Warming Up the Cold Call: Encouraging Classroom Inclusion by Considering Warm- & Cold-Calling Techniques

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Abstract

Student populations in higher education are more diverse than ever before. Studies of classroom engagement have repeatedly shown that instructors act on implicit biases and that classroom participation is rarely equitable. What can instructors do to support diverse students, specifically with regard to managing classroom engagement and facilitating equitable participation? The practice of cold-calling—calling on a student who has not volunteered to contribute a response—has previously been suggested to support a number of desirable classroom outcomes. However, cold-calling is increasingly recognized to be a potential source of significant student anxiety, particularly for students already experiencing heightened stress due to stereotype threat or other barriers to learning. As such, the solicitation of random and immediate feedback may actually exacerbate inequities rather than ameliorate them as intended.

Here, we introduce a novel classroom participation approach that we call the warm call. This engagement method provides students with an advance warning, and the opportunity to opt out of sharing in front of the class. We describe two different approaches—the “in-class warm call” and the “before-class warm call”—which can be utilized by instructors in any level or size of class to support equitable student participation while also respecting student autonomy.

Key Words: inclusive pedagogies; cold call; classroom participation; warm call; equity.

Introduction: Student Diversity in Higher Education & Considerations for Classroom Participation

Student populations in higher education are more diverse than ever before in terms of race, ethnicity, country of origin, gender identity, sexual orientation, religious affiliation, economic status, age, disability status, first/continuing generation status, and other attributes that compose students’ seen, unseen, and intersectional identities (Keller, 2001; Blessinger et al., 2018). Changing demographics coupled with social movements calling for greater equity and inclusion have led to increased focus on equity in education and desire to identify and remove barriers that prevent equal access, participation, and achievement along race, ethnicity, sexual orientation, gender, class, and ability lines (Blessinger et al., 2018).

While class participation of students is associated with positive academic outcomes (Rocca, 2010; Tang et al., 2020), studies have repeatedly shown that instructors act on implicit biases and that classroom participation is rarely equitable (Crombie et al., 2003; Nilson, 2010; Tatum et al., 2013; Eddy et al., 2014), with “consolidation of responsibility for classroom activity among only a portion of the students” (Crombie et al., 2003). Inequities in student participation can exacerbate stereotype threat (Kim, 2002; Kim, 2008; Nguyen & Ryan, 2008), a phenomenon that “occurs when a person’s identity as part of a negatively stereotyped group, such as African Americans in science or women in math, becomes relevant or important” (Dewsbury & Brame, 2019). This in turn can contribute to sustaining inequalities in achievement (Taylor & Walton, 2011; Eddy et al., 2014 Greene et al., 2008; Maries et al., 2020) and to the leaky pipeline of students leaving STEM (National Science Foundation, 2015). Conversely, fostering a sense of belonging has been linked to successful outcomes in STEM education (Binning et al., 2020; Martin-Hansen, 2018).

Supporting Equitable Classroom Participation: Warming up the Cold Call

What can instructors do to support diverse students, specifically with regard to managing classroom engagement and participation in an equitable way? A large body of growing research has repeatedly demonstrated that the incorporation of active learning pedagogies increases overall student performance (Freeman et al., 2014) and significantly improves equity in outcomes through a disproportionate positive effect on performance for students with historically minoritized or marginalized identities in STEM (Eddy & Hogan, 2014; Theobald et al., 2020). The main focus of active learning is to increase students’ physical and agentic engagement with course content, thereby making them active participants in their learning (Reeve et al., 2020). Thus, the adoption of active, student-centered
pedagogies has emerged as a primary recommendation for fostering inclusive learning environments that support positive learning outcomes for a wide range of learners.

Most active learning approaches include a focus on providing opportunities for student contributions to discourse in the classroom, rather than one-way dissemination of information from the instructor (i.e., “student-centered” rather than “instructor-centered” teaching). However, an increased emphasis on student participation in classroom discourse can increase student anxiety (England et al., 2017; Jacob et al., 2019; Hood et al., 2021). Recent research suggests that instructor choices, even among different types of active learning strategies, can both increase and ameliorate student anxiety in the classroom (Cooper & Brownell, 2020; Hsu & Goldsmith, 2021; Hood et al., 2021); consequently, instructors have much influence on shaping how students experience learning in their classes through selection of engagement strategies that support course learning goals. While anxiety can be a positive motivator in learning contexts (Al Mjali, 2020), there is a balance to strike between too much and too little to achieve an optimum outcome (Yerkes & Dodson, 1908), which will be different for different students (Hood et al., 2021).

Soliciting volunteers to offer information is a common classroom technique but carries with it potential pitfalls. Weaver and Qi (2005) explore the social structure of a classroom and state “a handful of students assume the role of active participants and discussants in the classroom, while the majority engage in ‘civil attention’—paying sufficient attention to know when to nod, to laugh where appropriate, or otherwise to appear attentive without risking too much involvement.” Student age, traditional/nontraditional status, gender identity, academic self-efficacy, and English proficiency are all factors that influence the likelihood of a student voluntarily participating in a college classroom (Rocca, 2010, Gaylon et al., 2012). As these factors will invariably differ between students in our classrooms, utilizing volunteers can create and sustain disproportionate participation. If our goal is to create an equitable and welcoming classroom environment, we suggest that efforts to move beyond voluntary student interactions should be taken.

One evidence-based approach that instructors have been encouraged to adopt to create a more equitable climate of participation in their classes, and to express value in hearing all student voices, is the practice of randomized “cold call” (Dallimore et al., 2013; Eddy et al., 2014; Tanner, 2017). The practice of cold-calling—calling on a student who has not volunteered to contribute a response—has previously been argued to support a number of desirable classroom outcomes, including promoting greater student engagement (Knight et al., 2016), broadening student participation (Tanner, 2017), enforcing student preparation (Levy & Bookin, 2014), providing opportunities to check student understanding, and increasing the frequency with which students voluntarily participate (Dallimore et al., 2013).

Different than a simple cold call, a random cold call requires the instructor to ensure randomization: by putting all student names into a common pool and using some sort of randomization tool when calling on students to make contributions during class, instructors can ensure that all students are being invited to participate equally and that implicit bias is not possible in the selection of student participants (Tanner, 2011, Eddy et al., 2014). At face value, this could seem an equitable solution to a persistent problem of unequal representation of who is heard in the classroom, and the instructor may be convinced that they have made strides to incorporate inclusive pedagogies that support the success of all students in ways that have been recommended by teaching and learning literature (Tanner, 2017).

While we agree that randomized cold-calling is preferred to soliciting student participation via open-ended questioning that is not directed toward an individual (Felder & Brent, 2008), and that it is more inclusive than calling only on individuals who volunteer, research examining the student experience in active-learning classes in which student participation is solicited has demonstrated that students experience differing levels of anxiety in response to various classroom activities (Cooper et al., 2018; Hood et al., 2021) and that the classroom participation experience can differ for students of different genders or races/ethnicities/nationalities (Eddy et al., 2014), identity groups, or anxiety levels (Hood et al., 2021). Thus, when a white, cisgender male student is randomly called on to contribute in a STEM class, they may feel comfortable doing so because they perceive that their place in STEM and relative position of power is accepted and usual. In contrast, a student with a historically minoritized or marginalized identity who is randomly called on to contribute may feel intense anxiety because of the stereotype threat they already experience in the culture of higher education or in STEM classes. This anxiety may be compounded by cultural norms in which verbal expression is not valued to the same extent or practiced as frequently as the majority white culture in the United States (Kim, 2002; Kim, 2008). Regardless of student identity, anxiety experienced as a result of a cold call might negatively impact efforts to foster a learning environment in which students feel positive in terms of comfort, belonging, and motivation; in fact, it has been concluded that randomized cold-call practice can serve only to increase students’ achievement anxiety, never to minimize achievement anxiety (Cooper et al., 2018). Moreover, as reported recently by Gin and colleagues (2020), for students with disabilities, directors of disability resource centers have described potential barriers to learning that are imposed by the use of the random/cold call: students with disabilities may need additional time to process the question, students with ADHD may have difficulty focusing during a timed task, and students with anxiety disorders may experience more acute adverse psychological impacts as a result of being asked to report out in front of their peers. As such, the incorporation of a random call to increase equity may actually exacerbate some inequities of social and academic capital rather than ameliorate them. While randomized calling may seem equitable, equality in the number of opportunities to participate is not the same thing as supporting qualitatively equitable participation.

In spite of these shortcomings stemming from the practice of the cold call, the goal of inviting all student voices and contributions in the classroom is a worthy goal, and one that we shouldn’t abandon because there are problems with the cold-call approach. The question is not a matter of what we’d like to elicit from students, but rather how we can best invite and support that participation and demonstration of engagement from students across identity and ability groups. Modifying the cold call has been recommended to ensure more equitable participation for students with disabilities (Gin et al., 2020) and for students who experience heightened anxiety as a result of active-engagement learning strategies (England et al., 2017; Cooper et al., 2018).

Enter the “warm call.” Rather than randomly calling on students “cold”—that is, without warning—an instructor can adopt the warm-call approach, wherein students are provided advanced knowledge of the instructor’s intent to solicit their input. This approach draws parallels to the well-established warm-call concept in the field of business sales, wherein a pool of prospective customers are not engaged with until a personal connection is first established. Each concept
What Is a Warm Call?

In this modified method of random call, the initial steps are the same: the instructor places all student names into a common pool and uses some sort of randomization method to determine which student is next to be called on to contribute. However, at the next step, the method differs from the cold call in that the instructor cues an individual student, or individual students, that they will be called on to share with the class, before the student is actually called on. Depending on the instructional format of the course, the nature of the content, or an instructor’s preference, the instructor can determine how much advance notice students are given before they will be called on to share in class. One author (KM) has several years of experience using a warm-call technique 5–10 minutes in advance of the call (the “in-class warm call”), while another author (ZV) has several years of experience using a warm-call technique 24–28 hours in advance (the “before-class warm call”).

Regardless of the technique, the warm-call framework is employed not to convey content to the students but instead to facilitate a learning environment that allows for student learning to be successful.

How to Implement a Warm Call

In-Class Warm Call Approach

The “think-pair-share” model is often employed as a well-intentioned method to enhance broad classroom participation, but it may instead foster classroom dynamics that benefit only a few students, particularly with respect to the “share” component of the activity. Additional approaches to classroom dialogue have been explored, including an “optional consent to share” model on which we would like to expand. (Cooper et al., 2021).

The in-class warm-call approach works well paired with classroom activities that involve discussion among students such as think-pair-share prompts, audience response “clicker” questions with a discussion component, or in-class group work using cases or problem sets. As the instructor moves around the classroom space, checking in with student groups while students are working on a provided prompt, problem set, or case, the instructor can approach the individual student(s) whose names are next on the instructor’s random-call list. The instructor informs the student that they are next to share and asks if the student would be willing to report out to the larger group during the debrief, review, or “share out” part of the activity cycle. At this point, particularly early in the term while the practice is still unfamiliar, a student invited to share out may at first appear flustered or hesitant to be put in the spotlight in front of the rest of the class, but the instructor can provide additional coaching to support the student in feeling confident in sharing out. Two forms that this additional in-the-moment-coaching has played out are review of the prepared response from the student and their team, either provided by the instructor or the team members, and/or the option for students to describe the viewpoints raised in peer dialogue, or the conclusion of their group rather than reporting “their” individual response. Both of these approaches ease students’ fears of providing and having to take sole ownership of an incorrect response while reporting out in front of peers. Scaffolding peer-to-peer interactions prior to large group discussions that invite or solicit individual student participation is an example of providing additional structure to courses, which demonstrably improves student outcomes, especially for historically minoritized or marginalized students in STEM (Eddy & Hogan, 2014). Establishing positive student-instructor rapport is an important aspect of the in-class warm call: the direct interaction with the instructor, and the need for students to “opt out” in the moment is a limitation of the in-class warm-call approach: students may feel more pressure to accept the invitation to share out when the instructor has approached them during class. Students are likely to feel less pressure to accept when the warm-call approach is implemented in ways that are congruent with a supported learning environment with respect for all students (e.g., class grounding values in syllabi, many opportunities for student feedback, etc.).

Before-Class Warm-Call Approach

In the before-class warm-call approach, a student is notified via email, 24–48 hours in advance of an upcoming class session, that they are being provided an opportunity to participate in warm-calling, and a prompt is provided. It is emphasized that warm-calling is entirely optional and not assessed in any formal fashion. The student is asked to reply if they wish to participate or not, and they are encouraged to ask questions about the prompt. This model is employed across a range of course subjects and levels, from first-year chemistry and sustainability, to general chemistry, to upper-level principles of biochemistry courses. The lecture sizes are small, with no more than 40 students. In the contact email, the goals of warm-calling are reiterated—to allow room for student voices, and to build classroom community. For this type of warm-calling to be successful, it is incumbent on the teacher to ensure that the warm-call goals are congruent with the broader classroom atmosphere. If the students do not feel that their voices and contributions are valued, they will likely be disinclined to participate in this optional process.

Questions are chosen to be tangentially related to the subject material of the course, but with the goal of adding content or information. For example, if a sustainability course is studying fossil fuel emissions, a student might participate in a warm call to identify the location of the coal-burning power plants in Minnesota and their proximity to population centers. When glycogen synthesis is being covered in biochemistry, a student could be warm-called to discuss von Gierke’s disease and how they find that it relates to the current lecture material. Sharing this information provides a student an opportunity to be the subject-matter expert, flattening classroom hierarchy and providing a more equitable learning environment.

The before-class approach can help to eliminate external pressures on the selected student. Their peers do not know who is being asked, so the student will be under no pressure to participate and will not be singled out if they choose not to do so. Allowing the student response to be optional also demonstrates a professor’s respect and understanding of the competing demands on a student’s limited time: if a student were inadvertently invited to participate during a
particularly busy or stressful time, the student can decline without losing classroom points or feeling inadequate in front of their peers. Student anxiety may be decreased, as students have ample time to prepare their discussions, and students often will check in with the professor to determine if their responses are reasonable. This check-in provides a valuable point of contact and increases a student's confidence toward the subject matter. Students can participate in this form of warm-calling if they are not taking the course in person—or even synchronously. Asynchronous students can record short YouTube videos in lieu of live classroom discussion, which allows their voice to be heard and enhances classroom community. Preliminary student feedback concerning the before-class warm-call approach has been positive, and this could provide the basis for semistructured interviews or a survey instrument.

Miscommunication can occur in the before-class model, particularly if the student neglects to check or respond to the emailed request. Such issues tend to be relatively nondisruptive to the upcoming classroom lecture—if no warm-call response is prepared, the lecture simply continues unabated. Additionally, this model is most effective in relatively small lecture courses. It would be impractical in a lecture course of 150 students, as multiple warm calls per day could take up significant portions of the class session.

Of course, the benefits of the warm call can be accomplished using other implementation variations than those described here: in courses that have stable teams and in which team work is used consistently in most or all class sessions, instructors can adopt a modified warm call in which the role of team reporter rotates in a consistent, predictable manner—e.g., according to a rotating schedule determined at the start of a term—such that any individual student and the instructor would know which student from each team is in the role of reporter ahead of time. Thus, students are afforded the benefit of having an advance notice of their expected participation by being “on deck” for a particular day. This is different from a “group random call” without an appointed rotating reporting role (Knight et al., 2016) in that the opportunity to contribute is distributed equitably not only across teams but also across the individual members within a given team. The crucial aspect is that there is a mechanism by which student participation is distributed equitably across all learners and that opportunities are scaffolded in a supported way that avoids increased anxiety and provides learner autonomy.

○ Conclusion

Warm-calling is a technique that can be used to facilitate the creation of an inclusive and enriching educational environment in which every student feels a sense of belonging—to the material, to the classroom learning community, and to the institution. Through this optional, inclusive, and respectful approach to student engagement, the social dynamics of the classroom can be enhanced and students may be more likely to feel that their voice has a place to be heard. To our knowledge, this is the first paper to comprehensively address the concept of warm-calling as a classroom engagement strategy. We feel this approach provides a valuable contribution to the repertoire of engagement tools that an instructor can employ congruent with the emerging concept of an “ecological learning environment” (Binning et al., 2020; Maries et al., 2020) in which “students are not fearful of being judged by the instructor and peers when they make mistakes” (Maries et al., 2020), and will assist in creating student-centered learning communities that enact more equitable learning opportunities, fostering a greater sense of belonging for all students. Due to the paucity of data on this subject, future research employing a more systematic data collection approach will prove illuminating in understanding the impact of the warm-call strategy.

Table 1. Benefits of in-class and before-class warm calls.

| Benefits                                      | In-Class Warm Call | Before-Class Warm Call |
|-----------------------------------------------|--------------------|------------------------|
| Randomization of class roster                 | Yes                | Yes                    |
| Equal opportunity for participation of all students | Yes                | Yes                    |
| Advance instructor preparation                | Creation of paired in-class activity | Creation of prompt for individual student |
| Advance student preparation                   | None beyond normal class expectations | Yes—preparation of response for sharing in class |
| Opportunity to opt out                        | Yes—directly       | Yes—via email          |
| Opportunity for online/asynchronous format participation | No                 | Yes—e.g., prerecorded response |
| Requires instructor to visually identify student | Yes                | No                     |
| Suited to implementation in large-enrollment class | Yes                | No                     |

References

Binning, K., Kaufmann, N., McGreevy, E., Fotuhi, O., Chen, S., et al. (2020). Changing social contexts to foster equity in college science courses: An ecological-belonging intervention. Psychological Science, 31(9), 1059–70.

Blessinger, P., Hoffmann, J. & Makhanya, M. (2018). Introduction to Contexts for Diversity and Gender Identities in Higher Education: International Perspectives on Equity and Inclusion. In Hoffman, J., Blessinger, P. & Makhanya, M. (Eds.), Innovations in Higher Education Teaching and Learning, Vol. 12, Contexts for Diversity and Gender Identities in Higher Education: International Perspectives on Equity and Inclusion (pp. 1–12). Emerald.

Cooper, K., Downing, V. & Brownell, S. (2018). The influence of active learning practices on student anxiety in large-enrollment college science classrooms. International Journal of STEM Education, 5(1), 1–18.
Cooper, K., Schinske, J. & Tanner, K. (2021) Reconsidering the share of a think-pair-share: Emerging limitations, alternatives, and opportunities for research. *CBE Life Sciences Education*, 20(1), 1–10.

Cooper, K.M. & Brownell, S.E. (2020). Student anxiety and fear of negative evaluation in active learning science classrooms. In Mintzes, J.J. & Walter, E.M. (Eds.), *Active Learning in College Science: The Case for Evidence-Based Practice* (pp. 909–25). Springer International. https://doi.org/10.1007/978-3-030-33600-4_56.

Crombie, G., Pyke, S., Silverthorn, N., Jones, A. & Piccinin, S. (2003). Students’ perceptions of their classroom participation and instructor as a function of gender and context. *Journal of Higher Education*, 74(1), 51–76.

Dallimore, E., Hertenstein, J. & Platt, M. (2013). Impact of cold-calling on student voluntary participation. *Journal of Management Education*, 37(3), 305–41.

Dallimore E., Hertenstein J. & Platt M. (2019). Leveling the playing field: How cold-calling affects class discussion gender equity. *Journal of Education and Learning*, 8(2), 19–23.

Dewsbury, B. & Brame, C. (2019). Inclusive teaching. *CBE Life Sciences Education*, 18(2), Fe2.

Eddy, S., Brownell, S. & Wenderoth, M. (2014). Gender gaps in achievement and participation in multiple introductory biology classrooms. *CBE Life Sciences Education*, 13(3): 478–92.

Eddy, S. & Hogan, K. (2014). Getting under the hood: How and for whom does increasing course structure work? *CBE Life Sciences Education*, 13(3), 453–68.

England, B.J., Brigati, J.R. & Schussler, E.E. (2017). Student anxiety in introductory biology classrooms: Perceptions about active learning and persistence in the major. *PLoS One*, 12(8), e0182506. https://doi.org/10.1371/journal.pone.0182506.

Felder, R. & Brent, R. (2008). The 10 Worst Teaching Mistakes. *Chemical Engineering Education*, 42(4), 201–02.

Freeman, S., Eddy, S.L., McDonough, M., Smith, M.K., Okoroafor, N., et al. (2014). Active learning increases student performance across the STEM disciplines. *Psychological and Cognitive Sciences*, 111(23), 8110–15.

Gaylon, C., Blondin, C., Yaw, J., Nalls, M. & Williams, R. (2012). The relationship of academic self-efficacy to class participation and exam performance. *Social Psychology of Education*, 15, 233–9.

Gin, L., Guerrero F., Cooper K. & Brownell S.E. (2020). Is active learning accessible? Exploring the process of providing accommodations to students with disabilities. *CBE Life Sciences Education*, 19(4), 1–15.

Greene T., Marti C. & McClenney, K. (2008). The effort-outcome gap: Differences for African American and Hispanic community college students in student engagement and academic achievement. *Journal of Higher Education*, 79(5), 513–39.

Hood, S., Barrickman, N., Djerdjian, N., Farr, M., Magner, S., et al. (2021). “I like and prefer to work alone”: Social anxiety, academic self-efficacy, and students’ perceptions of active learning. *CBE Life Sciences Education*, 20(1), ar12. https://doi.org/10.1187/cbe.19-12-0271.

Hsu, J.L. & Goldsmith, G.R. (2021). Instructor strategies to alleviate stress and anxiety among college and university STEM students. *CBE Life Sciences Education*, 20(11), es1. https://doi.org/10.1187/cbe.20-08-0189.

Jacob, B., Hofmann, F., Stephan, M., Fuchs, K., Markus, S. & Gläser-Zikuda, M. (2019). Students’ achievement emotions in university courses—does the teaching approach matter? *Studies in High Education*, 44(10), 1768–80.

Keller, G. (2001). The new demographics of higher education. *Review of Higher Education*, 24(3), 219–35.

Kim, H. (2002). We talk, therefore we think? A cultural analysis of the effect of talking on thinking. *Journal of Personality and Social Psychology*, 83, 828–42.

Kim, H. (2008). Culture and the cognitive and neuroendocrine responses to speech. *Journal of Personality and Social Psychology*, 94, 32–47.

Knight, J., Wise, S. & Sieke, S. (2016). Group random call can positively affect student in-class clicker discussions. *CBE Life Sciences Education*, 15(4), Ar56.

Levy, D. & Bookin, J. (2019). Cold calling and web postings: Do they improve students’ preparation and learning in statistics?. *Journal of Scholarship of Teaching and Learning*, 19(5), 92–109.

Majali, S. Al (2020). Positive anxiety and its role in motivation and achievements among university students. *International Journal of Instruction*, 13, https://doi.org/10.29333/iji.2020.13959a.

Maries, A., Karim, N. & Singh, C. (2020). Active learning in an equitable learning environment can increase the gender performance gap: The negative impact of stereotype threat. *Physics Teacher*, 58(6), 430–33.

Martin-Hansen, L. (2018). Examining ways to meaningfully support students in STEM. *International Journal of STEM Education*, 5, 53.

National Science Foundation. (2015). *Women, Minorities, and Persons with Disabilities in Science and Engineering*. National Center for Science and Engineering Statistics.

Nguyen H. & Ryan, A. (2008). Does stereotype threat affect test performance of minorities and women? A meta-analysis of experimental evidence. *Journal of Applied Psychology*, 93(6), 1314–34.

Nilson, L. (2010). *Teaching at Its Best: A Research-Based Resource for College Instructors* (3rd ed.). Jossey-Bass.

Reeve, J., Cheon, S. & Jang, H. (2020). How and why students make academic progress: Reconceptualizing the student engagement construct to increase its explanatory power. *Contemporary Educational Psychology*, 62, 101899.

Rocca, K.A. (2010). Student participation in the college classroom: An extended multidisciplinary literature review. *Communication Education*, 59(2), 185–213.

Tang, L., Li, S., Auden, E. & Dhuey, E. (2020). Who benefits from regular class participation? *Journal of Economic Education*, 51(3–4), 243–56.

Tanner, K. (2011). Moving theory into practice: A reflection on teaching a large introductory biology course for majors. *CBE Life Sciences Education*, 10, 113–22.

Tanner, K. (2017). Structure matters: Twenty-one teaching strategies to promote student engagement and cultivate classroom equity. *CBE Life Sciences Education*, 12(3): 322–31.

Taylor, V. & Walton, G. (2011). Stereotype threat undermines academic learning. *Personality and Social Psychology Bulletin*, 37, 1055–67.

Tatum, H., Schwartz, B., Schimmoeller, P. & Perry, N. (2013). Classroom participation and student-faculty interactions: Does gender matter? *Journal of Higher Education*, 84(6), 746–68.

Theobald, E.J., Hill, M.J., Tran, E., Agrawal, S., Arroyo, E.N., et al. (2020) Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math. *Psychological and Cognitive Sciences*, 117(12), 6776–83.

Weaver, R. & Qi, J. (2005). Classroom organization and participation: College students’ perceptions. *Journal of Higher Education*, 76(5), 570–601.

Wood, S., Henning, J., Chen, L., McKibben, T., Smith, M., et al. (2020). A scientist like me: Demographic analysis of biology textbooks reveals both progress and long-term lags. *Proceedings of the Royal Society*, 287(1929), http://dx.doi.org/10.1098/rspb.2020.0877.

Yerkes, R. M. & Dodson, J. D. (1908). The relation of strength of stimulus to human efficiency. *Science*, 28(719), 459–82.

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