# Supplemental Material

*CBE—Life Sciences Education*

Pfeifer *et al*.

**Supplemental Materials for**

# What I wish my instructor knew: How active learning influences the classroom experiences and self-advocacy of STEM majors with ADHD and specific learning disabilities

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## Supplemental File Inventory

**Supplemental File 1.** Extended methods

## Positionality of research team

Our research team was comprised of three members. Our relevant experiences are reported in aggregate in an effort to protect confidentiality. At least one or more of our research team was, or were, a STEM major with ADHD/SLD. At least one or more of our research team was, or were, previously a DRC coordinator at a different university than where data collection occurred, and at least one or more of our research team had teaching experience in undergraduate STEM courses. In some interviews, the interviewer disclosed their identity as someone familiar with the college accommodation process if the participant asked directly. It appeared that this disclosure helped participants feel more comfortable to speak openly about their accommodation experiences. Our analysis could be influenced by our own biases. For instance, at least one or more authors identify as individuals who could make decisions to support or reject an individual student's accommodation requests in their former or current roles within the college accommodation system, which may affect how participant data is interpreted. However, we attempted to mitigate this potential bias by carefully constructing our full research team. Given the overall composition of our research team, our collective positionality could strengthen our analysis because we discussed data from both the "insider" (or student perspective) and as "informed outsiders" (or the DRC coordinator and STEM instructor perspectives).

## Description of interviews

During the interview, the participant was asked to name STEM courses they had recently taken that used primarily lecture and STEM courses they had taken recently

that used active-learning practices. After naming these courses, the interviewer created a 3X5 inch notecard to represent each course and then asked the participant to name all the teaching practices they could recall in that course. The interviewer wrote these practices on the notecard as a visual aid to support further elicitation. The interviewer then asked the participant to select just one lecture STEM course and just one active-learning STEM course that they remembered best to discuss in more detail. The interviewer then asked interview questions related to the "primarily lecture" and the "active-learning STEM course" to understand the participant's experiences related to learning and self-advocacy in these courses. A list of the interview questions used are provided in Supplemental File 3.

**Trustworthiness of study**

The criteria to assess rigor differs between quantitative and qualitative research. Tracy (2010) provides a model of criteria to guide the assessment of qualitative research. These criteria include worthy-topic, rich rigor, sincerity, credibility, resonance, significant contribution, ethical, and meaningful coherence (Tracy, 2010). In our view, readers are the ultimate judge of some of these criteria, such as worthy-topic, significant contribution, and meaningful coherence. However, we acknowledge that the research team can enhance the transparency (or sincerity) of their work by articulating how their own research endeavored to address the remaining criteria. In terms of rich rigor, our study involved 25 participants, which is a relatively large sample size for a study of its nature. For example, some studies of STEM students with learning disabilities report findings from sample sizes of just three participants (James et al., 2020; Nieminen & Pesonen, 2020; Nieminen & Pesonen, 2022). We sought to establish sincerity by

engaging in self-reflexivity throughout the study, evident in our analytic memos during study design, data collection, and data analysis. Moreover, we provide transparency in our methods by acknowledging our positionality and intentions. We strove for credibility by employing triangulation, including the use of multiple researchers to code the data to consensus. Coding to consensus ensures that all research team viewpoints are considered during data analysis. We consider this a particular strength of our process because our research team included at least one or more researchers who was or were a STEM major with ADHD/SLD. Because our study focused on the experiences of students, we view this as an essential component of our study's credibility. We endeavored for credibility by presenting multiple voices in our results to represent the breadth of our participant's experiences. In addition to the typical ethical standards of qualitative research, we assigned participants new pseudonyms for this paper that differ from our previous papers to protect confidentiality. Finally, we provide contextual details in our results section. The purpose of these details is to aid readers in finding transferability of our findings to their own contexts where applicable.

**Supplemental File 2.** Screening survey questions used for the study.

1. What is your major?
2. What year are you in school?
3. Are you 18 years of age or older?
4. What is your disability?
5. Have you taken a STEM course or are you currently enrolled in a STEM course for Fall 2018 that meets either the Science or Quantitative Reasoning requirement?

   Note: A list and a website link to a list of these courses were provided to participants.

6. Type in all the STEM courses you have taken or are currently enrolled in for Fall 2018.
7. In your most recent STEM course, did your instructor use active learning?
8. Select which examples of active learning you remember your instructor using in your most recent STEM course.
9. If you chose other in the question above, what other active learning did you do in your most recent STEM course?

**Active learning description provided in survey**

**Active learning** is a type of instruction that instructors in college science, technology, engineering, and mathematics (STEM) courses sometimes use. Active learning may occur when the instructor is not lecturing. *Examples of active learning are clicker questions, group work, completing worksheets in class either individually or in a group, class discussions, and student presentations*.

Note: Survey questions related to participant name and preferred contact methods are redacted.

**Supplemental File 3.** Interview questions used for the study.

Interview questions previously published are redacted. Bold font indicates interview questions yielding participant responses that were most relevant for our analysis.

1. In your survey response, you mentioned that you have taken a STEM course to meet the Science and/or Quantitative Reasoning Core Curriculum requirement. **Which course(s) did you take?**

*To prepare for the interview, the interviewer compiles the list of courses the participant completed in Fall 2018. As the participant recalls these courses in the interview, the interviewer writes these courses on different notecards. The notecards are then used for Question #2.*

2. **Tell me about the type of instruction used in this course?**
    a. Did the instructor do a lot of lecture?
    b. Did you do any form of active learning?

*Show the participant the cards from Question 1. Ask the participant to describe the learning activities they remember for the course. Provide hand-out to participant with the various types of active-learning examples. Write active-learning practices on one half side and lecture activities on the other. After discussing all the notecards (courses), ask the participant to choose one STEM course they remember well that used mostly lecture, and one STEM course they remember well that used mostly active-learning practices. Use these courses as the basis for Questions 3 and 4.*

3. Think back to your STEM course that uses mostly lecture…
    a. Walk me through what a typical class was like for you.
    b. Tell me the specific ways you self-advocated in this class.
    c. Tell me about your interactions with your instructor.
    d. Tell me about your interactions with your peers.

4. **Think back to your STEM courses that used active learning…**
    **a. Walk me through what a typical class was like for you.**
    **b. Tell me the specific ways you self-advocated in this class.**
    c. Tell me about your interactions with your instructor.
    d. Tell me about your interactions with your peers.

5. **Do you learn better in a STEM course that uses lecture or active learning?**

6. **Do you think the type of instruction used in a STEM course influences your self-advocacy?**

7. **Is there anything you would like others (instructors, DRC coordinators, your peers,) to know about what it's like for you when you are in an <u>active-learning</u> STEM course?[1] If so, what?**

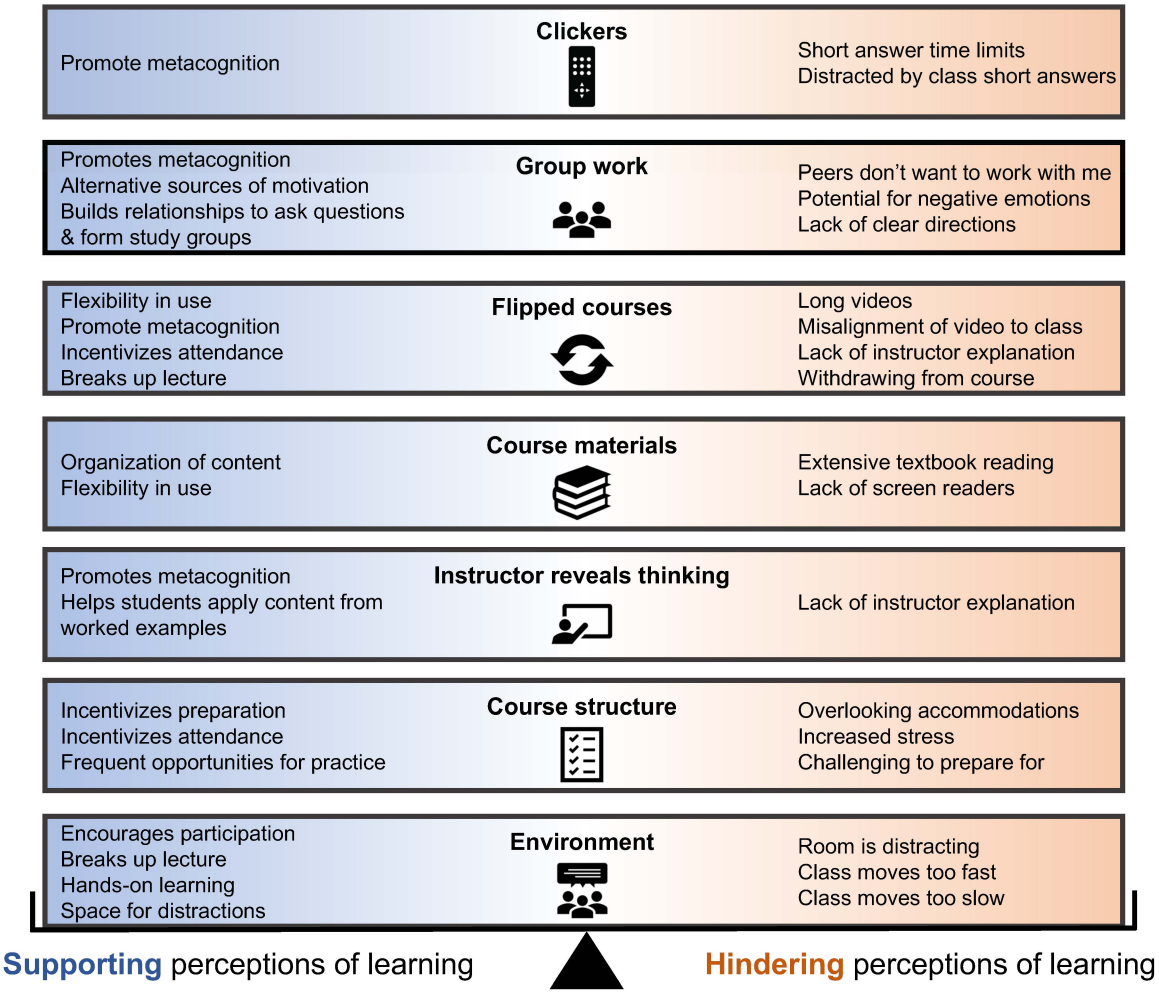
[1] The interviewer sometimes asked this question and omitted the phrase "active learning." For this reason, only participant responses related to active-learning STEM courses were considered for further analysis.

**Supplemental File 4.** Coding matrix used for data analysis.

**Date Coded Together**:

| **CodingMatrix_ParticipantName** | |
|---|---|
| Question | Coder responses |
| What is the participant's preferred learning method in a STEM course? | |
| What supports their learning in an active-learning STEM course? | |
| What barriers do they encounter in an active-learning STEM course? | |
| Do they suggest a way to overcome the barrier? | |
| Did they withdraw from an active-learning STEM course? | |
| Does the type of course influence their self-advocacy? | |
| What do they want STEM instructors to know about their experiences in active learning courses?<br><br>Note: Make sure interviewer asked about active learning in the question. | |
| Top 2-5 quotes from this interview: | |
| One-paragraph summary of participant's perception of active learning | |

**Supplemental File 5.** Figure displaying active-learning aspects perceived to support or hinder participant learning. This figure depicts the same information as shown in Table 3.



**Supplemental File 6**. Participant suggestions for STEM instructors about active learning. Table displays same information as shown in Figure 1.

| *Suggestion* | *Example quote* |
|---|---|
| **Consider student differences in your teaching** | You have a certain bar set and if some students are meeting that, then you think that, that's an appropriate bar but if other students aren't, it's like are they not putting in enough effort? Or maybe they have a learning disability that's keeping them from getting up to that [goal] and you don't really know. —Vivian |
| **Know that how instruction is implemented directly affects student success** | My grade in a course is usually pretty highly affected by how the teacher teaches, and the quality of their teaching. So the better they teach, the better I'm going to understand it. And I think that active learning just works a lot better in general for me when implemented correctly. It really does make a huge difference. —Therese |
| **Explain your thinking to the entire class** | It's not right for when everyone gets the question wrong and it's very obvious, it's like 80% for answer D, and the answer was A. You just say worrisome things, and groan and moan, and [say] "Uh-oh, you all have a test on Wednesday, uh-oh." That's not helping anyone. That's not building up anyone. That's giving everyone anxiety. That's giving everyone a little more stress about not understanding something that we don't even know what [the instructor is] referring to exactly. There's so many parts of a question, we don't even know where people could potentially be going wrong…That doesn't give people hope or determination to figure a question out. –Kacey |
| **Provide interactive notes to support learning** | I would have less of reason to self-advocate if I had those resources. —Stewart |
| **Videos are preferred over extensive reading from the textbook** | [High-quality] videos work a lot better than trying to flood [read] a textbook, just passages and passages of [STEM content] in really, really big words. It works a lot better. –Bryce |

| | |
|---|---|
| **Add a roadmap for accommodations in the syllabus** | With regards to accommodations, they could always have a footnote about accommodations and just protocol. I think that would be helpful for students with disabilities. Because then they see okay, I have a roadmap. I can approach the professor and, it'd just be something that would be nice to have in a syllabus. –Erik |

**Supplemental File 7**. Summary of how aspects of active learning influence participant self-advocacy with example quotes. Table displays same information as shown in Figure 2.

| *Influence* | *Why?* | *Example quote* |
|---|---|---|
| **No influence on self-advocacy** | Participants see accommodations as always sufficient | If I was having trouble with a certain style of teaching, I probably wouldn't say anything because my accommodations are what's supposed to put me on an even playing field, right, so it's like I don't feel like I deserve any extra special stuff on top of it. —Sadie |
| **Decreased need for self-advocacy** | Participants consider active learning supportive | When I'm in an active learning kind of [course]… I understand the stuff more… I'm not usually put in a situation where I have to go up to the teacher and tell them, "I'm struggling really badly with this." Because we've already incorporated [active-learning practices] in there…I understand [the material] better. –Therese |
| **Increased need for self-advocacy** | Participants with unmet accommodation needs | I'm not getting extra time quizzes, and we have one before every class. It's a five-minute quiz. I would like two and a half extra minutes. Even reading, I read it, but I don't internalize it, so I gotta do it again, and then I gotta internalize it. I'll just email her. I emailed her recently about the extra time on the quizzes. She hasn't responded. —Kacey |
| **Increased need for self-advocacy** | Participants say group work is a situation that requires more self-advocacy than a lecture course | When you are more in a group situation you need a little bit more of if then just a basic lecture. In a lecture you can kind of come and go out and not have to do anything, not have to interact... I feel like when you're with others you want to talk more about yourself and lean more towards using more self-advocacy. Definitely in active learning situations you use more of it. —Brett |
| **No influence on self-advocacy** | Participants describe always practicing self-advocacy, no matter the course. | It [active learning] doesn't change the fact that I'm still being a self-advocate. —Erik |

## References

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