# Embedded Math Tutor's Noticing: A Collaborative Exploration and Change of Practice

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*Embedded tutor (ET) programs have increased significantly in recent years to respond to new state requirements to phase out remedial math courses and increased need for tutoring support brought about by the COVID-19 pandemic. Despite this increase, ETs have remained understudied. ETs can face limitations in the classroom when instructors are underprepared to integrate ETs into their lessons. In particular, instructors can be unaware of the physical limitations ETs encounter in their practice, which can prevent them from delivering needed support to students. To better understand how ETs develop their practice this study uses the construct of teacher noticing to analyze interviews with an ET as they reflect on video recordings of their instruction. Findings demonstrate how an ET identified and addressed classroom features that limited their access to students. This study presents implications for faculty to ensure the presence of a collaborative work relationship between ETs, Instructors, and faculty.*

*Keywords:* Embedded Tutor, Teacher Noticing, Tutoring

Embedded tutors (ETs)—who provide in-class support and out-of-class tutoring (Chaves et al., 2023; Racchini, 2020)—are understudied despite their increasingly important role in undergraduate education. Colleges and universities have leaned on ETs as alternative support systems to remedial math, which have been shown to decrease retention rates (Bahr, 2008) and to have disproportionately negatively impacted the success rate of minoritized students (Bahr, 2010). State legislation that began a phasing out of remedial mathematics, like in California, prompted some universities to begin ET programs as an alternative support system for students (Duffy & Burkander, 2023). The COVID-19 pandemic was another motivating factor that prompted universities to place ETs in virtual classrooms, at a time with remote learning had created distance between students and traditional tutoring (Chaves et al., 2023). While ET programs have increased in popularity over the past decade, there is evidence to suggest ETs' teaching assets are being underutilized because faculty and instructors are not prepared to shape instruction to include the ET (Cawley et al., 2022). However, existing research on the practices of ETs' is not yet extensive (Channing & Okada, 2020), providing limited guidance for how instructors can better leverage ETs' strengths in the classroom.

Evidence based training programs could provide a space for collaborative learning for both the instructor and ET. Training programs could provide information the instructor needs to best integrate ETs into their classroom and lessons. Training programs could also help ETs voice principles they draw on in their practice and recognize the assets they could be utilizing in the classroom. This study hopes to provide evidence that could inform ET and instructor training programs. This study uses the construct of teachers noticing to analyze a conversation between an ET and I as we reflect on classroom video recordings of their practice. In particular my research questions is: How can we collaboratively work through limitations to an ET's practice that are imposed by the classroom environment?

## Theoretical Perspective

For this study, I build upon teacher noticing, and in particular I deploy Star and Strickland's (2008) classroom feature framework as an analytical framework to investigate what ETs attend

to and interpret as important features of the classroom. Although there are multiple definitions of teachers noticing, these definitions share three common components (Wei et al., 2023). First, teachers draw their attention to what is noticed, which they label as *attending*. Second, teachers then interpret what they are attending to, which they label as *interpreting*. Finally, some definitions of teacher noticing have a third step related to the teacher's *response* after they have interpreted what they have attended to. The classroom feature framework was developed to evaluate preservice teachers' development of teaching practices (Star & Stickland, 2008).

Teachers' connections between broader teaching principles and the classroom environment are mediated by what they notice (Star & Strickland, 2008). Star and Stickland claim that the most fundamental component of noticing is the identification of "important or noteworthy" classroom situations. To inform a survey for preservice teachers, they identified five classroom features: Classroom environment (e.g., desk arrangements, materials, and class size), classroom management (e.g., teacher physical presence, changes of pace, and moves to deal with disruption), tasks (e.g., warm-ups, taking notes), mathematical content (e.g., representation of the math) communication (e.g., student to student interactions or teacher to student interactions). While Star and Stickland acknowledge the limitation of their framework for its lack of exhaustion, possibility of category overlap, and the arbitrary choice of important and unimportant features, I argue it is sufficient for this study as it was for theirs. Similar to teachers, ETs knowledge and experiences are mediated by what they notice. The framework captures a variety of classroom features "in order to assess the full range of what novice teachers do and do not notice" (p.112). ETs are also novice educators in the classroom, and the framework serves to provide a foundation of what is recognized as a limitation.

## Literature Review

ETs have a measurable positive impact on retention rates (Channing & Okada, 2020) and grades (Hayes, 2021). While retention rates and grades are important markers of success for students, there is a social component of success within mathematics spaces that are important for long-term student engagement with mathematics. When ETs are in the classroom, students can "gain a familiarity with the tutor" (Racchini, 2020, p.49). Tutors can leverage this relationship to provide psycho-social support (Henry et al., 2011).

While it is important to make clear the demands of an ET in the classroom, those demands must be supported by training instructors in addition to ETs. Specifically, instructors must know the purpose of the ET program, and the function of the ET in their classroom so that everyone is "held accountable for the success of the program" (Chavez, 2023, p.170). Instructors must integrate ETs into classroom activities, introduce and emphasize their role in the classroom, and communicate with the ET and their supervisor (Chavez, 2023). When instructors are not trained to integrate an ET in the classroom or emphasize their role, that ET can struggle to build rapport with the classroom (Cawley et al., 2022). For example, when an ET is relegated to inaccessible parts of the classroom, then opportunities to impart their wealth of knowledge or to act as a role model in the classroom for students are limited. An incomplete understanding of ETs practices can contribute to the underutilization of an ET in the classroom and limit the efficacy of classroom support for students.

Research that could inform the development of ET training programs is sparse. Even when scholars have identified characteristics of a successful tutoring program, their grounding in student or faculty perceptions—rather than ETs' experiences—limits their applicability to improve training programs. For example, Chavez and colleagues (2023) generated their model of ET from a survey sent to a listserv of Learning Center Professionals, group discussions, and

reports from four participating colleges that analyzed their own program. The ET program best practices construct provides principles for ETs to draw on during their practice, like ETs should get to know students, or that ETs should not enforce classroom discipline. The framework, however, does not propose a model for an effective classroom environment for ETs, or a model for ETs practices. For example, while the framework promotes the importance of frequent communication between instructors, students, and ETs, the framework does not adress how a classroom should be constructed to promote communication or how an ET could navigate a classroom layout that creates space between an ET and a student, as seen in Cawley and colleague's (2022) investigation. To better support ETs in their practice, research exploring ETs' classroom practices, and how they may be improved, is needed.

## Methodology

### Context

This study took place at a research-intensive Midwest state university during the 2025 spring semester. The participant of this preliminary report, Lucy (pseudonym), was an ET assigned to college algebra stretch A. College algebra stretch is a sequence of two courses that break up the college algebra curriculum into two semesters --- college algebra stretch A and college algebra stretch B. Students enrolled in this course during the spring semester were students who did not pass the same course in the previous semester or who just started the sequence. Classroom instruction included direct instruction, independent activities, and group activities. Lucy engaged with students primarily during individual or group activities. Lucy, an undergraduate student, was responsible for grading, proctoring exams, holding tutoring hours, and providing in-class tutoring support.

This study employed a purposive sampling method; ETs were recruited using a mix of a priori criteria and contingent criteria (Bryman, 2012). A priori criteria restricted the sample to ETs for college algebra stretch because I had the opportunity to build rapport with these ETs through my role as a lead TA. As a lead TA, I facilitated group meetings and discussions to address common issues that emerged during their practice. The contingent criteria selected for scheduling compatibilities, as well as consent from the instructor and students. From the four studied participants, Lucy was selected as a focal case because preliminary coding revealed strong alignment with the framework and their practice uniquely responded to classroom limitations.

### Data Generation

Data generation began during the 10$^{th}$ week of the semester, at which point I started taking video recordings of the classroom and audio recordings of ET-student interactions. Lucy and I reviewed these recordings from the classroom to motivate both of our 30-minute conversations. When I emailed Lucy the link to the recordings of the classroom, I asked who they were attending to in the classroom and what moments stood out to them. My first conversation with Lucy took place in the same classroom environment where she served as an ET. The second conversation was held in a room nearby due to scheduling conflicts.

The goal of this study was to investigate how Lucy and I could collaboratively move through limitations on her practice. I made the methodological decision to center Lucy' experiences, since an over reliance of student and instructor perspectives produced findings that are limited in their potential to improve training programs. I began the conversation by asking Lucy how she felt reviewing her video recordings. She responded that she felt uncomfortable but also indicated

she had attended to the space she took up in the classroom. At the beginning of the conversation, Lucy set the stage for what she wanted to talk about, and I followed her down this line of conversation. Lucy's responses aligned with Star and Strickland's (2008) classroom features (i.e., classroom environment), and Cawley and colleagues (2022) findings that suggest desk layout limited ET-student interactions. My follow-up question aimed to have Lucy consider whether the space she took up in the classroom was limited by the desk layout. The conversation that ensued is presented in the findings below.

**Data Analysis**

Data collection and analysis overlapped and mutually influential (Holmes, 2014). During classroom recordings I took analytic notes to document how ETs navigated the classroom environment. Preliminary analytic themes guided the data collection conversations. Once data was collected, I deductively coded the transcripts (MacLure, 2013) from both of our conversations to identify moments when Lucy was attending to the classroom environment (Star & Strickland, 2008), and where our conversations focused on working through environmental limitations.

## Findings

The answer to the research question "How can we collaboratively respond to classroom characteristics that limit an ET's practice?" came from Lucy's and my conversation about classroom layout. In Lucy's opening response in our first conversation, she indicated that she was aware she is primarily "walking up and down the aisles staring people down". In response, I offered my opinion that the room is "awkwardly structured" and asked whether they felt they were influenced by the layout "to be in certain parts of the room". While I made the decision to explore the topic of classroom layout, Lucy responded, "that was one thing I was sort of thinking about as I was watching back the videos". By being in the room shown on the left side of Figure 1, Lucy was able to point to specific rows that she walked down "because that one has the most space". She elaborated that being able to walk into aisles enabled her to "catch people's eye more". Furthermore, Lucy hoped that by walking down the aisle more often, even though some aisles were "skinny", she would be able to "get more people to reach out if they have questions". Lucy's solution to the limiting "skinny" aisles was to just find a way through them, but I offered an alternative solution. While some aisles were made wider through an intervention with another ET, I also proposed that we could make a third column of tables as shown on the right side of Figure 1. Lucy responded positively to the suggestion and believed that it would "get more people to talk to us". At the end of our conversation, I summarized three major points of discussion, but in response Lucy only reiterated her "love" for the "idea of rearranging desks" or "just trying to walk up and down the aisle a bit more". In summary, prompted by the video recordings, Lucy attended to her position in the classroom, and I guided the conversation towards an investigation of the classroom environment. Lucy attended to the limitations of "skinny" aisles on her practice, and through both of us suggesting solutions, we arrived at a plan of action to respond to the limitation.

After our conversation, I arrived early at Lucy's class, asked the instructor for permission, and proceeded to rearrange the tables. During our second conversation, when asked about the impact of moving to a three-column table layout, Lucy celebrated the change. Lucy felt that the classroom felt more "active" and "loved" the change but proposed that there were other factors at play that could have contributed to the "active" classroom. Later in the conversation, however, we were able to identify a moment in the classroom recording where she was interacting with a

student who had been difficult to reach in the past. Lucy proposed that they did not frequently interact in the past because their seat was "in a row and not at the edge of the row". Lucy was referencing that in the previous classroom layout, there are only 10 students who sit at the edge of a row, but the new layout places twenty students at the edge of the row. At the end of our conversation Lucy shared that she felt she has "really grown as a [ET]" by "having these talks and conversations". The second interview validated Lucy's interpretation that the table orientation was limiting her interactions with students and showed the impact that a relatively minimal change to the classroom limitations could have on an ETs' practice.

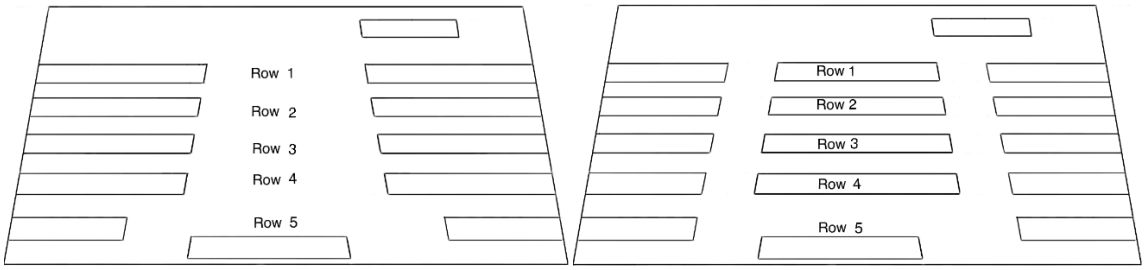


*Figure 1: Sketch of the classroom before and after rearranging desks*

## Discussion

This preliminary report develops knowledge of ET practices that may provide needed evidence-based strategies for ET training programs. While the instructor was able to shape tasks of the class to allow the ET to gain familiarity with some of the students, as expected by Racchini (2020), the instructor had an incomplete understanding of what Lucy was attending to in the classroom. Reflecting the findings from Cawley and colleagues (2022), Lucy was relegated to parts of the classroom that were inaccessible to some of the students. While Lucy showed a desire to adhere to principles of getting to know the students (Chavez, 2023), there was a breakdown of communication between the ET and the instructor. These findings suggest that two-way communication between ETs and instructors could lead to collaborative problem solving to maximize the potential reach of the ET.

This preliminary report is a product of initial deductive coding using the classroom feature framework of one participant of the study. Future research will include the deductive coding of three other participants' conversations, and thematic analysis of these conversations, identifying aspects of ET practices that both align with and depart from Star and Strickland's (2008) framework for noticing of classroom features to expand our understanding of ETs' assets.

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