Enacting Care in a Community College Math Classroom: A Case Study

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Too often college mathematics classes become a gatekeeper that pushes students off of STEM pathways. This study looks at an example of a community college mathematics instructor who appears to be successful in supporting students to stay on a STEM pathway through creation of a warm, caring classroom environment. Using the lenses of a caring relation and a teacher as a 'warm demander' this case study examines what pedagogical practices he used to create and sustain this environment. We illustrate in the findings how the instructor used his emotional intelligence and skill in relating to students to sustain a caring, warm classroom. He also incorporates metamessages and 'off-topic' talk in his classroom which demonstrate care to students. This case study serves as a beginning point in thinking about the social and emotional work of teaching and we end by proposing a model for caring instruction in community college mathematics classrooms.

Keywords: Community College Math, Care, Pedagogical Practices, Equity

The study of Science, Technology, Engineering, and Mathematics (STEM) disciplines is often seen as an avenue to good jobs and a requirement for many in the modern workforce of the 21st century. Politicians and business leaders regularly lament the lack of qualified students prepared to fill these roles. Unfortunately, STEM fields also continue to be a place where historical inequity around race, gender, and socio-economic status also continues to persist.

At the undergraduate level, mathematics is often the subject that determines whether students begin or continue these majors. Students are required to pass through the calculus sequence before they can access other higher-level classes in their desired major. Studies have shown that many students who drop the subject are not less prepared or capable but cite a negative experience in their early classes (Rasmussen & Ellis, 2013). Work over the last few decades has examined how to teach these disciplines better and has shown the effectiveness of active and inquiry-based learning for improving results for all students (Freeman et al., 2014; Hassi & Laursen, 2015; Laursen et al., 2014). However, a few studies have shown that discrimination can still exist in active learning classrooms and impact the experiences of students from marginalized groups (Ernest et al., 2019; Johnson et al., 2020).

In further understanding how to address the issues of inequity, researchers have also pointed to the value of focusing on community college contexts (Sitomer et al., 2012). While community colleges educate a disproportionate share of students from backgrounds underrepresented in STEM fields, they are also understudied in comparison to 4-year university contexts (Mesa et al., 2014). In a 2019 study, Nabb and Murawska found that community college instructors identified care as an important component of their jobs. This case study provides a detailed examination of what care may look like in the context of a successful community college mathematics program. The research question of focus for this report is: What pedagogical practices characterize care in a community college math classroom?

Theoretical Framework

In defining care, we draw on the work of Nel Noddings and her definition of care as a caring relation (Noddings, 2013). Noddings' definition of care importantly distinguishes the caring

relation from a definition of caring as a virtue simply dependent on the orientation of the individual in the role of 'carer'. The caring relation only exists if the 'carer' offers care and the care is acknowledged or received by the individual to whom it is directed, the 'cared-for' (Noddings, 1999).

This relational definition of caring offers important additional considerations in the enactment of caring. If caring is defined in the relationship built between the teacher and student, the experience of the student and how they respond to their teacher's acts of care is an important factor in determining whether the teacher was in fact 'caring.' This need for a relation means that there may sometimes be structural factors at play that could prevent a recipient from receiving the care intended, such as in a large class where an instructor is not able to build relationships with all students. Beyond structural factors, the instructor's cultural knowledge or skills, such as emotional intelligence, might limit or enhance an instructor's ability to enact care that is felt by their students. The enactment of this type of relationship with students relies on a skill set that many community college and undergraduate instructors have never been trained in. Caring in this definition requires judgment, awareness, and nuance to enact in ways equitable toward all students (Noddings, 1999).

Noddings' work on care is limited in that it does not provide specific guidance on what care looks like in educational arrangements (Roberts, 2009). Multiple scholars have also noted a lack of engagement with the impact of race and racism in the contexts of care, such as educational settings, that Noddings addressed in her work (Patterson et al., 2008; Thompson, 1998). We believe it is important to address these limitations, and so make use of Noddings' framework in connection with the idea of a 'warm demander' bringing in race conscious, critical perspectives.

Kleinfeld (1975) identified two characteristics that appeared to separate effective from ineffective teachers. The first characteristic, which she deemed the most important, was teachers' ability to "create a climate of emotional warmth that dissipates students' fears in the classroom and fulfills their expectations of highly personalized relationships" (p. 318). The second was, "teacher's ability to resolve his own ambivalent feelings about the legitimacy of his educational goals and express his concern for the village students, not by passive sympathy, but by demanding a high quality of academic work" (p. 318). This framework is important to pair with Noddings caring relation because it points to the importance of maintaining high academic standards while also creating warm environments. It adds more context to the caring relation that must be felt. Care in this context is not just creating "a climate of emotional warmth" but also communicating to students that you believe they are capable of academic success and pushing them to work hard toward achieving at high levels.

This framework also helps us bridge the gap between a caring relation and pedagogical practices. To define practices we look to social practice theory and the work of Reckwitz (2002), who defined a 'practice' in the social theory sense as a "routinized type of behaviour which consists of several elements, interconnected to one [an]other" (p. 249). This definition casts practices in the realm of actions that may be driven by mental processes, beliefs and learning but is enacted day to day through the actions taken. In the case of teaching these practices are a unit of study or focus, but whose existence depends on the interplay of beliefs, learning, emotions, social context and background of the individual engaging in the 'practice.' In the case of teaching, pedagogical 'practices' can take the form of instructional lectures or actions to facilitate student engagement in the classroom. Taking a more expansive view on the work of teaching to include motivating and engaging students in the discipline of study, pedagogical practices also include efforts to build relationships with students and help them develop a sense

of belonging and identity in the field. This study with extensive time in the classroom and interviews with the instructor and students allows for detailed examination of the pedagogical practices engaged in by the instructor.

Study Context and Methods

Study Participants

Students. The classroom population reflects the demographics of the school and the broader California Bay Area where it is located. In Fall of 2021, around 40% of the students identified as Asian and 20% as Latinx, the two largest demographic groups. While the racial and ethnic makeup of the class was similar to the school demographics, it was considerably more male, over 70%, and younger, 85% of students were 19 years or younger than the school as a whole. These differences likely reflect that the focus of the program was students interested in engineering or computer science, which are fields that skew male and included the introductory math sequence, so the majority of the students were in their first year of community college and came directly from high school.

Instructor. The instructor who is the focus of study, Professor O[1], is an experienced faculty member at the college with over 20 years of experience teaching mathematics at the school. Furthermore, he has been an instructor for the program of study for all 9 years of its existence. While Professor O identifies himself demographically as a white male, an important aspect of his orientation to teaching is how he identifies with his students. Professor O is a first-generation college student and describes himself as a bad student in high school. He is also a community college graduate himself. This shared experience provides him with important insight into his students' struggles and likely supports his ability to be highly empathetic towards them.

STEM-Core Model

The class is a part of a program initially started with funding from an NSF grant, STEM-Core. The STEM-Core model creates a cohort of students, who follow an accelerated math course sequence and stay together for one year. This study was conducted in the 9th year of the program at this school and is no longer supported with NSF funding.

Site implementation

This particular program was chosen for study because students are broadly succeeding at high rates. Students are prepared to pursue a STEM major and ultimately go on to complete 4-year degrees in STEM and find jobs in the field. Institutional data shows that students have a higher pass rate in Pre-Calculus 1 and 2 and Calculus 1 than the college as a whole. Historically, 64% of students who started the program in Algebra II reached Calculus 1 within one year, compared to the statewide average of 16% of students who start in algebra reaching calculus (Mejia et al., 2016). Furthermore, when students do struggle and drop or fail classes, they re-enroll in the classes at higher rates demonstrating resilience.

Analytic Methods

The study makes use of a case study design with the instructor and a single cohort of students serving as the case under study. This design was chosen because it allows for a fine-grained and

[1] All names are pseudonyms

detailed description of the environment. The first author spent a full year in the class, attending classes and documenting observations through fieldnotes. During the spring semester videos were also recorded. In addition to class observations, interviews were conducted with students and the instructor to understand their perspectives and experiences. The complexity of the environment and constructs of interest lend to the need to consider depth over breadth in this study and makes it particularly well-suited for an ethnographic case study methodology (Merriam & Tisdell, 2015). This need for deep understanding of a complex environment leads naturally to adopting a case study design for this work (Starman, 2013).

The fieldnotes and student interviews were coded with a priori codes based upon the 'warm demander' (Kleinfeld, 1975) and caring relation frameworks and observations of the classroom (Saldaña, 2021). Adjustments were made to each codebook to allow for analysis of the interviews to focus on students' description of the instructors' actions and their experiences in the class while the codebook for the fieldnotes was focused on observable behaviors in the classroom. After initial coding, the excerpts were pulled out and a thematic analysis conducted to develop descriptive categories for the codes (Clarke & Braun, 2017).

Results

Coding of field notes and interviews showed the practices breaking down into three broad categories: active learning, warm language and meta messages, and off-topic talk. The combination of both data sources allowed for important triangulation of observable actions in the classroom, conversations with the instructor to understand his intent, and hearing from students to understand their experiences.

Active learning

The instructor extensively made use of pedagogical practices associated with active learning. The most common code that appeared in the data was 'students relating to each other'. This code was driven by the frequent turn-and-talks initiated by the instructor. A turn-and-talk occurred when Professor O paused his lesson and told the students to check-in with one another on what he just shared or to ask them to attempt the next step in the problem. The frequency of these turn-and-talks led to a very active classroom, with around 8-15 turn-and-talks per a 110-minute class period. Professor O intentionally initiated interaction among students, occasionally telling students to stop working if he felt the class had gotten too focused on working individually and say, "Everyone needs to stop writing and talk to the person next to them." (FN 27 Oct)

An outcome of his push for regular student to student engagement, is that students appeared to start engaging with one another apart from the turn-and-talks. In interviews, students shared how they had built relationships with another in the class because they were pushed to interact. One student contrasted this experience with a previous instructor who did not push students to talk in these moments. He appreciated how Professor O pushed students to talk when necessary. Since talking with one another was normal, students started to talk together before class, or during breaks. Another strategy Professor O employed was structuring his long class with "working breaks" and "group quizzes" to encourage students to engage in math problems together. In interviews students used words like "community" in describing their experience in the class.

Students using one another as a source of knowledge would also often overlap with Professor O's use of turn-and-talk. He would make requests like, "I need everyone to pick up their calculator to attempt to do this calculation in your calculator and when you get the answer share

it with the person sitting next to you." (FN 13 Oct) This push to check with each other helped demonstrate to students that in working together they could build confidence in their answers. In addition to having students check in with one another, Professor O would also regularly solicit ideas from the class and make use of their ideas. He very intentionally encouraged students to challenge each other to make sure they understood what the other person was thinking and use necessary tools when it made sense. This environment of encouraging struggle aligned well with the second most common code from the field notes: a supportive learning environment.

Warm Language and Meta Messages

Professor O also appeared to use language intentionally for initiating the turn-and-talks. He regularly used language and phrasing that is not common in college math classrooms. Phrases like, "check in with the person next to you and say, 'I care about you and I want to make sure you are doing okay' say it" (FN 27 Sept) as the initiation for a turn-and-talk when he wanted students to check in with one another about whether they were understanding the next step in solving a problem. Another prompt he would use frames the need for each student to check-in with their neighbor to ensure the other person was understanding, "check with the person next to you to make sure they understand." (FN 22 Sept) Sometimes this statement was followed up with the rejoinder, "no one gets left behind". His phrasing for turn-and-talks brought the language of care into the classroom and emphasized that students are not only responsible for their own learning, but they are part of a community where everyone is learning. When interviewed 10 of 13 students made comments that explicitly addressed their comfort in the classroom.

He also often made comments and initiated discussions to push students to engage in productive learning behaviors. In talking about watching the videos before class he said, "If you come to class confused you will leave class not confused. If you come to class not confused because you have not watched any of the videos or done any work, you will leave confused." (FN 11 Oct) With this statement he is simultaneously pushing students to watch the classroom videos ahead of time and encouraging them that if they are confused after watching the videos then that is normal and where he wants them to be. He is also reinforcing to them that they have some agency about how confused they are, based on their behavior/choices to watch the videos.

Normalizing struggle also showed up in a number of small ways through comments from Professor O and norms he set in the class. This came up in the initiation of turn-and-talks with "explain to the person next to you what I just said, 'I know you understand but they were confused.'" Everyone in the class is simultaneously being identified as the person that understands but also the neighbor that is confused. He would sometimes take a moment in class to acknowledge, "that it might be overwhelming right now but by the time you get to the exam it will be okay." (FN 27 Oct). This acknowledgement did not mean that he was going to cover less material or slow the class substantially because that would not be possible with the requirements of material to be covered, but it made space for emotion and feeling and served as an acknowledgment of what many students might be feeling. Messages like this one about studying and learning were common supplements to the mathematics content in this classroom.

Students also commented about how Professor O handled mistakes in ways that helped them see their mistakes as part of the learning process. One student Zara commented, "every time I've made a mistake, it was more just like, oh no, it's fine. This is the actual answer and this is how we're supposed to do it. Just remember that for next time. And I was like, okay. Not that big of a deal." Messages like this were interspersed with regular, micro growth mindset messages he

gave by encouraging students that their brain was growing when they made a mistake in class, and struggle is a normal part of the learning process.

Off-topic Talk

Professor O regularly took the time to address relevant issues for the students that were not directly related to mathematics, which we coded as "off-topic talk." These topics could range from broad educational and career goals and skills to mental health and university resources. He would often connect these topics to aspects of the class. On several occasions he mentioned vaccine clinics for both COVID and flu vaccines that were being hosted by the school. (FN Oct 11) When talking about the flu vaccine he commented to students about how getting the flu at the wrong time can really mess up your academic plan and encouraged students to get vaccinated.

In addition to health-related issues, he would occasionally address topics that he felt were important even if they were completely disconnected from mathematics such as Banned Book Week and the connections between book bans and racial issues in the U.S. Professor O did not generally address race explicitly in class, although he would regularly wear t-shirts with messages around racial, gender, LGBTQ and immigration equity issues. However, in this case, Professor O made use of the moment to name and address his racial identity and share support for work that would allow him to better understand other people's experiences. In interviews several students share how these comments demonstrated to them Professor O's awareness of structural inequities and made them more comfortable approaching him when they had an issue.

Professor O regularly connected what students were learning to their future careers and educational trajectories. He would often share about the importance of internships and creating resumes to apply to those internships because, "you aren't going to put a math topic on your resume, so that is why you need to make sure that you are doing clubs and activities." (FN Sept 6) He pushed students to attend information sessions about various internships they were eligible for and supported them through the application process. Professor O also used these opportunities to help offer perspective to students on what they were working towards, "no one is here because the one thing missing in your life is trig identities, but you are all here to get a job and internships will help with that." (FN Oct 27)

Professor O also took time out of class to invite two speakers from the counselor's office and host a 'field trip' to the school's Transfer Day so the students could engage with schools they would be interested in attending in the future. All of these conversations communicated to students that Professor O had a bigger picture in mind when he was teaching them math. He wanted them to learn the content in his class but ultimately to use it as a stepping stone for careers in their desired fields.

Interviews with students confirmed that they received his inclusion of these outside as helpful, caring actions. In interviews (9 of 13) shared how Professor O cared about them and would support them in various ways, beyond just learning mathematics. Several students explicitly connected his discussion of non-math or 'off-topic' content as an indicator of his caring about them.

Discussion and Limitations

These findings illustrate that while one area of practice related directly to content, active learning, the other two involved engagement and work not directly related to the curricular content of the course. From this case study, we propose a framework of caring instruction in a

community college mathematics classroom. The major components of the framework are: *relationships*, *holistic support,* and *active learning*. *Active learning* has been discussed extensively in math education literature and shown to be effective in increasing student success and learning. (Deslauriers et al., 2019; Freeman et al., 2014). However, some studies have also shown that it alone may not be able to address all the challenges and equity gaps that exist in the mathematics classroom (Johnson et al., 2020). In this case, *active learning* appears essential to enabling the other portions of the framework because without space to engage in mathematical conversations and interact with other students and the instructor, the other pieces are not possible. However, *active learning* alone does not equate to caring instruction.

The data from this study reveal that *relationships* are a fundamental driver of success in this math classroom. Students felt like they had access to a warm relationship with their instructor who knew their name and cared about them as people. Professor O worked to cultivate opportunities and encouraged students to develop *relationships* with one another. The richness of these *relationships* and normalization of mistakes and struggle in the classroom appears to have improved students' sense of their ability to belong in and succeed in mathematics as shown by their comments in interviews.

Finally, the *relationships* are also intertwined with the *holistic support* offered in this classroom through the inclusion of 'off-topic' material such as health information, school transfer fairs and various speakers sharing about resources on campus. These discussions helped show students that their instructor cared about them as people beyond just being math students in his class, which helped build trust and enable *relationships*. This broader, *holistic support* also helped to even the playing field by making explicit aspects of the education experience that are often part of the hidden curriculum and not revealed to first generation and low-income students.

While not addressed in this paper, it is important to note that in the background of these three pieces: *relationships*, *holistic support,* and *active learning*, are the challenges of implementing these ideas with students, which requires critical consciousness and emotional intelligence. It is important for instructors to be aware of systemic inequity and the realities of position, power, and privilege when they are working with diverse groups of students (Rubel, 2017). They need to understand that certain groups of students may be less comfortable in their classroom or may have a different experience because of their identity or social positioning. At the same time, instructors need to be careful not only to rely on broad generalization or stereotypes but instead know how to engage with the wide variety of students they teach and meet each student where they are. Such work requires a high degree of emotional intelligence.

This case study involves only a single instructor and class, which means it can only serve as a starting point. An important next step for this work is the observation and study of other successful instructors to see if and how these pieces show up in those classrooms as well. An active classroom appears to be a necessary foundation for enacting care, but it alone does not appear to be sufficient. We need to build capacity for the social and emotional work of teaching in college math classrooms. Instructors need support in learning how to enact care in their classrooms for all their students. Community college math instructors know care is an important part of good teaching (Nabb & Murawska, 2019) but not all know how to enact care. This work shows the need to support teachers to move beyond an orientation of care, but to caring relations that are received by students. We as a community of educators and researchers need to think about how we can create learning environments that are truly welcoming and supportive for all students.

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