowed for a personalized interaction with the teacher. For instance, Salama said:

> When it comes to working one-on-one with her, I feel like it is better than the actual lectures because she has her undivided attention on me. And so, she can help me with any personal issues that I have.

For Salama, working with the teacher "is better" because the teacher's attention is "undivided", and the teacher can personalize the instruction to "help [her] with any personal issues." The juxtaposition Salama made with lecture time was also raised by Jayden who said that one-on-one segments helped him to get clarity on ideas that he "didn't understand when she [the teacher] was talking to the whole class."

In summary, the four students had varied identity narratives for the four common lesson segments in their mathematics classrooms (see table 4) and gave varying reasons. For some, their reasons related to their general

perceptions of school mathematics and their self-perceived competence, while for others, the reasons for identifying (or not) with the specific lesson segments depended on the value they attached to those segments.

Table 4

Overview of the Students' Identification Patterns

	Homework Review	Lesson Introduction & Development	Student Practice Time		
			Individual Work Time	Group Work Time	One-on-One Teacher & Student Work Time
Bonnie	Comply with	Comply with	Identify with	Identify with	Identify with
Amanda	Resist	Resist	Resist	Identify with	Identify with
Salama	Comply with	Comply with	Resist	Identify with	Identify with
Jayden	Identify with	Identify with	Identify with	Identify with	Identify with

Discussion

In this study, the goal was to recognize what relationships exist across students' general perceptions of school mathematics, their self-perceived mathematics competence, and how they identify with specific lesson segments. By analyzing students' identity narratives across different lesson segments, the patterns that emerged reveal the complexities surrounding the students' reasons for (non)identification. In summary, although there were some explicit connections—with two of the four students mentioning their general perceptions of school mathematics and their mathematical competence as the reason for identifying or not identifying with various lesson segments—all students mostly cited the value they attached to specific lesson segments as the reasons for their (non)identification.

Explicit Connections

For two of the students, there were explicit connections between their general perceptions of school mathematics and the ways they identified with the various lesson segments. Those connections existed both for a student who identified positively with school mathematics because of their perceived high competence (i.e., Bonnie) and one who identified negatively (Salama). On the one hand, Bonnie perceived herself as being competent in mathematics and cited this general perception as her reason for how she identified with various lesson segments. For Bonnie, competence was based on getting correct answers and hence good grades, and she specified that she *identified with* lesson segments that reinforced her mathematical competence, for instance, solving tasks individually because she is "always the first person done," and group work because that is a time for her to "teach" her peers.

Salama, on the other hand, was straightforward about how her dislike for school mathematics led to her resisting or merely complying with most of the lesson segments. According to Salama, school mathematics is inherently "mundane", "boring", "tedious", "not fun" and rigid because "there's not a lot of flexibility" around what the correct answer can be. As such, Salama developed a persona she described as "not a fan of math" and used it as a

justification for resisting or complying with lesson lectures, homework review, and individual work time. Interestingly, Salama said that even when she gets correct answers (what she had described as her mark for competence), school mathematics was "not enjoyable" because, "even if you are right, the satisfaction doesn't outweigh the fact that you are still in math class." As such, Salama's general perceptions of the discipline of math and of herself as not being good at math was closely tied to how she perceived the individual lesson segments.

Other Connections

Another pattern that emerged was that students who described themselves as being good at mathematics expressed that they either *identified with* or *complied with* all lesson segments and did not express a resisting aspect. As such, these students participated in all segments including the ones in which they were only meeting the expectations of others. For example, Bonnie mentioned that although she preferred solving practice tasks individually, she engaged in group work because she felt obliged to teach her peers and give them the correct answers. Additionally, Bonnie and Jayden engaged in lesson lectures and homework reviews because it was the teacher's expectation, although Bonnie found that segment "boring" and Jayden reported that taking notes "hurts [his] hand." These results suggest a good-student-compliant-with-segments phenomenon. In other words, it is likely that students who perceive themselves as being generally competent in mathematics are under pressure, both internally (within themselves) and externally (from their teachers and peers) to participate in ways that befit a good mathematics student. This could also explain why students who perceive themselves as being not good at mathematics (i.e., Amanda and Salama) resisted some lesson segments (e.g., solving tasks individually) because they were not under similar pressure to reflect the image of a good and compliant mathematics student. But it is also possible that because Bonnie and Jayden tend to be compliant during various lesson segments, that compliance led to them self-identifying and being identified by others as good mathematics students. Indeed, it seems that both perceptions (general and specific) can be mutually reinforcing. That is, perceiving oneself as a generally good mathematics student can lead into students complying with all lesson segments, and continued compliance reinforces the impression that they are good mathematics students. And this is moreso the case for students like Bonnie and Jayden who thrive in playing by the rules of conventional school mathematics (Hiebert & Grouws, 2007; Nicaise et al., 2000; Munter et al., 2015; Stigler & Hiebert, 1999) by abiding by the teacher authority, getting correct answers, and good grades

However, the inverse of the good-student-compliant-with-segments phenomenon is not always true. In other words, just because a student does not generally perceive themselves as a good mathematics student does not mean they do not identify with any lesson segment. For instance, Amanda and Salama described themselves as 'not good in math' and yet expressed that they identify with group work and one-on-one work time with the teacher because these lesson segments support their learning of mathematics either through collaborative work with peers (group work) or by helping them get unstuck or confirm the correctness of their work (one-on-one work time with teacher). These findings align with those of Andersson and colleagues (2015) who found that even students who identify as "math haters" enjoyed and affiliated with group projects because they had control over the direction of their tasks. Brought

together, the findings from this study and that of Andersson and colleagues indicate the situated and contextual nature of students' identities—even students who do not generally identify with mathematics have specific moments and activities that they find enjoyable and meaningful for their learning. Therefore, it would be problematic for us as educators to hold a single identity marker for our students. Instead, a more fruitful venture would be to take note and intentionally incorporate the practices our students find meaningful so that we can make their learning of mathematics enjoyable and valuable.

Finally, the students in this study shared certain perceptions which have important implications for both practice and research. Despite the differences in the students' general perceptions of school mathematics and their competence, all the four focal students expressed more tendencies of *identifying with* lesson segments that involved them in active solving of tasks (i.e., individual work time, group work time, and working one-on-one with the teacher) in comparison to the ones that were more teacher-led (i.e., homework review and lesson introduction/development), a finding that resonates with the work of Ellis et al., (2014) and Nicaise et al., (2000). At the classroom level, these results indicate that creating more opportunities for students to solve tasks either individually or in groups with the teacher offering one-on-one support would appeal to students who perceive themselves as being competence as well as those who don't. This does not however mean we should eliminate teacher-led lesson segments. Educators should, however, be intentional in mixing teacher-led and student-led lesson segments (Munter, 2024; Sinha & Kapur, 2021). One way to do so could be by dividing the lesson lecture into smaller chunks with individual and group work opportunities in between. At the research level, students' preference for group work has been tied to elimination of boredom (Andersson et al., 2015; Boaler, 2000). This current study points out that in addition to eliminating boredom, students love the autonomy to choose for themselves when to work individually or in groups. There is need to further explore contextual factors that influence students' choices for grouping and how to support their autonomy.

Conclusion and Limitations

Despite decades of research on ways to improve students' mathematics classroom experiences and build positive dispositions and identities, the results of this study suggest that there is still more work to be done. This study expanded the literature base by going beyond examinations of whether students generally 'like math" or not and examined how students' identity narratives for specific lesson segments relate to their general perceptions of school mathematics. The findings show that as researchers and practitioners, we need to continue listening and attending to students' narratives so as to co-create learning opportunities that are meaningful and enjoyable for them.

This study was not without limitations. First, the focal students were from one secondary school and are hence not representative of all K–12 students. Future studies should explore the perceptions of different student populations to build a more diverse literature base. Second, the analytic framework used did not incorporate an overtly critical lens (Gutstein, 2016; Skovmose 1994). As such, the analysis did not include examination of how issues of power, privilege, and oppression play out in conventional schooling and how they influence students' perceptions of

themselves and school mathematics. I acknowledge and invite (different) future analysis guided by the critical lens to complement the findings of this current study.

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