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WIP: Perceptions of Instructional Practices among Engineering College Students with Attention-Deficit/Hyperactivity Disorder

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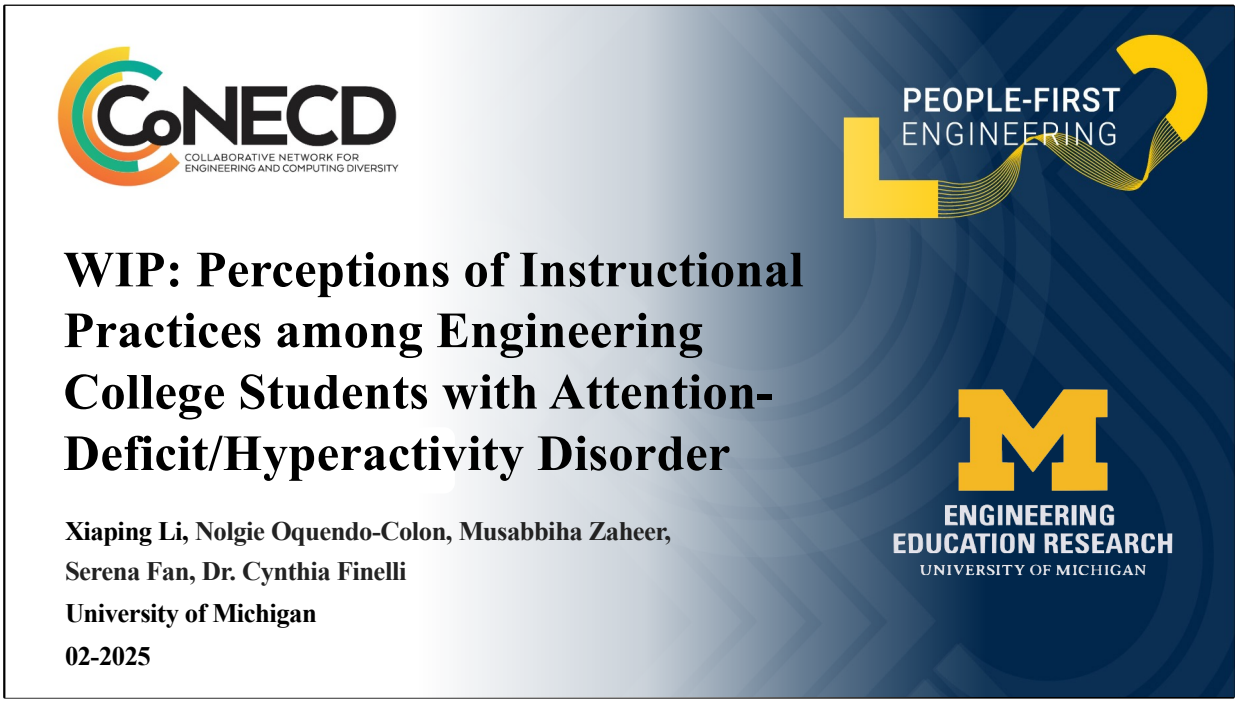
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WIP: Perceptions of Instructional Practices among Engineering College Students with Attention-Deficit/Hyperactivity Disorder
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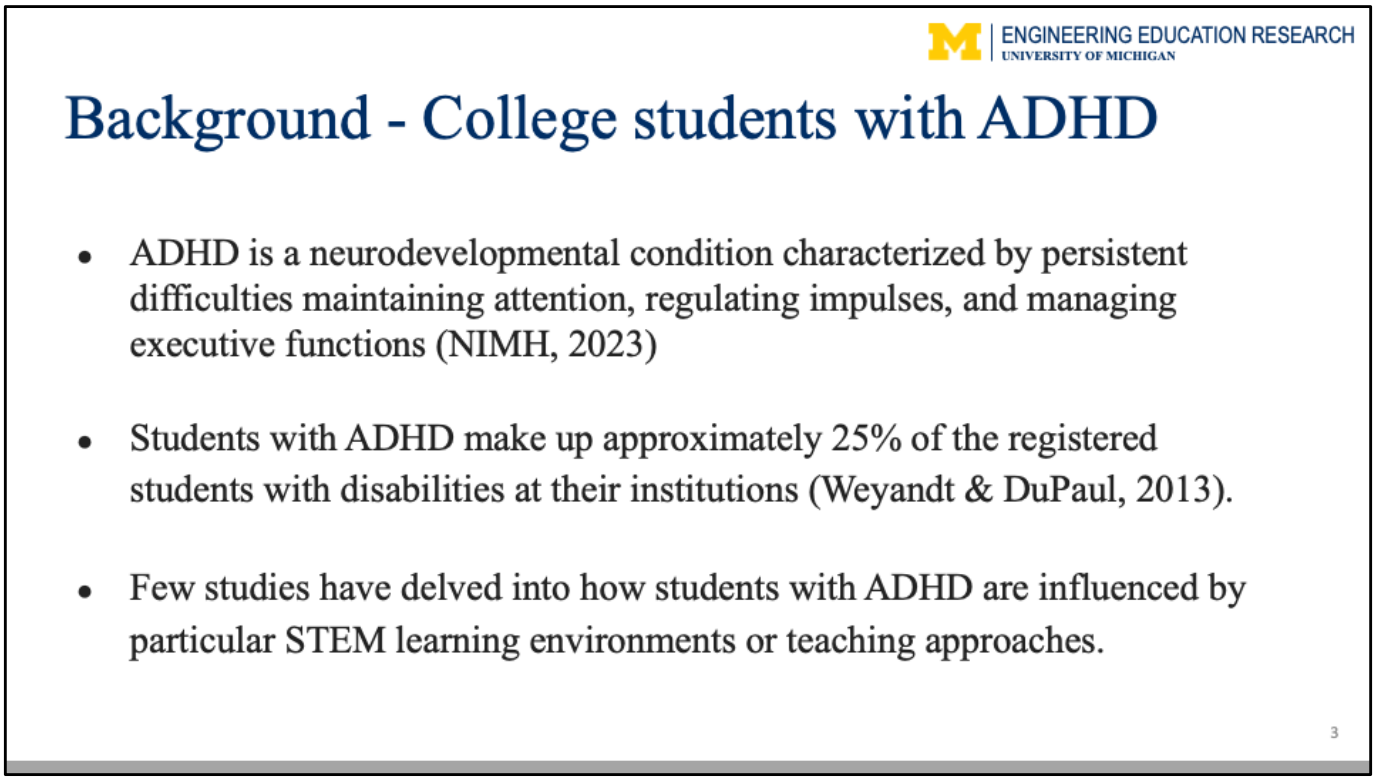
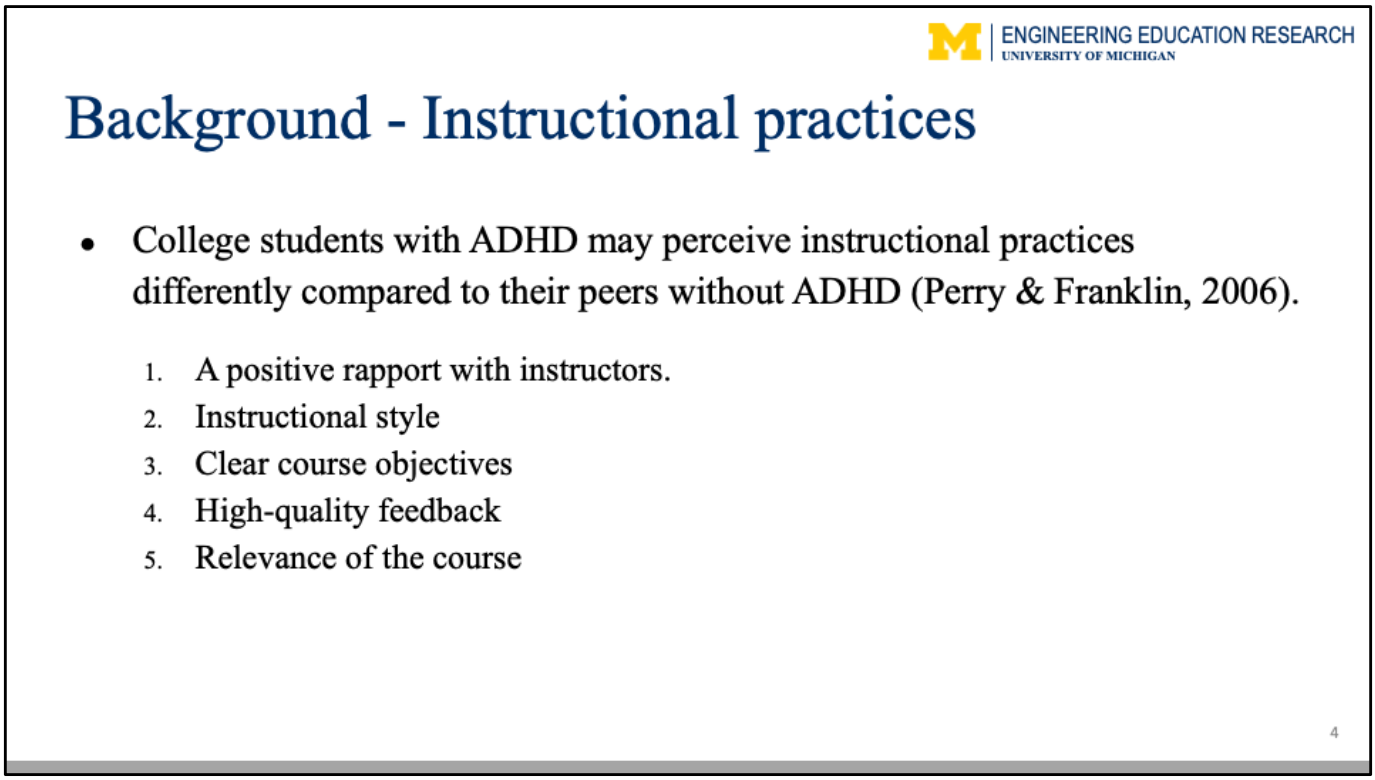
Agenda

- Background
- This study
- Framework
- Methods
- Preliminary results
- Summary & Future work
- Acknowledgement

During this presentation, I will first introduce the background and research purposes of this study. Then, I will discuss our framework and methods. After that, I will mainly focus on our preliminary results. Finally, I will summarize our findings and briefly outline the next steps.



ADHD is a neurodevelopmental condition characterized by persistent difficulties in maintaining attention, regulating impulses, and managing executive functions. While as many as 63% of students with disabilities do not disclose their disability status to their institutions (NCES, 2022), the exact proportion of students with ADHD who do not register is currently unknown. Nevertheless, it is noteworthy that students with ADHD make up approximately 25% of the registered students with disabilities at their institutions (Weyandt & DuPaul, 2013). Few studies have delved into how students with ADHD are influenced by specific STEM learning environments or teaching approaches.



College students with ADHD may perceive instructional practices differently compared to their peers without ADHD and the academic achievements of students with ADHD may be especially affected by their classroom experiences (Perry & Franklin, 2006).

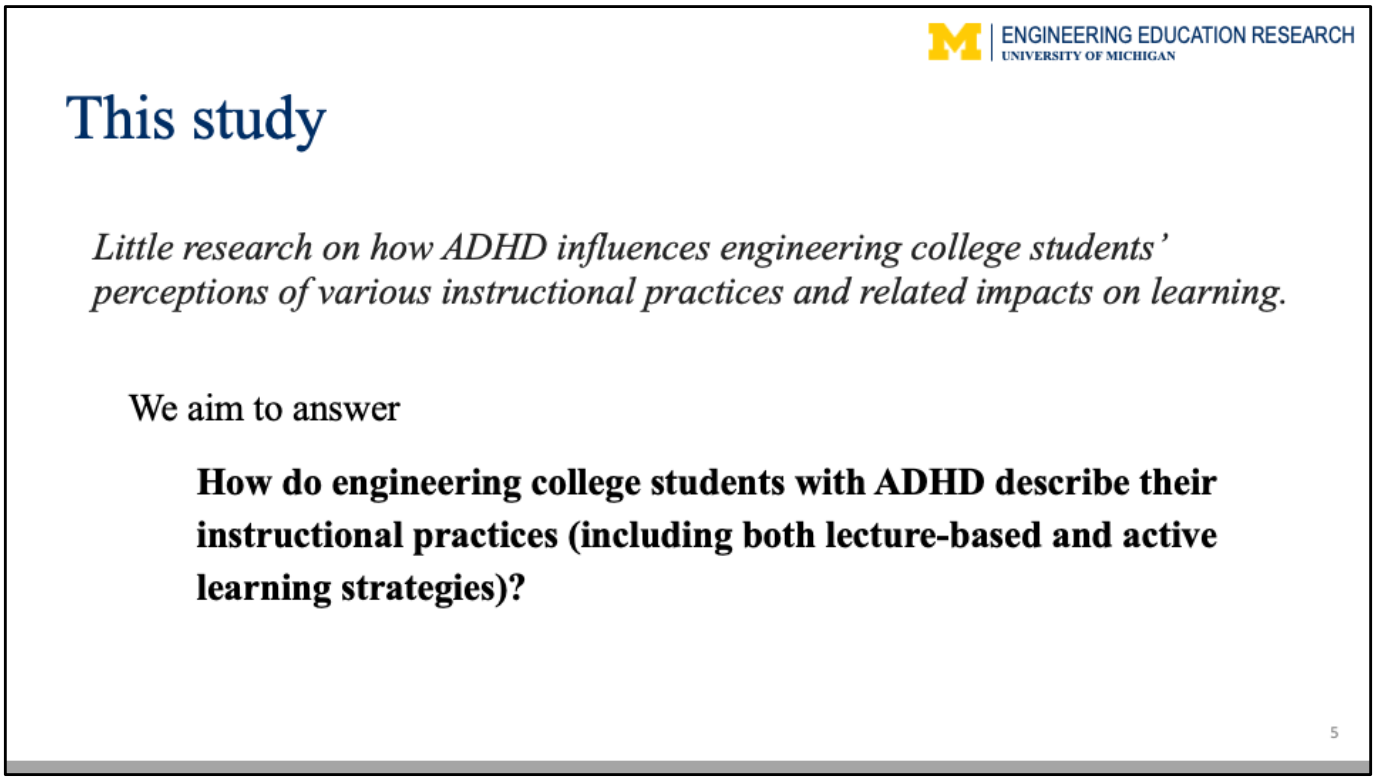
These students often struggle with distraction and inattention, and they may have difficulty navigating the somewhat unstructured college environment, primarily lecture-based courses, and long-term assignments.

Extensive evidence supports the idea that effective teaching practices can enhance academic success, including:

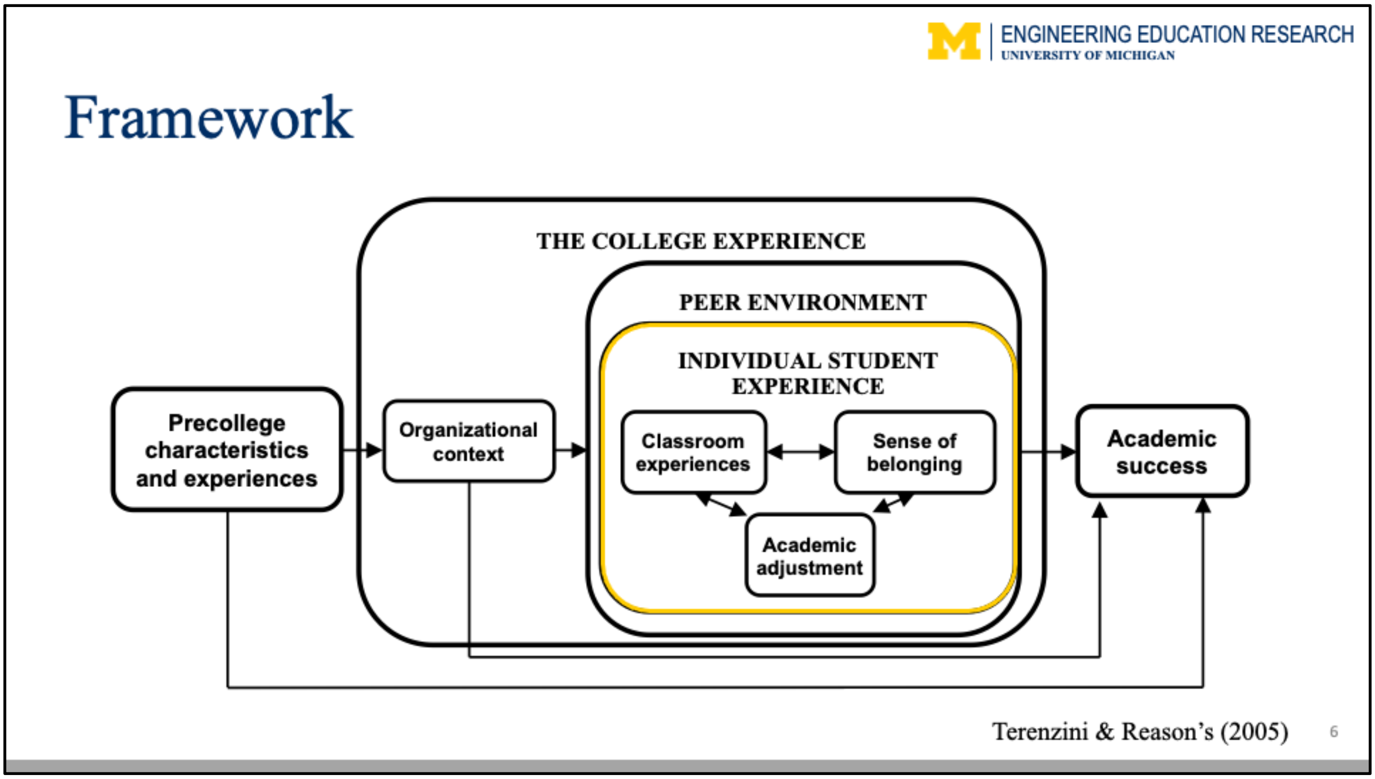
1. **Building a positive rapport with instructors:** Negative interactions and communication with instructors can have lasting effects on these students (Perry & Franklin, 2006). One study discovered that students with ADHD heavily rely on instructor support, especially in response to accommodation requests like extended test time or written lecture notes, to succeed in college.
2. **Employing an instructional style that fosters learning:** The instructional style also plays a crucial role in the academic success of these students since they often struggle with study skills and the passive nature of lecture environments. As a result, researchers have suggested that “hands-on” or

active learning environments may be beneficial for college students with ADHD (Lefler et al., 2016).

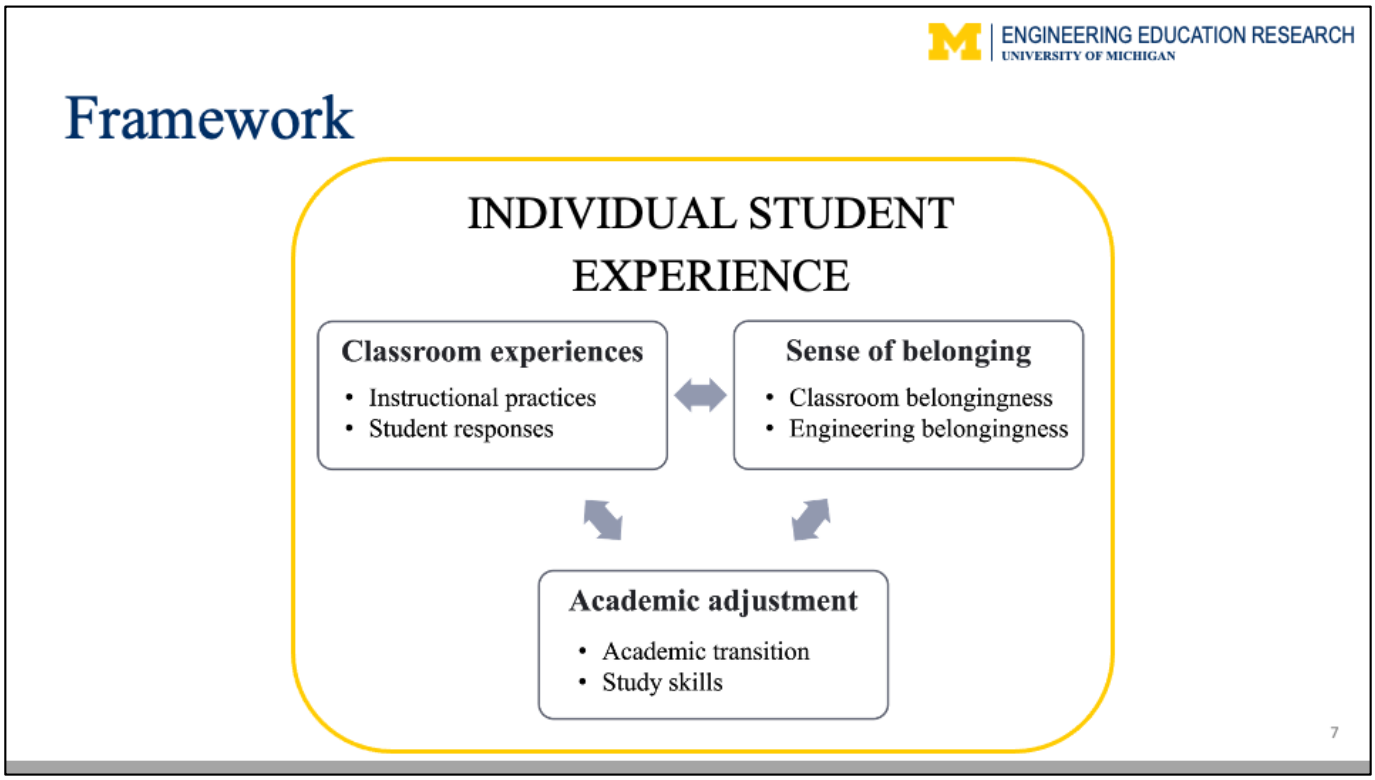
3. **Setting clear course objectives:** Having clear **course goals** can provide students with a better understanding of what to expect in terms of course learning activities and assessments.
4. **Offering high-quality feedback:** Being clear about grading criteria, providing students with frequent feedback on their work, and giving students ample opportunities to check their own progress are good practices for supporting student success.
5. **Highlighting the relevance of the course:** Some evidence suggests that when coursework is not in areas of high interest, students with ADHD may lack motivation to complete it (Lefler et al., 2016). In contrast, for tasks that pique their interest, some students with ADHD report being able to achieve high levels of motivation and focus (Sedgwick et al., 2019).



Very limited research has been conducted on how ADHD influences engineering college students' perceptions of various instructional practices and related impacts on these students' learning experiences and outcomes. Notably, increasing the participation of students with ADHD can help broaden representation in the field of engineering, as these students are currently very underrepresented. This WIP project aims to answer the research question: How do engineering college students with ADHD describe their instructional practices (including both lecture-based and active learning strategies)?



To explore both their academic success and their college experiences, we use a variation on Terenzini & Reason's (2005) college impact model. This model posits that students' educational outcomes are influenced by pre-college characteristics and experiences as well as the college experience (organizational context and individual student experience).



In our project, we focus specifically on the individual student experience, which is comprised of **Classroom experiences**, **Academic adjustment**, and **Sense of belonging**.

- **Classroom experiences** represent students' experiences in class, which include instructional practices and student responses.
- **Academic adjustment** refers to the process of adapting to, coping with, and managing the academic and social demands of higher education. In terms of academic adjustment, we focus on academic transition and study skills.
- **Sense of belonging** means students' sense of being valued, included, and encouraged by others in an academic setting (e.g., the classroom and engineering).

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Participants

Twenty-six engineering college students with ADHD

- 8 men and 18 women
- 16 undergraduates and 10 graduate students
- At what age officially diagnosed with ADHD
  - ≤ 5 years of age: 2
  - 5 < and ≤ 10 years of age: 2
  - 10 < and ≤ 15 years of age: 3
  - 15 < and ≤ 20 years of age: 14
  - > 20 years of age: 5

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We recruited engineering college students with ADHD at a research-intensive institution located in the Midwest. From a list of all engineering students enrolled at the university, we emailed a random sample of students. We invited those who had received an official ADHD diagnosis to participate in focus groups or interviews addressing either lecture-based instruction, active learning, or both.

In total, 26 engineering college students with ADHD participated in our study. There were 8 men and 18 women (no other gender identities were reported) with an average age of 23.3 years (SD=5.4). Sixteen of the participants were undergraduates, and 10 were graduate students. Fourteen participants were formally diagnosed with ADHD between the ages of 15 and 20, five were diagnosed after the age of 20, and four were diagnosed before the age of 10.

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Data collection

Focus groups

Two sessions:

Lecture-based (LB)

Active learning (AL)

Individual interviews

	LB Only	AL Only	Both
Focus groups	3	8	10
Interviews	---	---	6*

**After attending a focus group addressing active-learning instruction, one participant requested an individual interview.*

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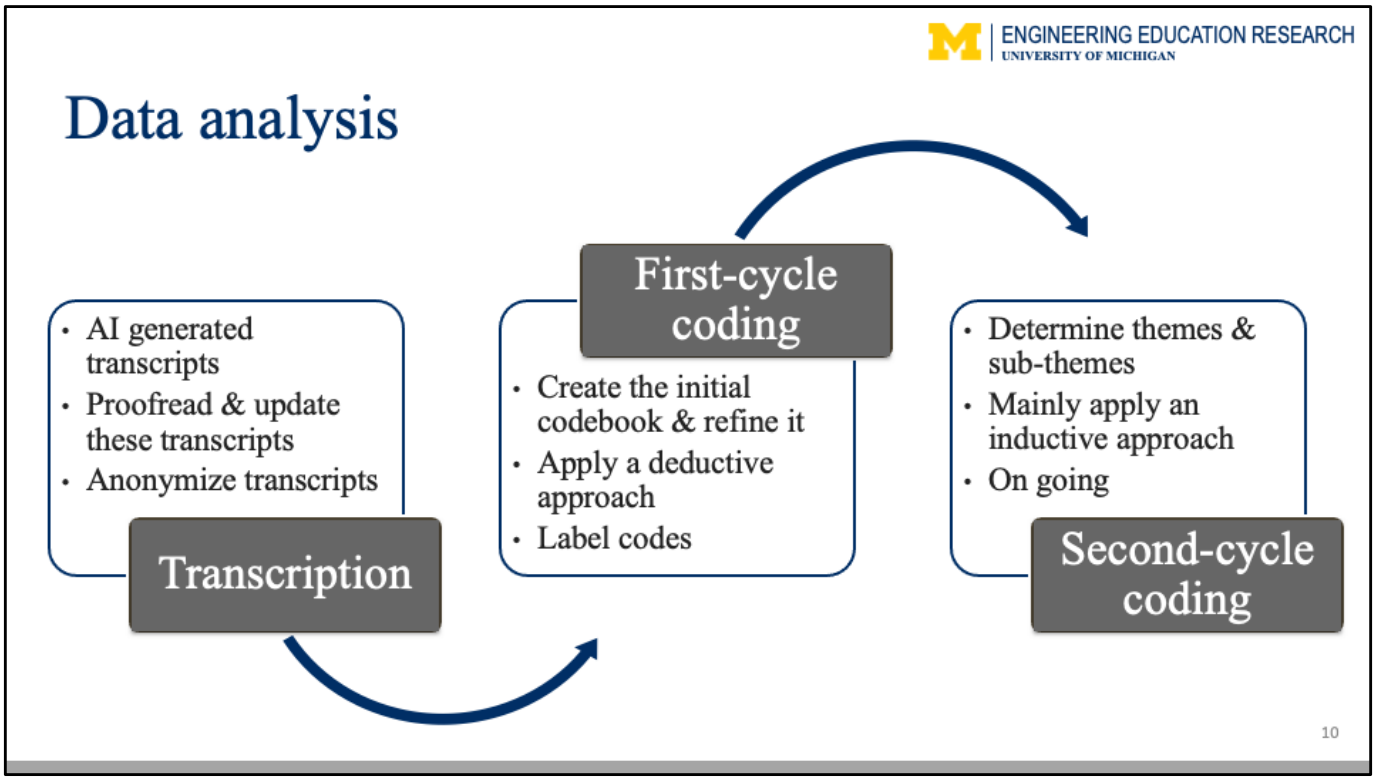
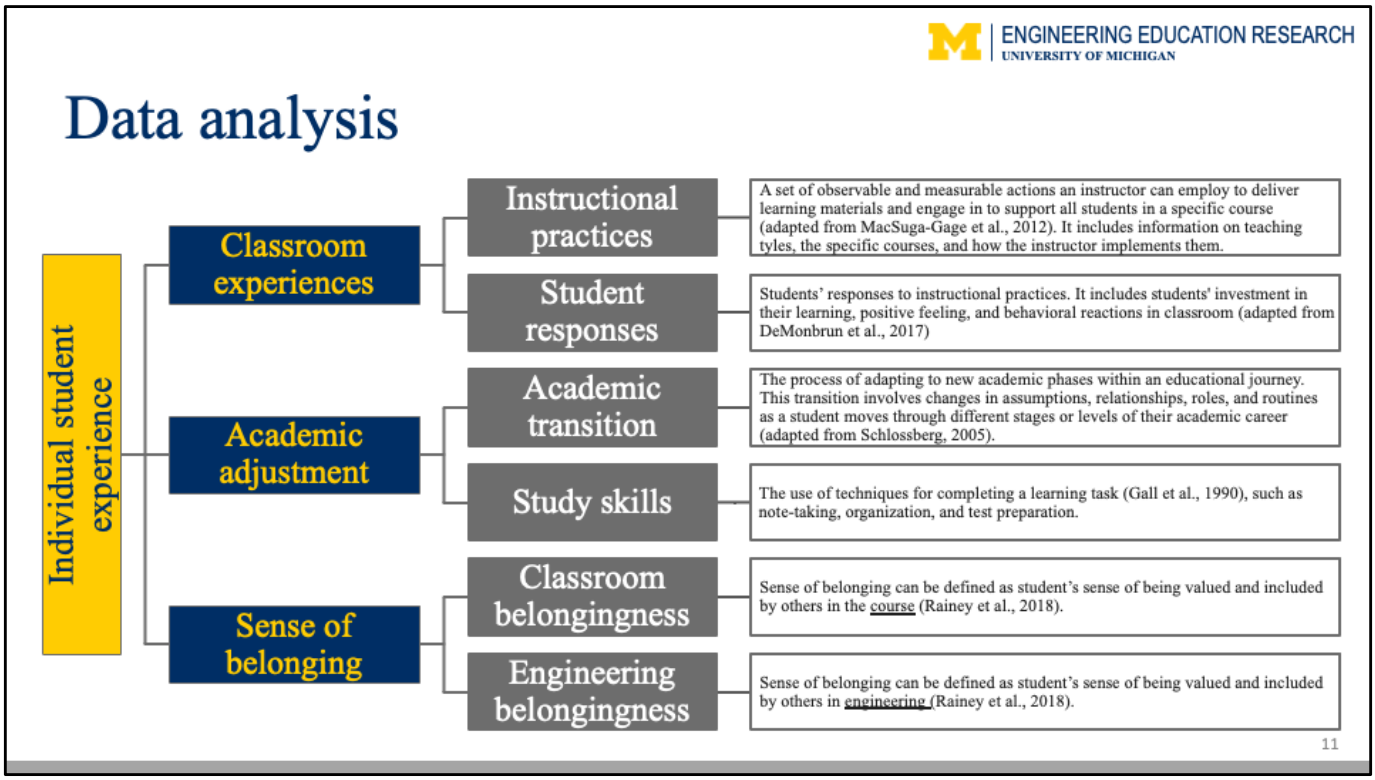
To understand perceptions of engineering college students with ADHD on various instructional practices and their impacts on learning experiences, we conducted 11 focus groups and 6 individual interviews, including 26 engineering students with ADHD. We designed two types of sessions (i.e., lecture-based and active learning) for both focus groups and individual interviews to encompass a broad range of instructional practices.

Interview questions for both focus groups and individual interviews were developed based on our project framework of individual student experiences and included the three elements: classroom experiences, sense of belonging, and academic adjustment. Three participants attended only a focus group about lecture-based instruction and eight attended only an active-learning based focus group. Ten students attended both types of focus groups and six students attended an individual interview. In total, 19 (=3+10+6) participants shared lecture-based classes during LB sessions, while 24 (=8+10+6) participants shared classes featuring active learning during AL sessions.



For data analysis, we first transcribed and anonymized focus groups and individual interviews. Then we employed Saldaña's (2018) coding methodology to systematically analyze fifteen anonymized transcripts by using MAXQDA(Gizzi & Rädiker, 2021). There are two main rounds of coding. The first round of coding was conducted using a deductive approach based on our conceptual framework. Then, we apply an inductive approach for categorizing codes and identifying emerging themes and subthemes.



We created an initial codebook based on our framework and existing literature. It contained three elements: classroom experience, academic adjustment, and sense of belonging. Under each element were two categories, each with a definition. In this work-in-progress study, we mainly focus on instructional practices. It refers to a set of observable and measurable actions an instructor can employ to deliver learning materials and engage in to support all students in a specific course (adapted from MacSuga-Gage et al., 2012). It includes information on teaching tyles, the specific courses, and how the instructor implements them.

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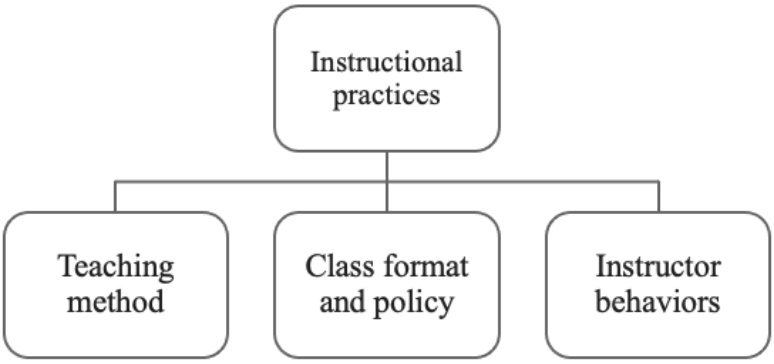
Preliminary results

Teaching practices: three themes



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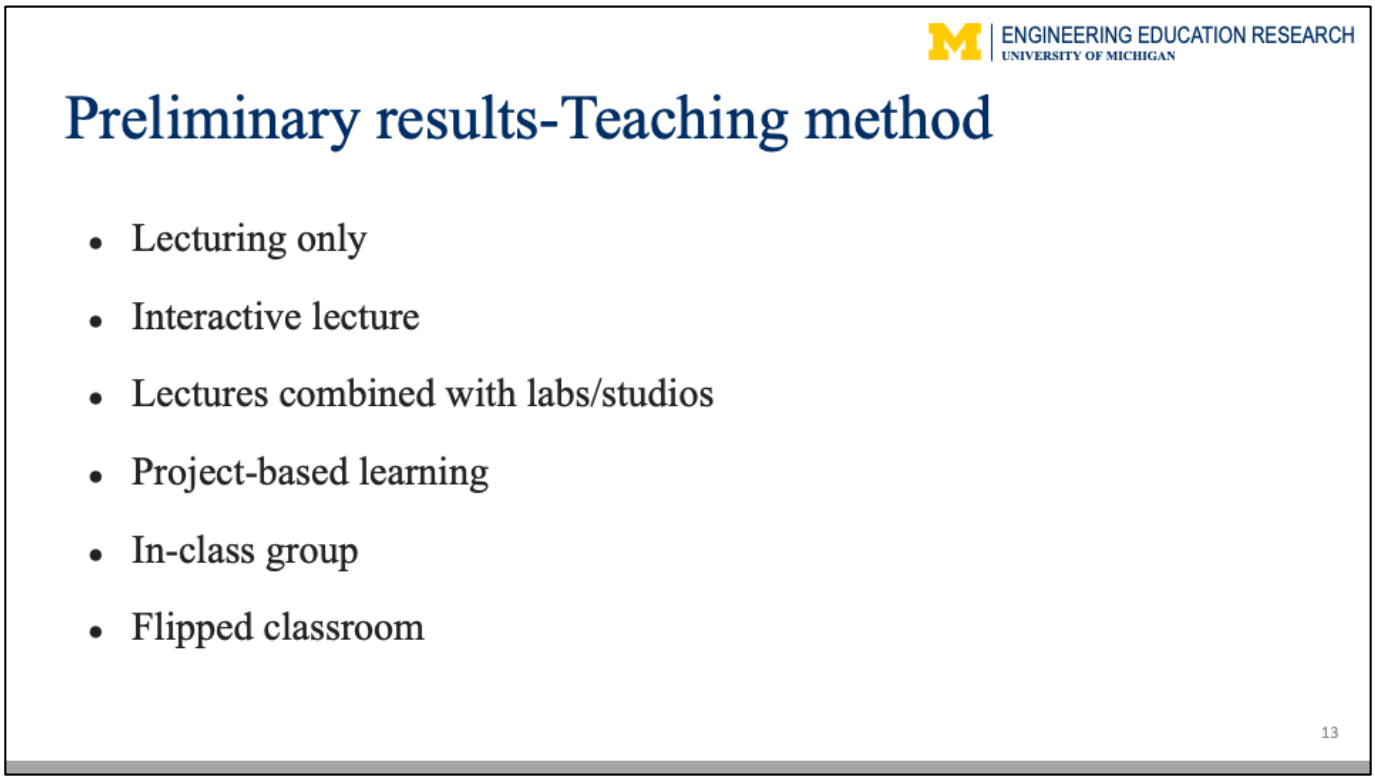
In this section, we will present our preliminary results of instructional practices. We identified three themes of instructional practices. They are teaching method, class format and policy, and instructor behaviors.



Participants mainly shared six types of teaching method. They are:

1. *Lecturing only* represents a traditional didactic teaching method in which the instructor focuses on delivering knowledge while students primarily receive information from the instructor during class (Adapted from Jarvis, 2006). There were 10 participants mentioned lecturing only during BL data collection sessions (including focus groups and individual interviews).
2. *Interactive lecture* refers to a lecture-based teaching method that incorporates student activities, such as inviting students to discuss or solve problems with their neighbors, participating in iClicker questions, or pausing periodically (Adapted from Prince, 2004). Four participants form lecture-based sessions and 9 participants from active learning sessions reported lecturing combined with informal classroom activities.
3. *Lectures combined with labs/studios* pertain to a course consists of two different sessions: lectures and laboratories/studios. In labs or studios, students are expected to apply knowledge imparted during lectures through hands-on activities and projects (Adapted from Gelernter, 1988). For lectures combine with labs or studios, 3 participants of lectured-based sessions focused on lecture part, while 5 participants of active learning sessions talked more about

labs or studios.

4. *Project-based learning* means a student-centered teaching method in which students learn by actively participating in one or more context-specific projects, with the goal of creating an end product over the duration of the course (adapted from Kokotsaki et al., 2016). Five participants reported project-based learning, and they shared that projects were generally graded for midterms and/or finals.
5. *In-class group* represents a teaching method in which students are assigned to small groups, either temporarily or permanently, to learn through activities such as discussions and solving problems during class (Adapted from Abrami et al., 2000). Six participants shared their group problem-solving classes.
6. Finally, four participants reported their experiences in *flipped classroom* which represents a related new teaching method in which traditional content delivery becomes a home activity, while traditional after-class activities, such as doing homework, become classroom activities (Adapted from Akçayır & Akçayır, 2018).

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Preliminary results-Teaching method

- Lecturing only
- Interactive lecture
- Lectures combined with labs/studios
- Project-based learning
- In-class group
- Flipped classroom

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Based on classes shared by participants, we observed that participants from lecture-based sessions predominantly mentioned lecturing only with the following two instructional methods: Interactive lecture and Lectures combined with labs/studios. In contrast, those from active learning sessions identified a broader range of instructional methods, except lecturing only. Also, there is a discernible shift from instructor-centered methods to student-centered approaches when comparing the instructional methods mentioned in lecture-based sessions to those in active learning sessions.

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Preliminary results-Class format & policy

- Course content
- Class size
- Homework
- Exams
- Attendance

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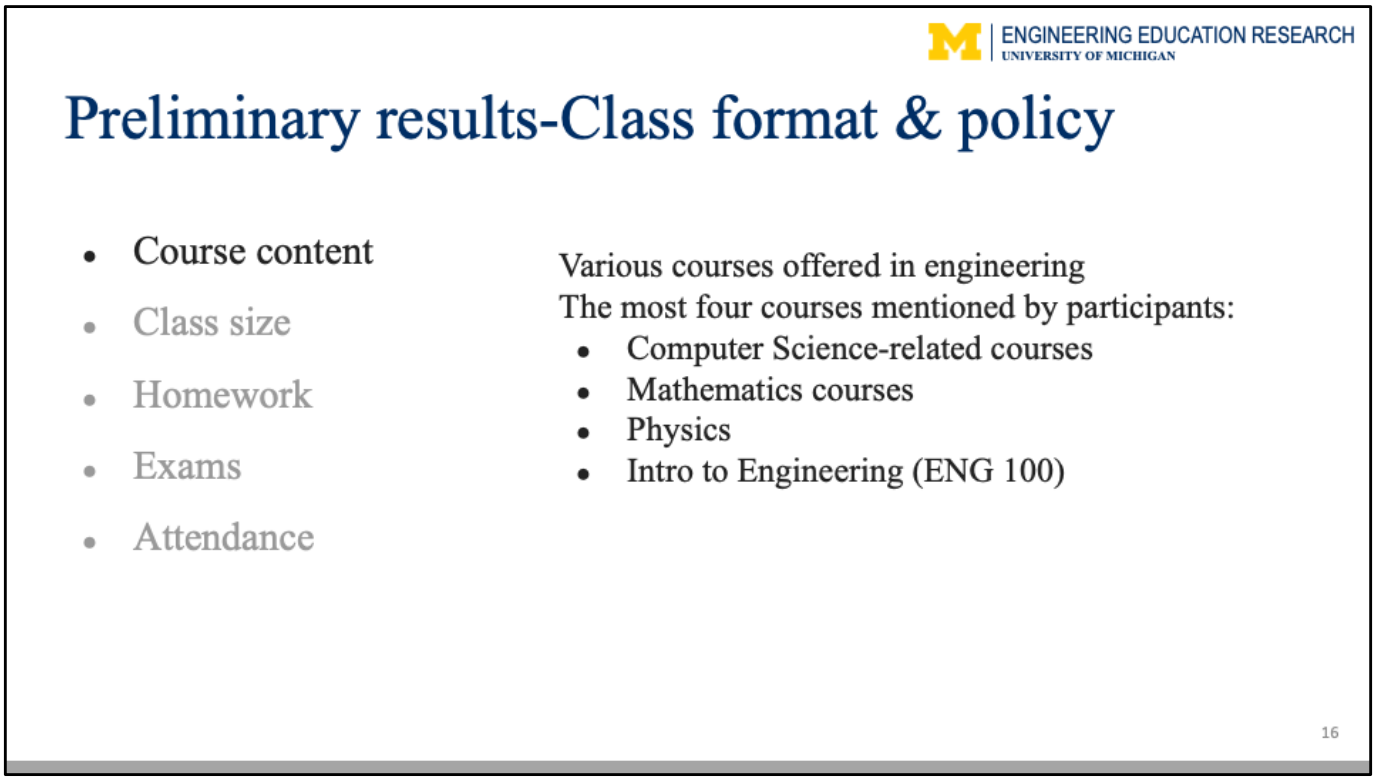
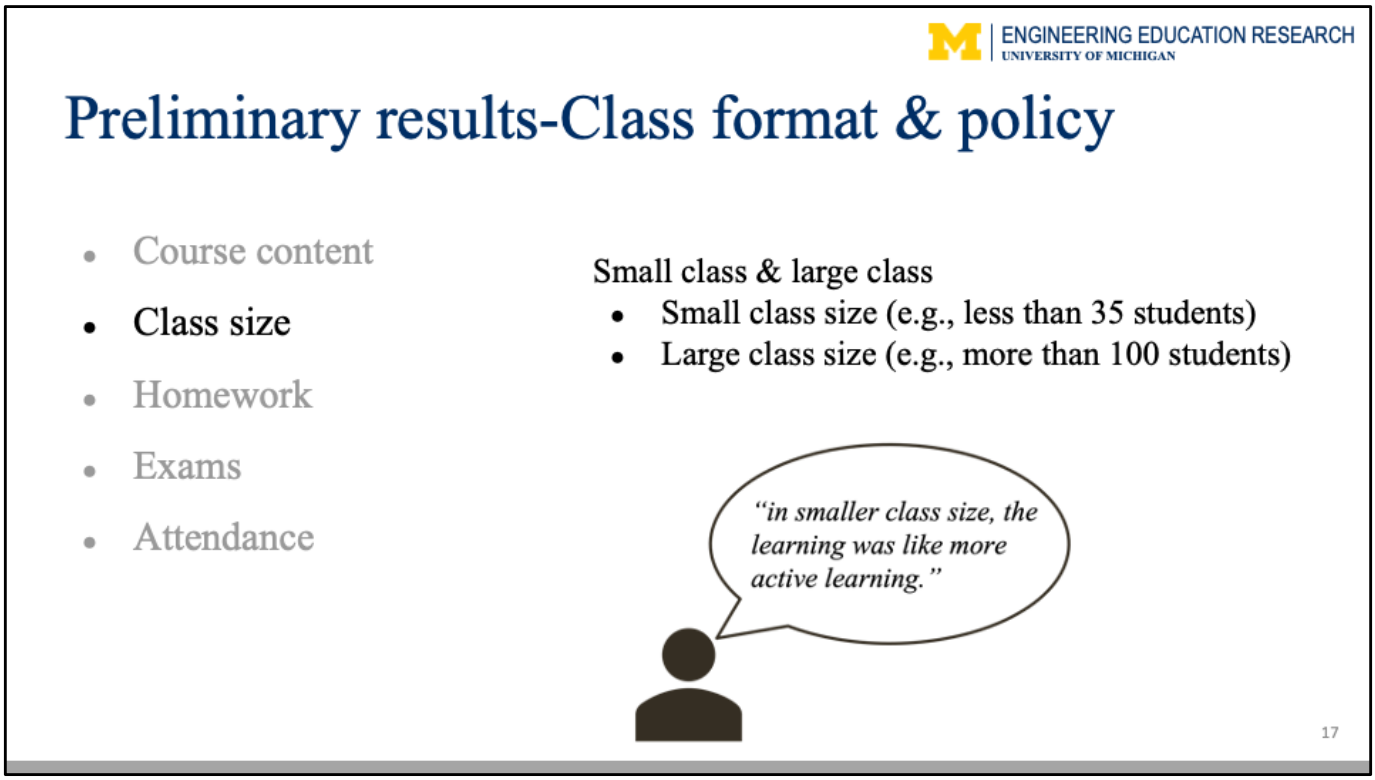
Under the theme of class format and policy, we identified five sub-themes shared by participants. They are course content, class size, homework, exams, and attendance.



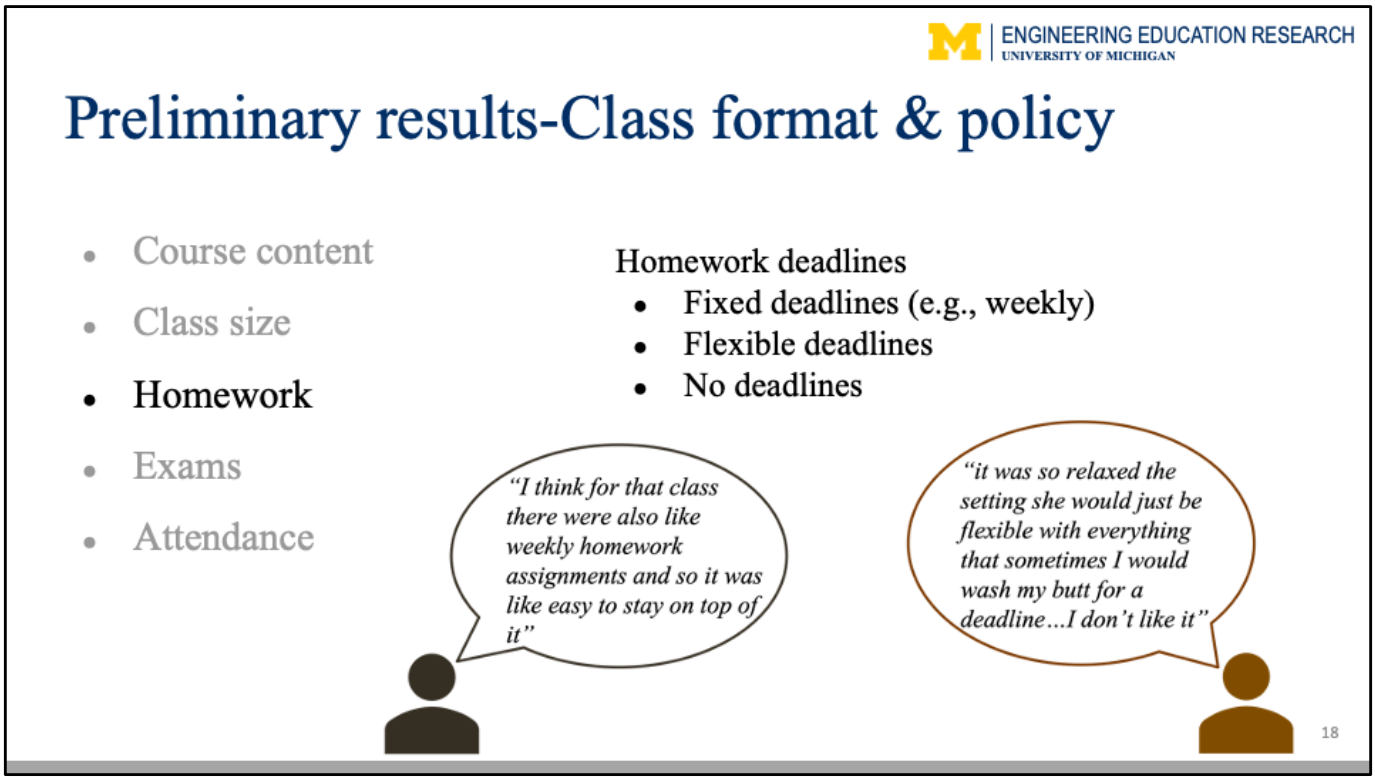
Course content, here, represents the main areas of study or disciplines in which the content of a course is focused.

Participants shared a variety of courses offered in the engineering field, such as mathematics, physics, chemistry, mechanical engineering, bioengineering, aerospace, and electrical engineering and computer science. The four most common course content shared by participants were electrical engineering and computer science-related courses (shared by 7 participants from LB sessions and 3 participants from AL sessions), mathematics (mentioned by one participant from LB session and five participants from AL sessions), physics (shared one participant from LB session and five participants from AL sessions), and introductory engineering (mentioned one participant from LB session and four participants from AL sessions).



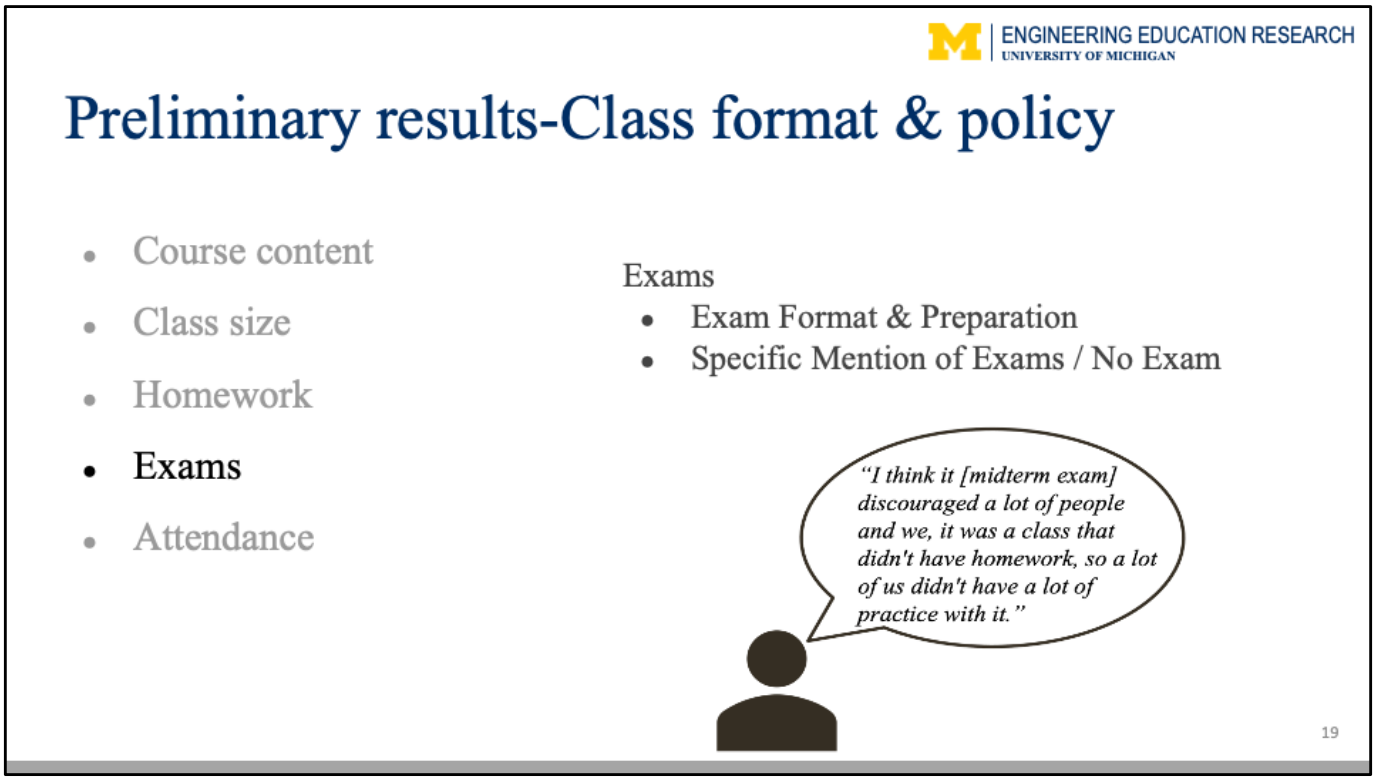
Class size means the number of students in the class.

Some participants mentioned class size. Ten participants from AL sessions and three from LB sessions reported small class sizes. The three participants from LB sessions indicated that their courses were upper-level undergraduate or graduate courses. In contrast, three participants from AL sessions and five from LB sessions mentioned that their classes were large or held in very large lecture halls. A few participants also indicated that learning was more active in smaller classes.



The sub-theme *Homework* refers to class policies related to homework, such as homework deadlines and homework format.

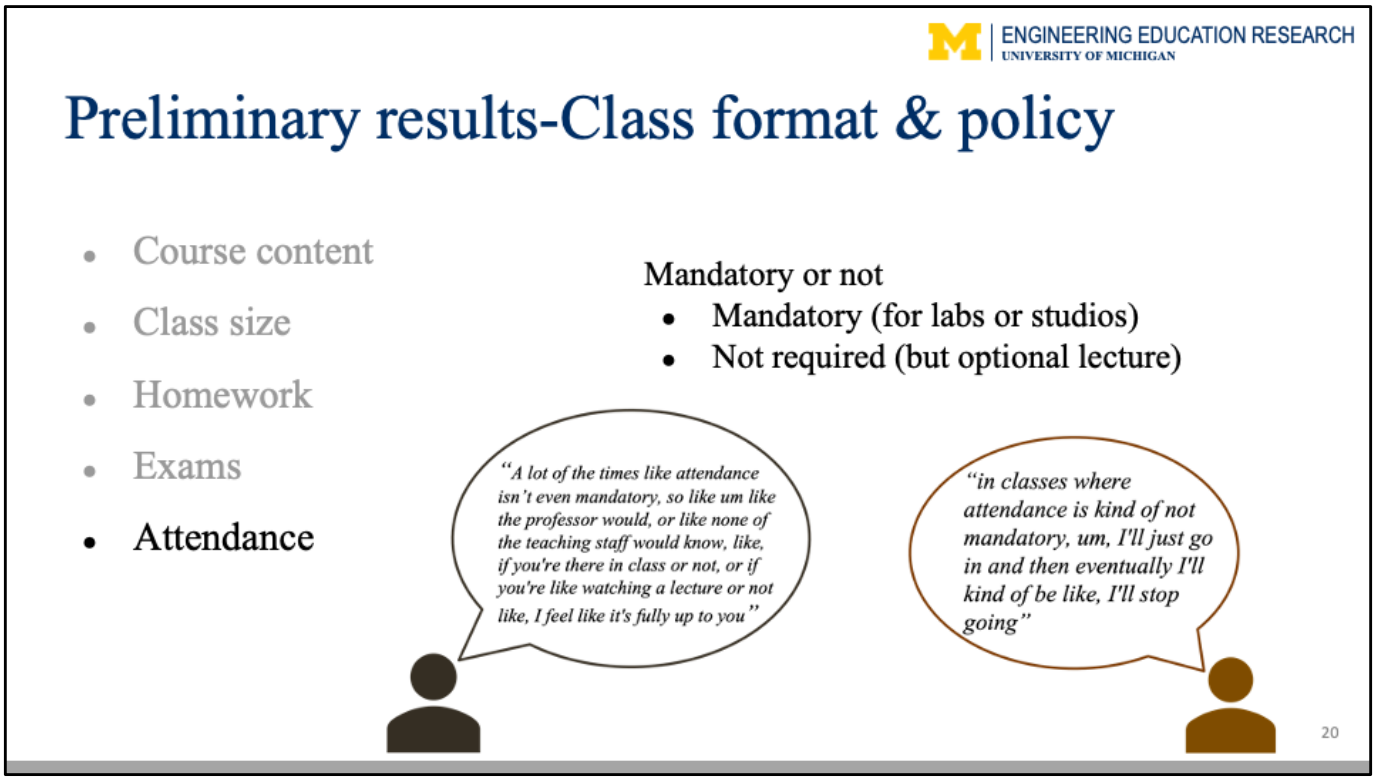
Participants mainly discussed about homework deadlines. Six participants from AL sessions and two participants from LB sessions mentioned homework/assignments with fixed deadlines. Three participants from LB sessions and three participants from AL sessions reported courses with flexible deadlines. In addition, three participants shared active learning classes without deadlines. Some of these participants mentioned that they preferred fixed deadlines and that they often had difficulty adapting to deadline flexibility (please see the quotes). This may be due to their limited time management skills.



The sub-theme *Exams* means class policies related to exam, such as exam format (e.g.,take-home exams and timed exams).

There were 17 individual students who mentioned exams during data collection sessions. Exam format and preparation refers to the exam's format and how they felt they were prepared for it during class time. Six participants from AL sessions and 4 students from LB session discussed about it. Participants from AL sessions mostly mentioned that the expectations for what to expect on the exam and how or when they were going to be tested were not clear. One participant did mention a take-home exam, and another participant also mentioned that they did sample exam problems in class, but this wasn't really a trend.

Some participants only mentioned that their class had exams or did not have exams, so that's what the second cat covers. Four students from AL sessions and three from LB talked about it. Three students mentioned that they did not have exams (e.g., midterm and or final exams) but a project instead in their shared active learning classes. During LB sessions, two participants only said that they did not have exams, while 1 student mentioned that their class did.



Here, *Attendance* pertains to class policies related to attendance, such as mandatory attendance.

There were 5 participants from AL sessions who mentioned mandatory labs or studios. Only one course featuring active learning did not require attendance. Although attendance was not required, instructors were able to know who was absent due to the small size of the class. Three participants from LB sessions reported optional lectures. When attendance was not required, they were more likely not to show up. In addition, most lectures were recorded, so they tended to do other things during classes and watch recordings afterward.

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Preliminary results-Instructor behaviors

- Talking through slides
- Writing on board
- Answering questions
- Knowing students by name
- Asking questions
- Delivering materials at a specific pace
- Creating an engaging space

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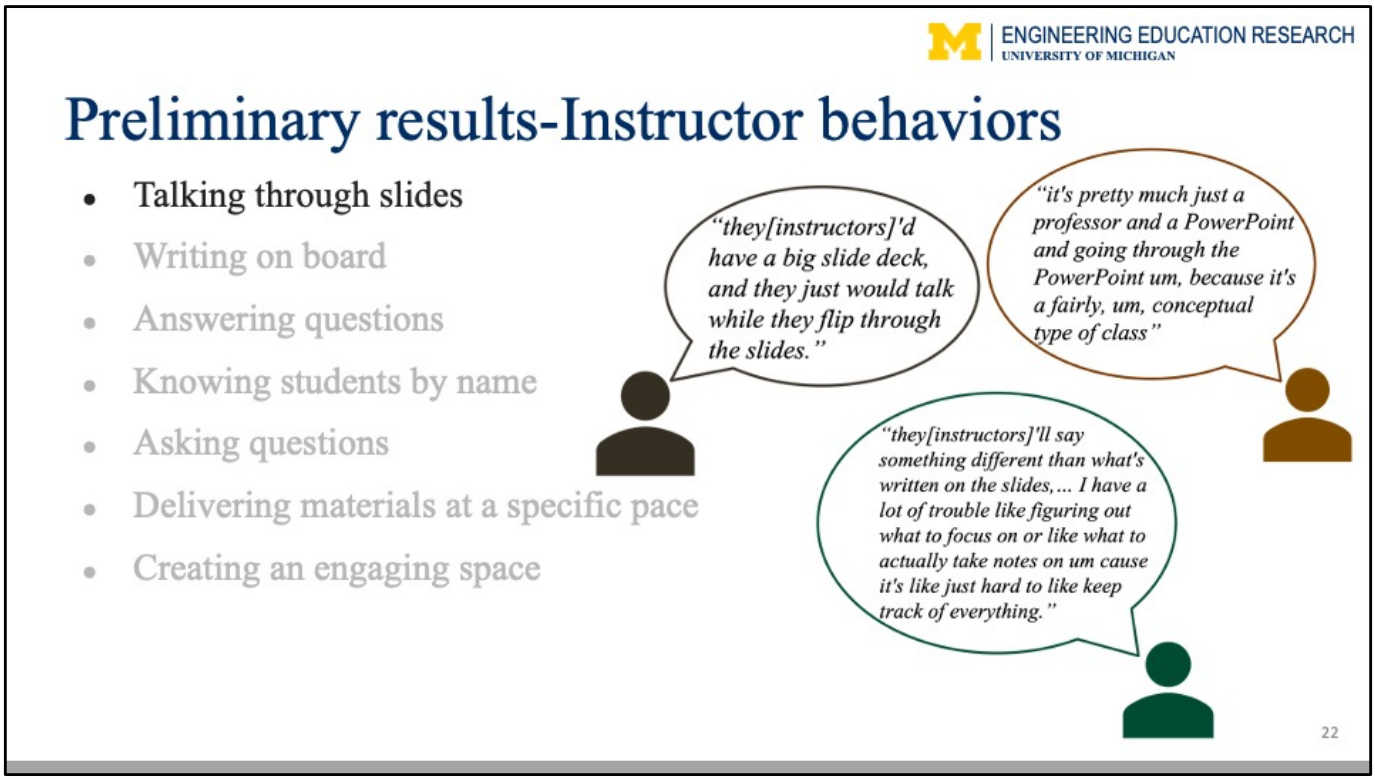
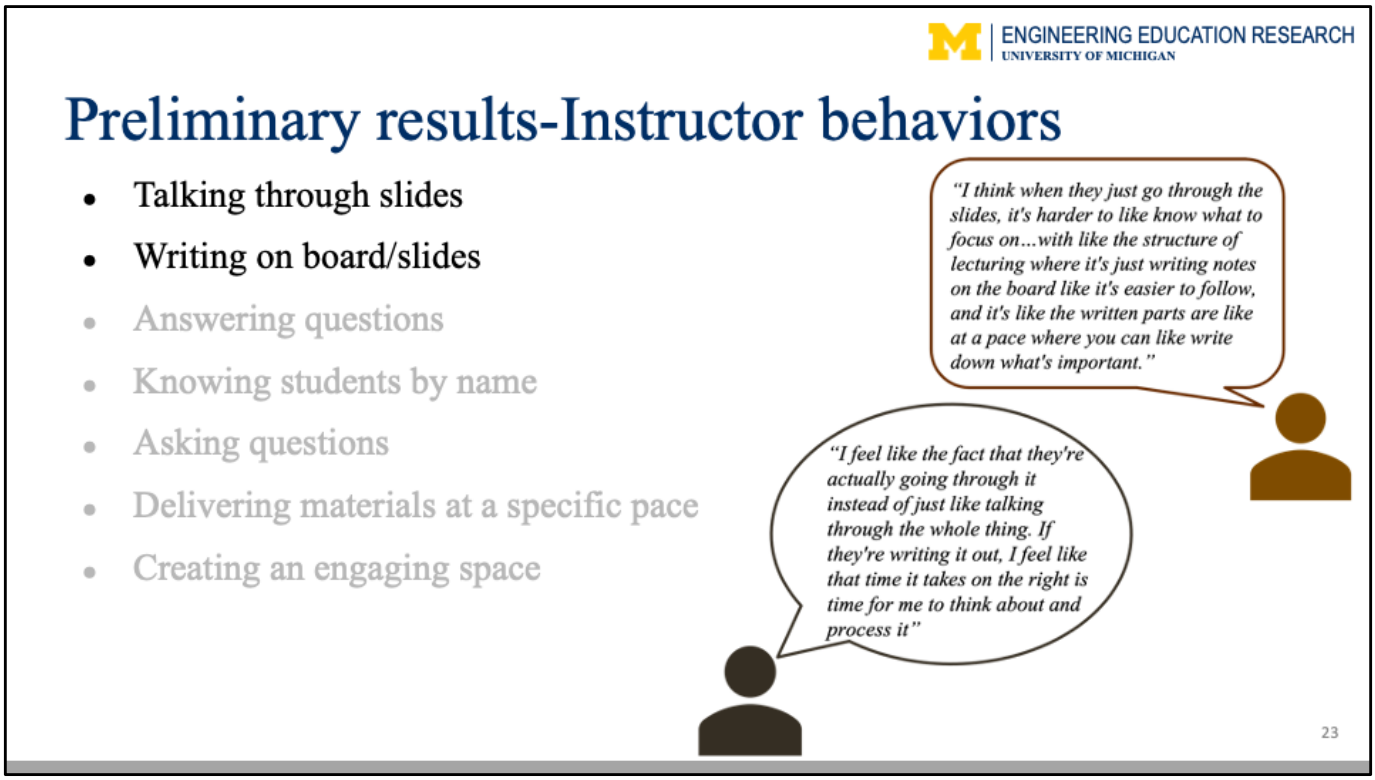
Instructor behaviors refer to how and exactly what their instructors did during classes from the participants' perspectives. We identified seven sub-themes of instructor behaviors: talking through slides, writing on the board, answering questions, knowing students by name, asking questions, delivering materials at a specific pace, and creating an engaging space.

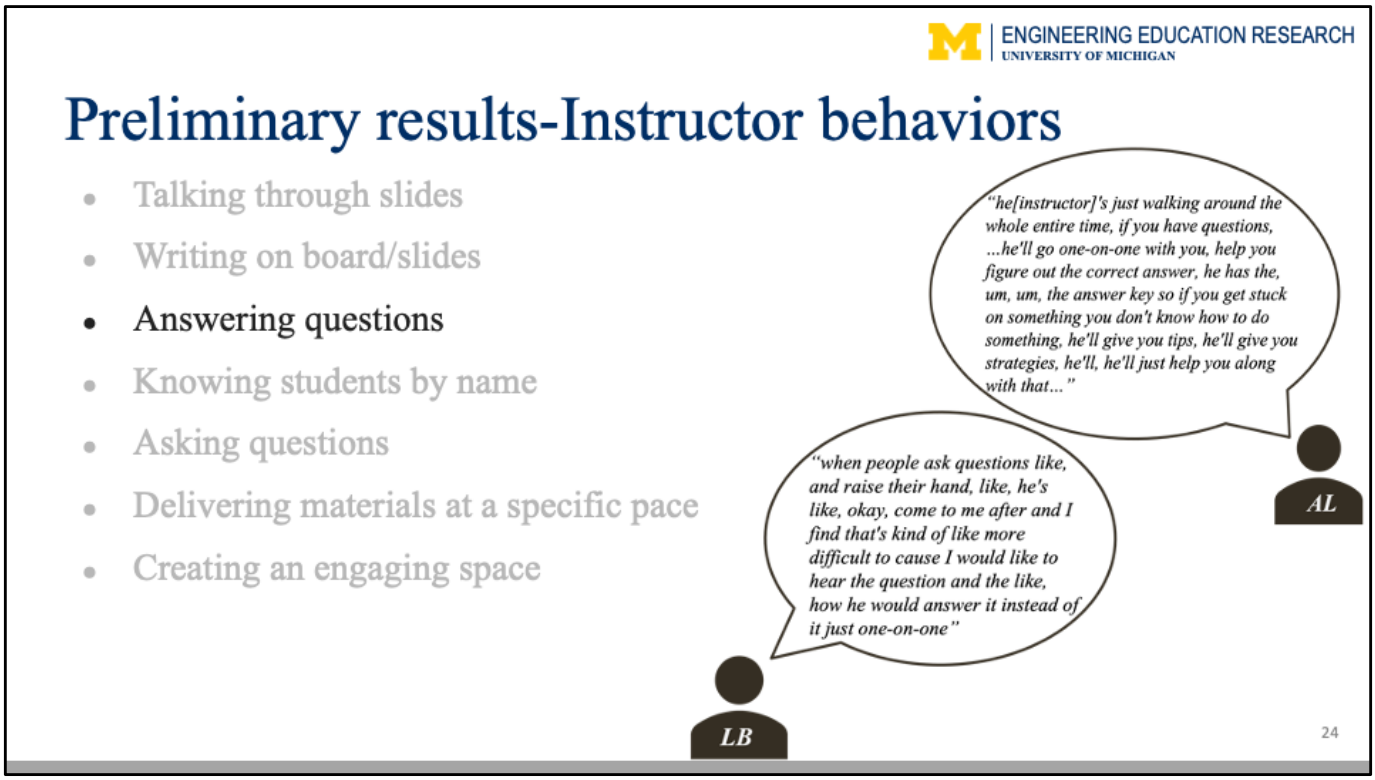


Talking through slides refers to an instructor's use of presentation slides (e.g., PowerPoint, Google Slides) as a visual aid during class (mainly in lectures).
It was a typical instructor's behavior mentioned by 11 participants from LB sessions. Participants generally had a negative perception of talking through slides like the left-handed quotes. Some participants reported that it was hard to follow instructors and would do other things if instructors only went through slides. Also, a few participants mentioned that this teaching behavior was related to course content.



Writing on board/slides represents an instructor's use of the classroom board (whiteboard, chalkboard, or digital board) to visually present information, concepts, examples, and solutions during class.

While only two participants from AL sessions mentioned writing on the blackboard, six participants from LB sessions discussed talking through slides and writing on the blackboard together. Participants reported that they preferred lecturers writing on the blackboard or slides, as opposed to instructors only talking through slides because they had time to think and process the information or to take in additional information that was not listed on the slides.



Answering questions means an instructor's practice of addressing inquiries posed by students during class.

It was one of the most common instructors' behaviors reported by participants (6 from LB sessions and 11 from AL sessions). Four out of six participants from LB sessions reported that instructors did not answer questions satisfactorily in lectures, and one participant mentioned that large lecture based classes made it more intimidating to ask questions. While participants from AL sessions tended to shared that instructors walked around classroom to talk with students or groups and answered questions.

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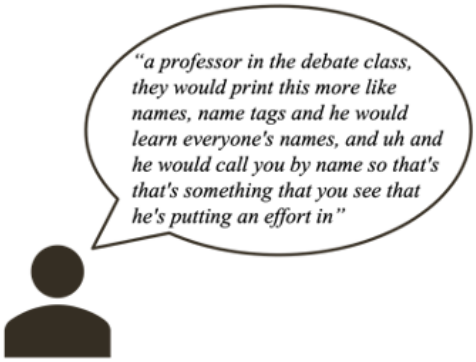
Preliminary results-Instructor behaviors

- Talking through slides
- Writing on board/slides
- Answering questions
- Knowing students by name
- Asking questions
- Delivering materials at a specific pace
- Creating an engaging space



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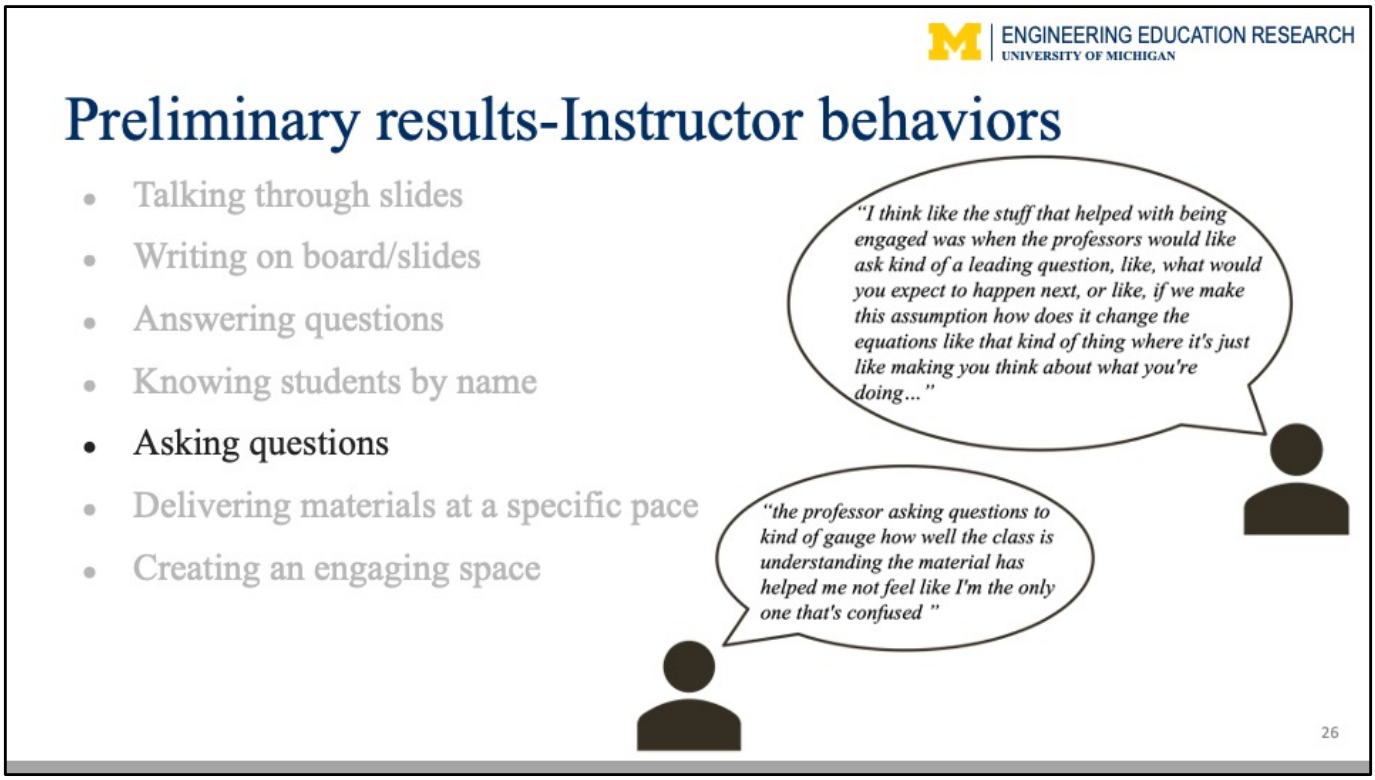
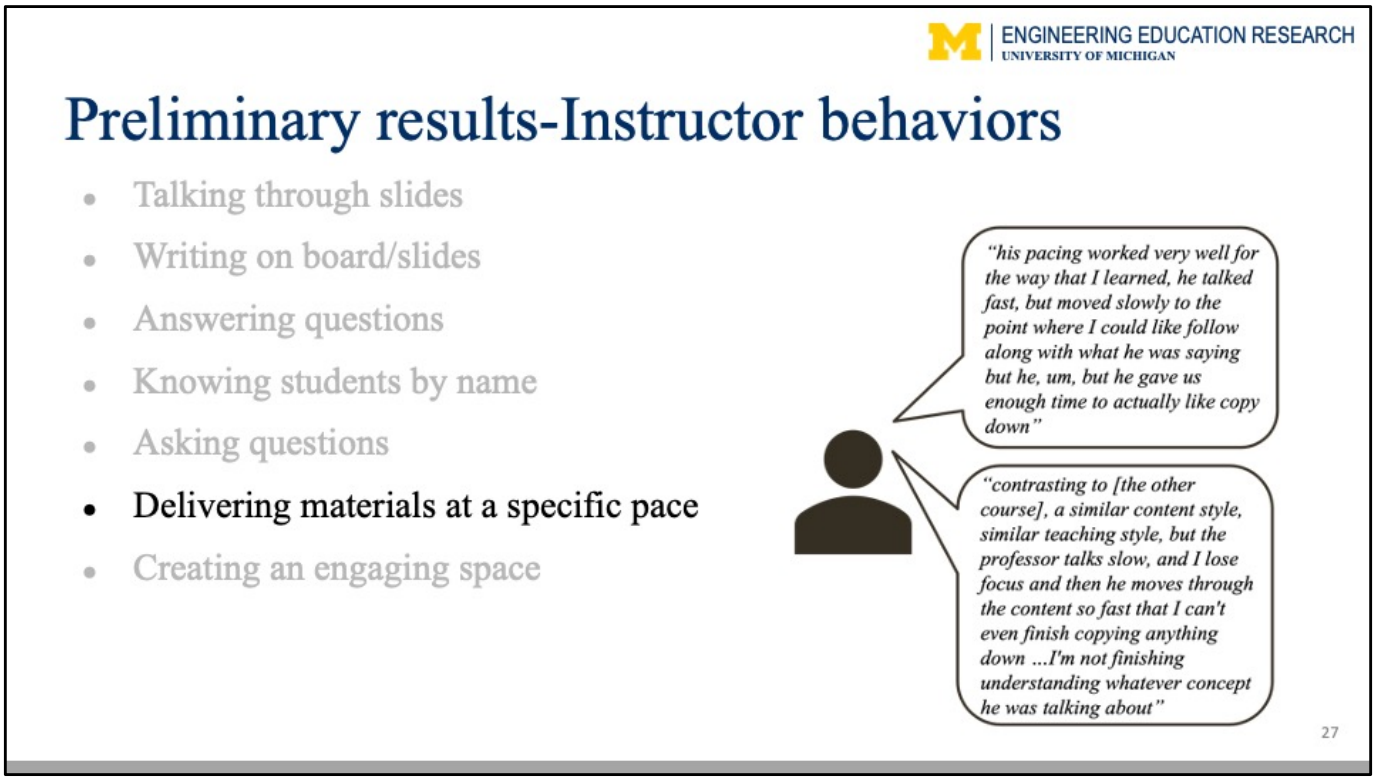
Knowing students by name refers to an instructor's practice of learning and using students' names during interactions and class activities.
A few participants (2 from LB and 3 from AL) shared that their instructors knew them by name, which they appreciated and made them feel valued.



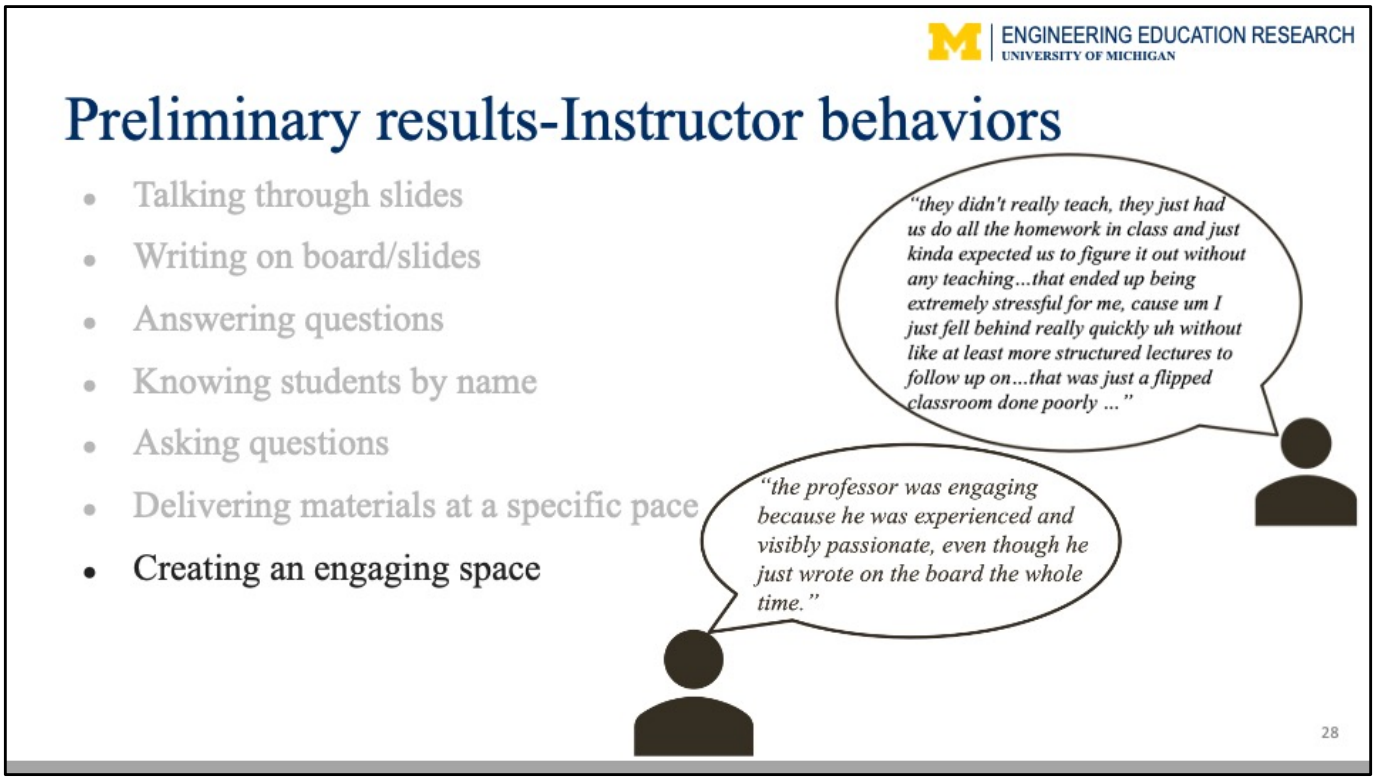
The sub-theme *Asking questions* refers to an instructor's practice of posing questions to students during class.

Two participants from LB sessions and eight from AL sessions reported that their instructors asked checking/stimulating/guiding questions to check students' learning processes, engage students with the material, or encourage them to think more.



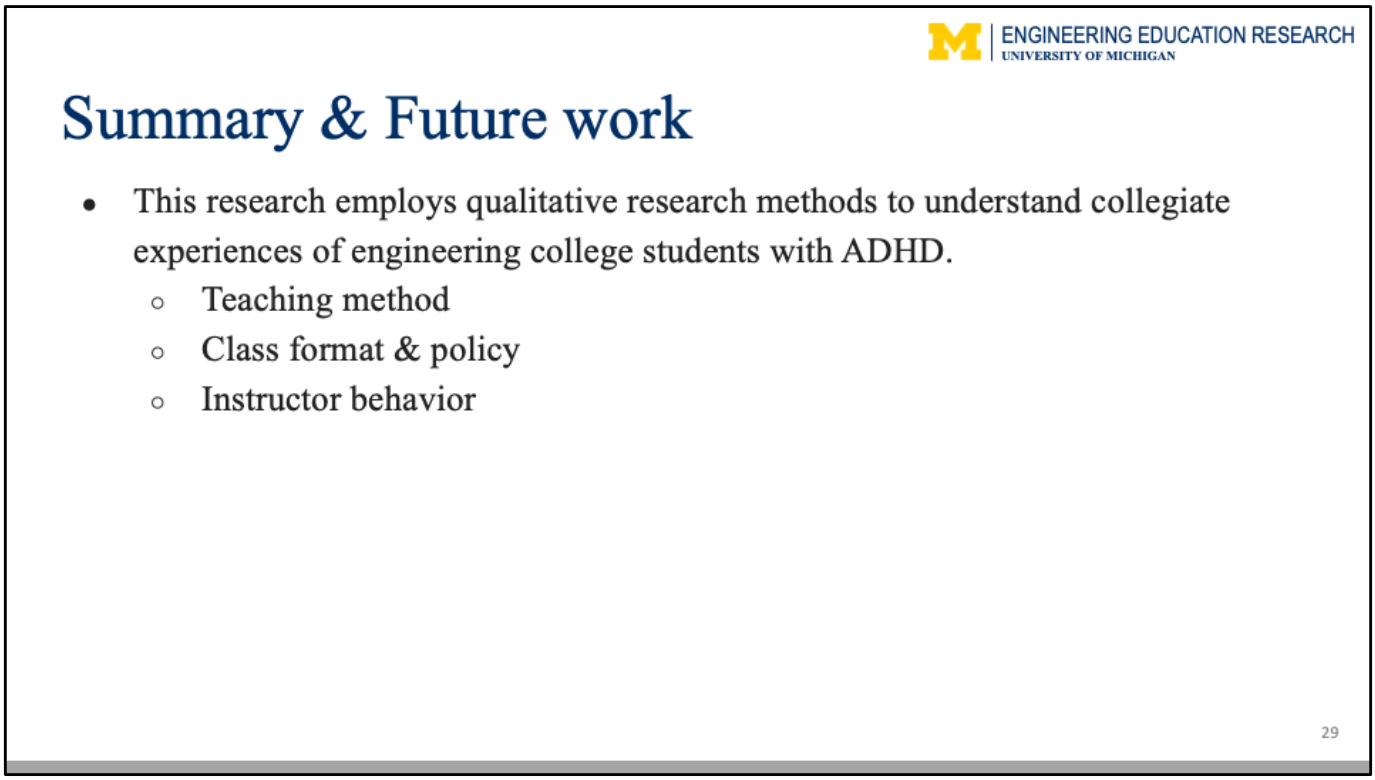
The sub-theme *Delivering materials at a specific pace* means an instructor's delivery rate.

Two participants from LB sessions and four from AL sessions reported that instructors' pacing influenced their understanding and staying focused. A participant compared two similar lecture-based courses (e.g., similar content and similar instructional style). In one course, his instructor delivered course content at a very good pace, which provided him enough time to write down notes, while in the other, his instructor talked too slowly to stay focused. He further commented that, for students with ADHD like him, "*the professor needs to have energy, they need to engage the students just with like, just nonverbal cues, like being focused on the subject.*"



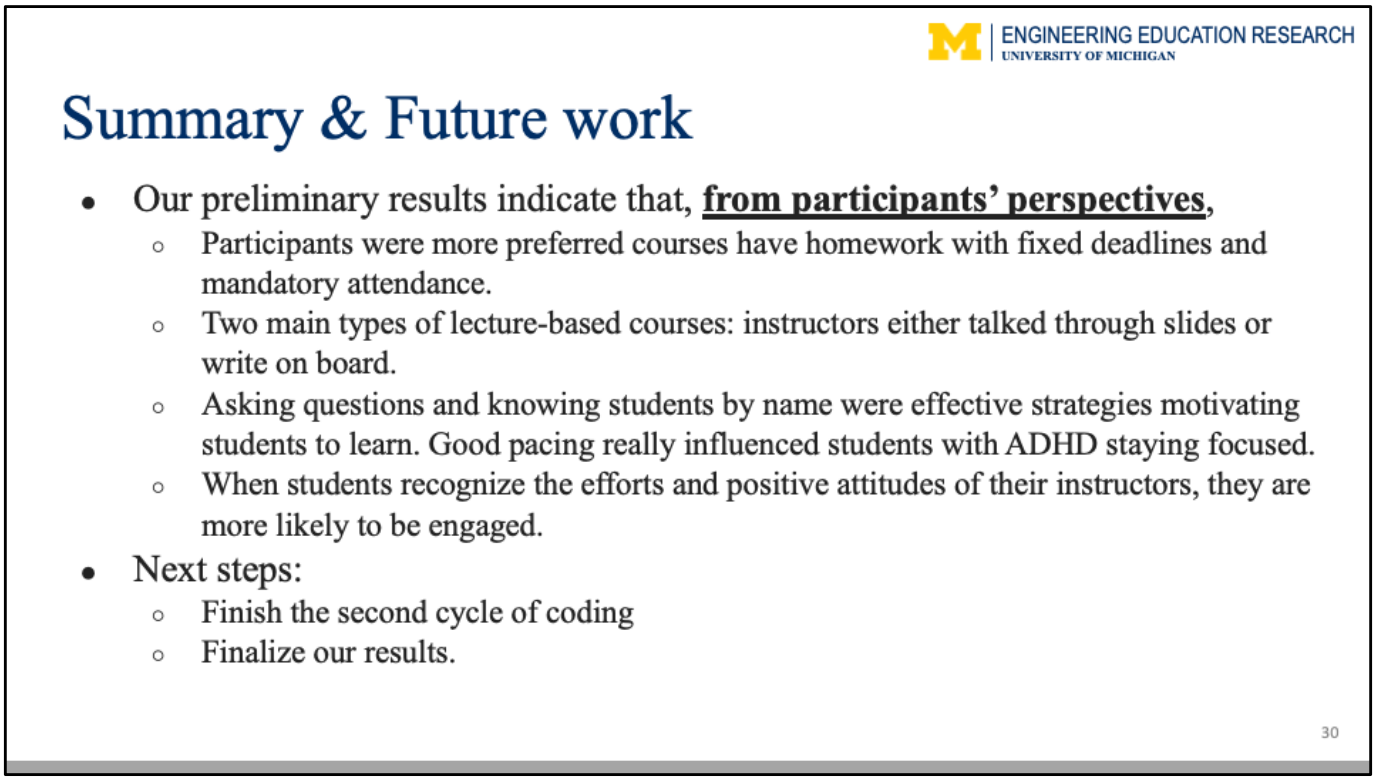
Creating an engaging space refers to an instructor's use of different strategies to capture or maintain students' attention, interest, or active participation in the learning process during class.

Nine participants from LB sessions and seven from AL sessions mentioned noticing their instructors' efforts to engage them. Most of the nine participants from LB sessions reported that their instructors were not very engaging, while six participants from AL sessions stated that their instructors seemed to care about teaching and attempted to motivate them. However, one participant from an AL session reported that their instructor was not interested in teaching and relied heavily on student learning through group activities. In addition, these participants shared that when they noticed their instructors' efforts to engage them, they were more inclined to learn.



This research employs qualitative research to understand collegiate experiences of engineering college students with ADHD. The individual collegiate experiences include classroom experiences, academic adjustment, and sense of belonging. Our preliminary results of the WIP project indicate three themes of instructional practices:

1. Instructional methods including 6 sub-themes: lecturing only, interactive lecture, lectures combined with labs/studios, project-based learning, in-class group, flipped classroom
2. Class format and policy with 5 sub-themes: course content, class size, homework, exams, and attendance.
3. Instructor' behaviors with 7 sub-themes of instructor behaviors: talking through slides, writing on the board, answering questions, knowing students by name, asking questions, delivering materials at a specific pace, and creating an engaging space.



In addition, we found that, from participants' perspectives,

1. Participants were more preferred courses have homework with fixed deadlines and mandatory attendance;
2. Two main types of lecture-based courses: instructors either talked through slides or write on board;
3. Asking questions and knowing students by name were effective strategies motivating students to learn;
4. When students feel instructors' efforts and attitudes in teaching, they were more likely to learn.

For next steps, we will continue identifying themes and sub-themes for three elements of individual student experiences and finalizing our results.

Lastly, it should be noted that we are not attempting to generalize our findings. We identified themes and sub-themes primarily based on the data collected for this study. We referred to existing literature when describing these themes and sub-themes to better contextualize our current dataset and related studies in the future. Some patterns related to the themes and sub-themes need to be further validated with more diverse sample sizes and multiple research methods.

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Thank you for your attention. Do you have any questions or suggestions?