Promoting classroom community and belonging using instructor trivia by faculty of various experience levels

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1. Introduction

Belonging plays an important role in retention in engineering programs, and interactions with peers as well as with instructors impact a student's sense of belonging [1-3]. Previous work has demonstrated that using ungraded, non-compulsory multiple-choice questions during lecture about hobbies and interests can promote conversations among students and improve the student-instructor relationship while also providing a mental break during lectures [4-6]. These questions may pertain to student interests or may focus on the instructor's personal background and hobbies. Questions about the instructor, referred to here as "instructor trivia" (IT), can be used to highlight different professional pathways or help students connect with the instructor. Examples of IT questions are provided in Table 1.

Table 1: Sample instructor trivia questions (correct answer in bold).

Instructor A	Instructor B	Instructor C
I am very bad at singing. So bad in fact, that my family has limited me to only 1 "allowed" karaoke song. What is that song?	What extra-curricular activity have I **not** participated in?	What food on the Thanksgiving table is my favorite?
Tequila	Danced in my college's annual musical	Turkey and gravy. It's the star of the day!
Wagon Wheel	**Went bouldering in Guatemala**	Stuffing…inside the bird and out!
Fergalicious	Participated in a powerlifting competition	**Sweet potato casserole…it's like dessert during the meal.**
Mr. Brightside	Changed my car's oil	Obviously the answer is pumpkin pie.
Sweet Caroline		

Past results have shown positive benefits, indicating that IT questions provided a mental break while also keeping students engaged. These results were consistent for instructors at both public and private institutions as well as for both male and female instructors. However, the instructors involved in previous studies were both mid-career faculty with 10 to 15 years of teaching experience [4-6]. In order to probe any impact of faculty experience on the efficacy of IT, the present study investigates the impact of IT in classes taught by faculty with diversity in their levels of teaching experience: (1) a "brand new" first-year tenure-track assistant professor teaching her first course, (2) an early-career assistant teaching professor in her fourth year of teaching, and (3) a highly-experienced tenured professor in his 26th year of teaching.

2. Methods and Data

2.1. Research Questions

This study aims to answer the following research questions (RQs):

1) How does instructor use of IT questions impact students' perspectives of (a) instructor approachability / relatability, (b) how well they feel they know their instructor as a person, (c) whether they are capable of achieving a career in engineering while maintaining a work-life balance, and (d) their sense of belonging in the department?
2) Do students feel that time spent on IT questions would be better spent on course material?
3) How does instructor use of IT questions impact student perceptions of being a chemical engineer?
4) Are there any differences in student perceptions of instructor use of IT questions between (a) brand new, (b) early career, and (c) highly experienced faculty members, and how do these perceptions compare against previous work that examined mid-career faculty?

2.2. Courses Studied

This study examined the use of IT questions in three courses taught by different instructors across two institutions, as detailed here:

- Class A (taught by Instructor A) was a material and energy balances (MEB) course (enrollment: 51) taught by a first-time instructor at North Carolina State University, which is an R1 research university in the southeastern U.S. with an enrollment of approximately 40,000.
- Class B (taught by Instructor B) was a reactor design / kinetics course (enrollment: 31) taught by an early career instructor with three years of teaching experience at North Carolina State University. The instructor had previously taught this course once before. Most of the students enrolled in this course were seniors, and many had taken previous courses with Instructor B.
- Class C (taught by Instructor C) was an MEB course (enrollment: 35) taught by a highly experienced instructor (26 years of teaching experience) at The University of Akron, which is an R2 research university in the midwestern U.S. with an enrollment of approximately 15,000. The instructor had previously taught this course on several occasions.

2.3. Methods

This study uses a mixed-methods approach in its investigation, with a portion of the study constructed to facilitate a pre- / post-intervention comparison. Proper human subjects research approvals at both institutions were secured as part of this study.

The first portion of the study is quantitative in nature. For the first eight weeks of the semester, each instructor participating in this study taught their course as they normally would, i.e. without including instructor trivia questions. A survey was administered to students after the conclusion of these eight weeks, which asked students to provide numerical answer regarding how strongly they agree with the following statements on a scale of 1 to 5 (with 5 being "strongly agree" and 1 being "strongly disagree"):

- The instructor is approachable and relatable.
- I feel like I know the instructor as a person.
- I believe I am capable of achieving a career in engineering while maintaining a work-life balance.
- I feel like I belong in the Chemical Engineering Department.

A total of 20, 17, and 13 students provided responses to this pre-intervention survey for Classes A, B, and C, respectively.

For the following eight weeks of the semester, each instructor included multiple-choice IT questions in one lecture each week for students to respond to on a voluntary, ungraded basis. The instructor then showed students the distribution of answers from the class, presented the correct answer, then provided a brief discussion of the correct answer. After this second eight-week period was over (the end of the semester), the instructor provided the same survey described above to students; a total of 7, 8, and 16 students provided responses to this post-intervention survey for Classes A, B and C, respectively. These pre- and post-surveys are used to examine any impacts of instructor use of IT questions on student self-perceptions of the questions above.

The second portion of the study is qualitative in nature. At the end of the semester, students were presented with the following open-ended response questions either as part of end-of-semester course evaluations (Institution #1) or as part of a survey (Institution #2):

- This semester your instructor used instructor trivia questions in the later part of the course. What, if any, benefits do you perceive from participating in the instructor trivia?
- Do you feel the time spent on trivia questions would be better spent on course material?
- In what ways does getting to know the instructor alter your perceptions of being a chemical engineer?

A total of 12, 12, and 16 students provided open-ended responses to these qualitative questions for Classes A, B, and C, respectively. Student responses to these questions were analyzed through the qualitative analysis method of thematic coding, which involves extracting themes that are present in the open-ended comments [7]; the thematic coding procedure followed in this study is described in the next section.

2.4. Qualitative Data Analysis and Handling

To complete the qualitative portion of the study, all open-ended student comments were examined through thematic analysis by each of the first three authors of this paper, who served as coders. Using multiple coders offers a number of benefits regarding eventual coding accuracy and reduction of biases [8]. The first part of the thematic analysis involved each coder reviewing open-ended student responses from all studied classes at both institutions. As each coder evaluated each student response, they noted if they felt a theme (e.g. "IT questions are fun") emerged from the response. After reviewing all responses and noting emergent themes, each of the coders had a list of codes that comprised their personal code book.

After each coder constructed their personal code book, the authors met to discuss and compare the personal code books towards production of a unified code book; production of this unified code book involved the authors debating options such as wording of codes, consolidation of codes, etc. Once the unified code book was agreed upon by all authors, the coders then reviewed the open-ended student responses again using only the codes contained in the unified code book. After each coder had completed their review of the responses with the unified code book, the authors met again to compare each coder's assigned codes for each response and discussed / debated until consensus code(s) for each response were agreed upon. These final codes were then tallied and representative comments for each unified code were extracted.

2.5. Positionality

Positionality statements for each of the authors who performed qualitative coding in this study appear below.

One author of this study (author AE, referred to as Instructor A) is an early career, white female from the Midwestern United States and is in her first year of teaching. This was the first time she taught Class A. She approaches this study with mainly her experiences as a student, where she better engaged with course content when taught by faculty members that emphasized their individuality to connect with students. She was excited to utilize IT as a simple and efficient method to achieve student engagement (with the faculty instructor and among the students) and to improve faculty approachability. She seeks to integrate inclusive teaching practices, such as the trivia utilized herein, to enhance student learning experiences.

Another author of this study (author LG, referred to as Instructor B) is an early career, white female from the Southern U.S. and is in her fourth year of teaching. The course in which she implemented IT questions was a senior-level reactor design and kinetics course. The study occurred during her second time teaching this particular course, and it is important to note that many students had previously had this instructor for one or two other courses. Her interest in this study stems from past efforts to make her classes feel welcoming and accessible. While her teaching style inherently includes opportunities to share her professional background and personal interests, she was interested in testing how intentional, scheduled moments of IT could impact students' course experience and perceptions of engineering.

Another author of this study (author DV, referred to as Instructor C) is a later career, white male from the Midwestern US and is in his 26th year of teaching. This is his 7th, non-consecutive year teaching this course. The course is taught in a mostly problem-based learning approach, with individuals, then partners and teams discussing prompted worksheet problems (at tables that hold four persons). As a teacher who is at least one generation older than the students in the class, he was interested to see if and how relating personal information in a fun way would make him more relatable to the current generation of students, and, in turn, how this relatability might increase engagement (in the classroom, office hours, etc.)

2.6. Limitations

This study has a few notable limitations in its analysis that were unable to be avoided when constructing and administering instruments; these should be kept in mind by the reader as they consider the discussed analyses and conclusions. Per the study's approved human subjects research guidelines, student responses to all instruments were voluntary, which resulted in a somewhat small number of respondents; fortunately, due to the depth of information present in open-ended responses, it is acceptable for qualitative thematic analysis to provide impactful findings even with small sample sizes [7]. It was also required that student responses be anonymous, and as such it was not possible to follow up with respondents for additional information. Due to the anonymous and voluntary nature of student responses, it is likely that all four scenarios existed for the population in each of courses at some level: (1) a student took the first survey, but not the second; (2) a student took the second survey, but not the first; (3) a student took both surveys; and (4) a student took neither survey. Since this study probes student perceptions, it is possible that biases and power dynamics exist regarding race, gender, etc. that may impact collected data beyond the tested IT questions. Additionally, the differences in courses studied may have introduced additional variability; for example, students enrolled in Class B were primarily seniors who had already taken other courses with this instructor. It should be noted that due to the nature of this study, many limitations are similar to earlier investigations on the IT method [4-6].

3. Results

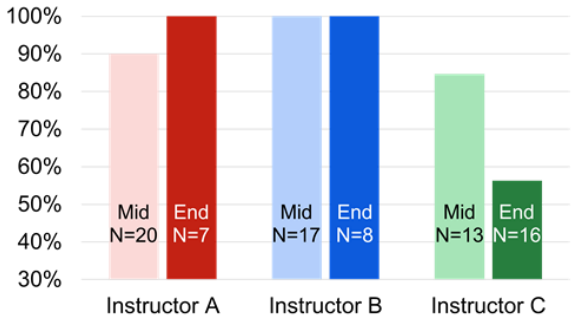
The quantitative results from the pre- and post-surveys (given mid-semester and at the end of the semester, respectively) are organized in Table 2. The percentage of responses indicating “5 (Strongly agree)” or “4” are visualized in Figure 1.

Table 2: The number of responses for each Likert-scale value for the given statement from the mid-semester and end-of-semester surveys.

	Instructor A		Instructor B		Instructor C	
"The instructor is approachable and relatable."	Mid	End	Mid	End	Mid	End
1 (Strongly disagree)	1	0	0	0	0	2
2	0	0	0	0	0	2
3	1	0	0	0	2	3
4	2	0	1	1	4	7
5 (Strongly agree)	16	7	16	7	7	2
"I feel like I know the instructor as a person."						
1 (Strongly disagree)	1	0	0	0	1	1
2	1	0	0	0	0	3
3	2	0	1	0	7	4
4	6	2	6	3	5	5
5 (Strongly agree)	10	5	10	5	0	3
"I believe I am capable of achieving a career in engineering while maintaining a work-life balance."						
1 (Strongly disagree)	1	0	0	0	0	3
2	1	0	1	0	2	1
3	5	1	1	0	3	2
4	6	4	7	2	3	4
5 (Strongly agree)	7	2	8	6	5	6
"I feel like I belong in the Chemical Engineering Department."						
1 (Strongly disagree)	1	0	0	0	0	3
2	0	0	0	1	1	1
3	5	0	2	0	4	3
4	10	4	7	2	5	5
5 (Strongly agree)	4	3	8	5	3	4

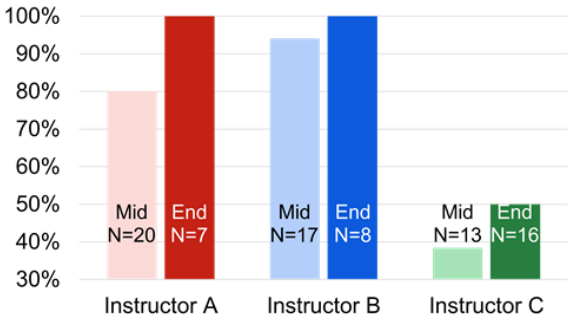
(a)

"The instructor is approachable and relatable."



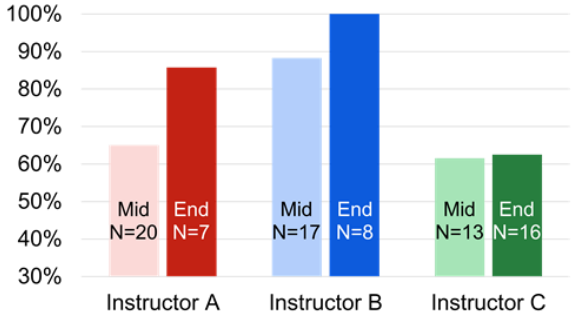
(b)

“I feel like I know the instructor as a person.”



(c)

"I believe I am capable of achieving a career in engineering while maintaining a work-life balance."



(d)

"I feel like I belong in the Chemical Engineering Department.”

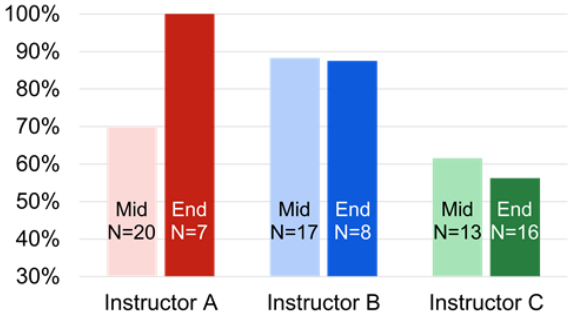


Figure 1: The percentages of survey responses indicating “5 (Strongly agree)” or “4” for the given statement. The number of total responses (N) for the mid-semester and end-of-semester survey are given within the columns of the corresponding data set.

The final code book developed for the qualitative responses is included in Table 3. Twenty codes were established and grouped into categories to aid analysis; these categories include student-instructor relationship, perceptions of engineers/engineering, the classroom experience, and opinions concerning IT. The percentage of code appearances for each category is visualized in Figure 2 for each instructor.

Table 3: Number of appearances of a given code for each instructor.

	Instructor A	Instructor B	Instructor C
Student-instructor relationship			
Category Total	**16**	**16**	**20**
1) Build relationship with / Get to know professor	11	7	14
2) Humanize professor / make them relatable	0	6	3
3) Instructor as role model	1	0	0
4) Improve instructor approachability	4	3	3
Perceptions of engineers/engineering			
Category Total	**9**	**12**	**4**
5) Showcase individuality of professor / "we're not stereotypes"	2	3	0
6) Improve knowledge about ChE careers	2	1	2
7) Work-life balance realizations	1	7	2
8) Normalize unique paths	4	1	0
The classroom experience			
Category Total	**23**	**35**	**28**
9) Building community / warm environment	2	7	9
10) Engagement / focus	4	6	4
11) Break / cognitive load management	3	9	4
12) Stress reliever / mental health	1	3	2
13) Enjoyable / fun / interesting	9	7	5
14) Career motivation	2	3	4
15) Empowering students to express themselves	2	0	0
Opinions – worth it/minimal time			
Category Total	**4**	**5**	**12**
16) Keep doing it! / worth it	1	2	3
17) Minimal time investment	3	3	9
Opinions - neutral or negative			
Category Total	**4**	**0**	**11**
18) Time could be better spent	0	0	2
19) Distracts from class	0	0	1
20) Did not affect / ambivalent	4	0	8

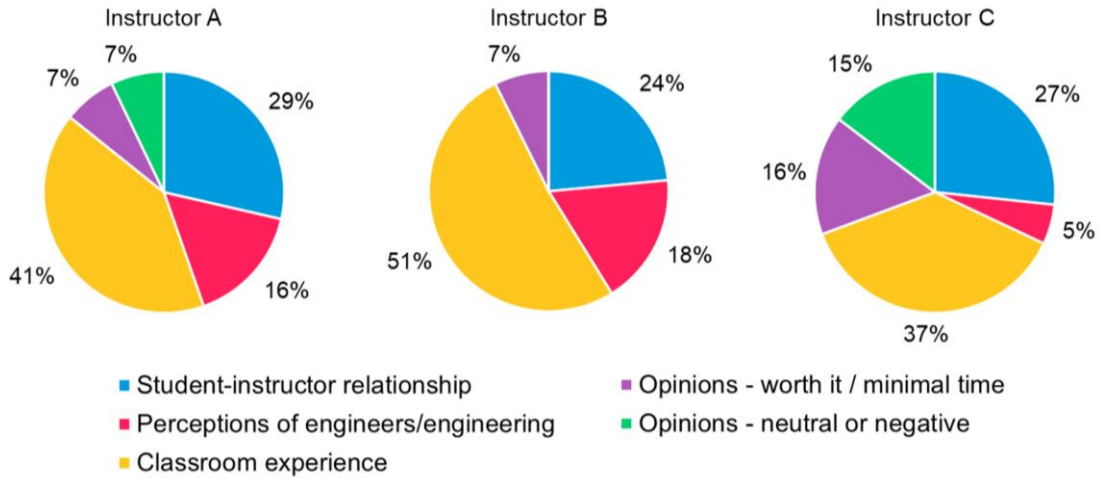


Figure 2: Percentages of total code appearances for each code category for each instructor.

4. Discussion

In general, student responses indicate a positive perception and opinion of the use of IT. Due to the small number of responses, direct comparisons are not definitive but the results inspired meaningful conversations that are shared here.

4.1 Research Question #1: How does instructor use of IT questions impact students' perspectives of (a) instructor approachability / relatability, (b) how well they feel they know their instructor as a person, (c) whether they are capable of achieving a career in engineering while maintaining a work-life balance, and (d) their sense of belonging in the department?

4.1 (a) Instructor approachability / relatability.

Instructor approachability and relatability was measured via both the quantitative and free response questions. The quantitative responses, shown in Figure 1(a), indicate a minimal or even negative effect; however, the initial responses during the mid-semester surveys were already very high for Instructors A and B so there was minimal room for improvement. In the case of Instructor C, the IT topics and generational differences may have contributed to the decreased measurement of relatability. For example, Instructor C noted that when he asked about his favorite science fiction movie, *none* of his students selected his choice – and several mentioned that they had not heard of it. While learning about their instructor, the students may have noticed significant generational differences and perceived such differences as "unrelatable;" however, comments from the free response questions still indicate a positive impact:

> "*When we first did the [IT], I found a new respect for [Instructor C] because he isn't just my MEB professor and he has a life outside the classroom*." (Class C)

While the relatability effects may be more pronounced for younger instructors, positive benefits still extend to experienced instructors as well.

Instructor approachability was specifically brought up by students in the free response questions, with Code 4 (improving instructor approachability) appearing 4, 3, and 3 times for Class A, B, C, respectively. Sample responses are shown below:

> "*This allowed for the students to get to know [Instructor A] more which made asking for additional help or going to office hours seem less intimating than before*." (Class A)

> "*I believe that humanizing the professor makes them more approachable and in turn eases the mental burden on students who may otherwise not want to ask questions*." (Class B)

> "*It makes it easier to approach the professor and talk to other classmates*" (Class C)

These responses indicate that students feel more comfortable asking questions and attending office hours, which speaks to the benefit of using IT questions and instructor approachability.

4.1(b) How well they feel they know their instructor as a person and 4.1 (c) Whether they are capable of achieving a career in engineering while maintaining a work-life balance.

Responses indicate that students feel they know their professor better as a person (Figure 1(b)) and that they feel more confident in achieving work-life balance in engineering (Figure 1(c)) following implementation of IT. Code 1, (Build relationship with / get to know prof), is one of the most commonly appearing codes in the free responses, and code 7 (work-life balance realizations) is also common. Students expressed positive reactions to learning that an engineering career does not require sacrificing other interests and hobbies:

> "*I think it helps me understand that being a chemical engineer doesn't mean that it is your whole life. You have a hobby and life outside of being an engineer*." (Class A)

> "*I enjoyed learning about her college experience, and the fact that she is successful while having a fun college experience makes me more hopeful for my future*." (Class B)

4.1(d) their sense of belonging in the department.

Quantitatively, each class experienced minor but differing effects, as shown in Figure 1(d). Sense of belonging increased for Class A, stayed the same in Class B, and slightly decreased in Class C. The nature of each class may contribute to these observations. Class B, for example, is a senior level class so many students already have established feelings about their sense of belonging in the department. Classes A and C are MEB classes that are often the first class in the chemical engineering curriculum. Students may have stronger feelings of belonging as they learn

more about the major, or they may have the opposite feeling as they discover chemical engineering is not the right path for their career goals. The qualitative responses provide additional insight indicating students appreciate IT:

> "*I think it's nice because I can go off in my career knowing that future colleagues I might have can talk about things besides their profession, and we can work better together from it*." (Class C)

> "*Finding ways that I relate to the instructor makes me feel comfort knowing I share some similarities with another chemical engineer*." (Class C)

Comments regarding role models also highlight that connections built through IT can provide support for students in underrepresented groups:

> "*Having a female instructor who has been so successful in her field as a chemical engineer made me feel much more confident in my own abilities. I really enjoyed getting to know [Instructor A] and I appreciated having her as a role model as a woman in the engineering field*." (Class A).

4.2 Research Question #2: Do students feel that time spent on IT questions would be better spent on course material?

Students overwhelmingly give positive feedback regarding IT during class time. The survey question that directly addresses the time investment, "Do you feel the time spent on trivia questions would be better spent on course material?" was often answered with a simple "no," and no code was assigned to those responses. Some students elaborated further, specifically indicating the time investment was minimal (Code 17) or the break was valuable (Codes 11 and 12). For example:

> "*I feel the time spent on trivia was worth it*." (Class A)

> "*No I find the trivia questions are a nice brain break and way to connect. Finding connection is something we are starting to miss in society*." (Class B)

Very few responses (3 instances of Codes 18 or 19) were negative and indicated no interest in participating in IT:

> "*Very much so. The trivia was pointless and the time would be much better spent on content*." (Class C)

This observation is relatively unique as similarly negative comments were not identified in previous studies. As the number of instances is so low, the source is likely just one or two responders, and even within the same class, negative responses were far outnumbered by those

who believed the time investment did not impact the course material and felt the class was benefiting from IT:

> "*My instructor does a good job on covering the material so no*." (Class C)

> "*No I think this helped everyone feel more engaged in class*." (Class C)

While a vanishingly small number of students may not be interested in IT, most students perceive the time investment as minimal and valuable.

4.3 Research Question #3: How does instructor use of IT questions impact student perceptions of being a chemical engineer?

Positive effects on student perception of work-life balance and of belonging in chemical engineering have previously been discussed, but additional student comments highlight the impact on motivation and excitement towards their future careers:

> "*It allowed me to see that there are different career paths out there, through a chemical engineering degree. It also taught me that I can be who I am, without having to alter myself to fit into a stereotype for engineers. If anything, it made me more eager to become a chemical engineer!*" (Class A)

> "*Getting to know the instructor makes it easier to believe that I can become a chemical engineer. When instructors are on pedestals it makes the knowledge they possess seem unobtainable. But when we learn that our instructors spend their weekends hiking, maintaining a garden, or even that they did bad on a test during their undergraduate degree it breaks down some barriers that are not helpful when it comes to learning*." (Class B)

> "*Makes everything a little more personal. [Instructor C] is another person just like all of us, makes everything feel a little more obtainable. I also feel more comfortable talking to [Instructor C], whether that be for guidance or for help with class work*." (Class C)

4.4 Research Question #4: Are there any differences in student perceptions of instructor use of IT questions between (a) brand new, (b) early career, and (c) highly experienced faculty members, and how do these perceptions compare against previous work which examined mid-career faculty?

While minor differences were observed in the quantitative data, the low response rate and variability among the three courses limited the conclusions that can be drawn. Student comments provide stronger insight into the effects of IT, and feedback was overwhelmingly positive for all three instructors, similar to the positive response in previous work. While some results may

indicate the impact may be stronger for younger instructors and those of underrepresented groups, positive benefits were observed in all studied cases.

Figure 2 illustrates the categories of codes that appear most frequently for each instructor. The distribution is similar for the three instructors of diverse experience levels: the majority of observed codes fall under "The classroom experience" category. Table 3 details the codes within this category, with the most common codes being Code 13 (Enjoyable/fun/interesting) and Code 9 (building community/warm environment). For all three instructors, approximately one quarter of observed codes fell under the student-instructor relationship. Students perceive IT to improve their connection to their instructor and to contribute to a more enjoyable, engaging class.

5. Conclusions and Future Work

Previous studies have shown positive outcomes and student reception following the implementation of voluntary, ungraded multiple-choice questions about the interests and hobbies of their instructors during breaks in lectures. The present study investigated whether the observed outcomes extend to instructors of diverse experience levels, including a new tenure-track professor, an early career assistant teaching professor, and a tenured professor with decades of experience. The student response rate was relatively low for the post-intervention surveys, and future studies may try to increase response rate by providing time during class or even incentives like gift cards if funding is available.

Student feedback was strongly positive for all three instructors, but observations not seen in previous studies prompted additional discussion and directions for future work. Following implementation of instructor trivia, student perception of instructor relatability decreased slightly only for the experienced tenured professor. This outcome may be due to generational differences as the interests of the instructor may have less anticipated overlap with those of his students, while the younger instructors may have more relatable interests. The types of questions asked could also contribute to the observed outcome as some instructor trivia may be more impactful for students; future studies may try standardizing questions to directly investigate the effect of generational differences.

Student comments highlighted the personal impact of developing the student-instructor relationship through instructor trivia. In addition to students indicating they felt more comfortable asking questions in class or office hours, several instances of students feeling more motivated to pursue engineering or more comfortable expressing themselves were identified. Further, a student comment specifically mentioned that learning more about their female instructor, whom they saw as a role model, made them feel more confident in their own abilities, indicating instructor trivia may have a particularly strong impact for underrepresented groups. Future studies may include questions to specifically investigate this connection.

Overall, the greatest impact appears to be on the classroom experience: the most common feedback was that students enjoyed instructor trivia and appreciated the mental break from course content. Students found that the trivia helped class engagement and prompted connections with both the instructor and with each other. While there are many variables for further study, these results are consistent with previous studies showing that students find value in instructor trivia.

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