

Use of Top Hat Questions to Build Classroom Community and Improve the Student-Teacher Relationship

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1. Introduction

Top Hat is one of many services that enable instructors to poll students in the classroom with questions; students provide answers via their smartphones, and the instructor can display the class's responses for everyone to see. Typically these questions are technical / educational in nature, such as conceptual quizzes on course content. However, the author has recently researched the use of these services toward improving the student-teacher relationship through asking questions unrelated to coursework, specifically trivia questions about the instructor's personal life (e.g. the music or games they enjoy) [1]; it was found in this prior work that students were delighted by these "Instructor Trivia" questions and appreciated the opportunity to get to better know their instructor. This enhancement of the student-teacher relationship is valuable for many reasons, but is particularly important in the post-pandemic landscape of modern education since a number of studies have shown student-teacher relationships unfortunately eroded during remote learning [2-6].

Student perspectives of classroom community with their fellow students were similarly impacted in a negative way by the pandemic. For instance, a number of faculty have reported poor in-person student attendance since class returned from remote learning, and it has been found that in many cases students will not attend class if recorded lectures are available for asynchronous viewing [7]. This is unfortunate, as university courses offer a unique opportunity for students to interact with each other and develop important psycho-social skills [8].

In an effort to build a feeling of community amongst students themselves in addition to strengthening the student-teacher relationship, in the past academic year the author included Top Hat questions aimed at polling students on various topics to solicit their own opinions, which were then presented to the class in aggregate. The goal of this effort was to give an opportunity for students to get to better know each other and build community based on their shared responses. This study aims to examine student perspectives on this practice to determine if this strategy should continue in the future and/or be considered for adoption by other faculty.

2. Methods and Data

2.1. Research Questions

The goal of this research is to understand perspectives of undergraduate chemical engineering students toward the use of ungraded Top Hat questions aimed toward eliciting aggregated student opinions and sparking conversations about their own perspectives, referred to here as "Better Know Your Fellow ChE Students" (BK) questions. These BK questions poll students on

non-technical topics for their opinions, as exemplified in Figure 1. Additionally, it is desired to get feedback on whether students prefer their instructor offer BK questions or Instructor Trivia (IT) questions (as described in a prior work [1]) and exemplified in Figure 2. In short, IT questions refer to Top Hat questions where the instructor asks students a multiple-choice question about the instructor's own life in an effort to help students get to know them and hopefully improve the student-teacher relationship. With this discussion in mind, this study is guided by the following research questions (RQs):

- 1) Do students feel that BK questions helped them better know their classmates and build community?
- 2) Do students feel BK questions should continue to be offered in future semesters?
- 3) If only one of BK or IT questions were offered in the future, which type of questions would students prefer be offered?

Of the options below, what is your favorite type of vacation?	
A	Beach
B	Mountain
C	City
D	Road trip

Figure 1. Example of a Better Know Your Fellow Students Trivia question used in the studied class.

At which of the following games is [the instructor] most skilled?	
A	Pool / Billiards
B	Darts
C	Ping Pong / Table Tennis
D	Mini Golf / Putt Putt

Figure 2. Example of an Instructor Trivia question used in the studied class, with the correct answer highlighted.

2.2. Course Studied

The course studied in this work is a junior-level undergraduate classical thermodynamics course which studies topics such as 1st law balances, entropy balances, and Carnot and vapor-compression cycles. The course is delivered as a twice-a-week 75-minute lecture, and as is typical for courses taught by the author, the course includes active learning activities (e.g. think-pair-share) approximately every 15-20 minutes. A five minute break is provided to students at approximately the midpoint of the lecture on days when there was not an exam scheduled; during this break is when BK and IT questions were posed to the class, and students were free to chat amongst themselves during the break. BK questions were included throughout the semester during the five minute break in Tuesday class sessions, while IT questions were included during the break in Thursday class sessions. Unfortunately demographic information for the studied class is unavailable, so readers should take caution in drawing general conclusions beyond the studied setting.

2.3. Methods

The research methods used in this study are similar to those described in earlier ASEE proceedings [7]. Qualitative data was collected through end-of-semester student course evaluations, which were provided by students enrolled in the studied course on anonymous and voluntary bases through an online survey administered by the university. To facilitate data pertinent to the research questions of the study, the author included these two custom open-ended response questions as part of online course evaluations:

1. This semester [the instructor] included “Know Your Fellow ChE Students” polling questions during mid-class breaks on Tuesdays. Did you find this helped you better know your classmates and build community, and do you think [the instructor] should continue this practice in future semesters?
2. [the instructor] offered short trivia questions about [themselves] during mid-class breaks on Thursdays. If [the instructor] had to choose to offer only one of “Better Know Your Fellow ChE Students” or “[instructor] Trivia” questions in future classes, which type would you prefer (and why)?

The qualitative responses analyzed in this study result from a sample of 27 students who volunteered to provide written responses to the questions above, out of a classroom population of 57 students enrolled in the studied course. Proper human subjects approval was secured as part of this study.

2.4. Data Analysis and Handling

The author notes that data analysis and handling for this study are similar to that used in a prior ASEE proceeding [7]. Thematic coding was employed toward addressing RQ 1, using feedback from students on the first custom course evaluation question. As previously stated, “thematic coding is used to determine common themes or topics which emerge from a number of open-ended responses [1, 7, 9-12]. It is possible (even likely) that multiple themes may be identified within a single response.” The thematic coding strategy was selected since answering RQ 1 involves identifying student perspectives toward the use of the described BK community-building Top Hat questions. When evaluating RQs 2 and 3, the author focused on responses to the first custom course evaluation question (for RQ 2), and second custom course evaluation question (for RQ 3), using the technique of protocol coding. Protocol coding is used when the codes are specified by the researcher rather than emerging from the text [11]. Protocol coding was selected since RQ 2 focuses on the proposition of whether students felt use of BK questions should continue in future semesters; it was expected that the codes assigned to students responses would be “Yes”, “No”, and “Can’t Decide”. Similarly, RQ 3 specifically asks which of the two types of Top Hat questions students preferred; it was expected that the codes assigned to student

responses would be “Better Know Your Fellow ChE Students”, “Instructor Trivia”, “Both/Can’t Decide” or “Neither”.

When analyzing the responses toward investigating RQ 1 using thematic coding, the author evaluated each student response to the first custom course evaluation question listed above. Themes existent in student responses were recorded in a code book maintained by the author. Data handling for this thematic coding exercise involved identifying relevant passages of text and assigning a relevant code associated with the themes emerging from the text. Initially, one code book was kept by the author upon the first time reading the responses. Next, the author consolidated similar codes to develop a master code book. This master code book was then used during a second time reading the responses, and codes from this master code book were assigned to appropriate portions of the text responses.

When analyzing responses toward investigating RQs 2 and 3, the “master” code book was developed as described above for protocol coding of the responses. The author then sorted student responses into each of the predetermined code “buckets” and kept track of the tally.

2.5. Positionality

The author of this study is a middle-aged white male who has been teaching university chemical engineering courses for over a decade. This was their first time teaching the classical thermodynamics class analyzed in this study. They approach this study from the perspective of an educator who loves to teach, but feels disappointment (and perhaps sorrow) over their own perceptions of how student interactions have changed since the COVID-19 pandemic. They feel that prior to the pandemic students were more interested in classroom interaction amongst themselves as well as their instructor, whereas currently they feel many students would prefer to watch lecture recordings rather than interact with their instructor and fellow students in the classroom. The author has become interested in devising ways to improve student-teacher relationships and classroom community to repair these important personal connections, and this study represents one step toward better understanding student perspectives toward these emerging practices.

2.6. Limitations

A key limitation of this study is the practice of only the author coding qualitative responses. It is typical for rigorous research studies to use multiple coders with a goal of improving research outcomes and reducing bias [13], but this study represents an early look into an ungraded “soft” classroom practice and the author decided not to employ this more rigorous practice for this investigation. Since the sole coder was also the author of this study, as well as the instructor of the studied course, it is possible that conscious and unconscious bias related to their experience teaching the course may cloud research findings. Only a fraction of students provided qualitative feedback and due to the nature of anonymous course evaluations follow-up questioning is not

possible. Finally, student perspectives may be colored by their perception of the instructor and associated power dynamics related to respective backgrounds. Studies have shown that gender bias exists in student feedback through (e.g.) course evaluations [14], and results of this study should be digested by readers with the knowledge that the author/instructor is a middle-aged white male with the reputation amongst students of being a “fair, but tough” instructor. It is possible that student perspectives on the studied practice, and resulting effects impacting the classroom dynamic, may change for faculty (and students) of various backgrounds, race, gender, age, etc. which were not studied here.

3. Results and Discussion

3.1. Research Question #1

The first research question is related to the student views on the goal of improving their sense of classroom community. There were two themes which were most prevalent in thematic coding of student responses. The first of these themes was **“Building Community/Meeting People/Starting Conversations”**, which was identified 11 times. This code was assigned to a student text response which directly or indirectly mentioned that the BK questions helped them meet other students, initiate conversations with students around them, or intimated that the BK question practice improved their sense of classroom community. Examples of these described responses are:

“(…) it sparked conversations between us and made it more like we were friends than just classmates.”

“(…) it helped me get to know more of the people in the class in a fun and light-hearted way.”

“I think this helped the students feel more comfortable with one another.”

The other primary theme which also appeared 11 times across the data set was **“Fun”**. This code was applied when a student response specifically referenced the BK questions as being enjoyable. Examples of such student responses were:

“(…) it was fun to see the consensus of the questions (…)”

“I found this practice to be very enjoyable (…)”

“I enjoyed them, very fun.”

The next-most common theme emerging during investigation of Research Question 1 was **“Break”**, which was identified seven times in the data set. This code was selected for text which referenced the fact that the BK activity provided an activity differing from technical coursework, such as in these responses:

“(...) it was a good method for resetting class engagement.”

“[it was] an excellent interactive break (...)”

“[it was] a nice way to refresh the student’s brains for the latter half of class.”

The unexpected theme of **“Foster Inclusive Environment”** was identified three times in the data set. This theme was coded for student responses that indicated that students felt the BK questions and discussion fostered a more inclusive classroom environment. Examples of these comments were:

“I think [the instructor] tries to foster an inclusive environment even in larger lectures, and these polling questions helped that.”

“This definitely helped us learn the inclusive environment [the instructor] wanted to teach us in.”

These results show that using BK questions offers clear benefits toward getting students to converse with each other and meet new people – this is an apparent indication of improved classroom community. Students also appreciated the break from technical material to change their perspective toward doing something they viewed as enjoyable, which aligns with research in cognitive load theory [15].

3.2. Research Question #2

Research Question 2 of this study relates to whether students in the studied sample felt the practice of offering BK questions should continue in future semesters. Results from protocol coding of the first custom course evaluation question using the codes previously described in Section 2.4 are given in Table 1. As observed in Table 1, students in the sample unanimously felt that the author/instructor should continue this practice in future semesters. Supporting comments in this regard are:

“Loved them, always continue doing them!”

“Yes (...) I honestly wish more of my professors would do something like this.”

Based on the results shown in Table 1, students overwhelmingly felt the BK question practice should continue in future semesters.

Table 1. Results of protocol coding of Research Question 2, “Do students feel BK questions should continue to be offered in future semesters?”

Yes	No	Can’t Decide
27	0	0

3.3. Research Question #3

Research Question 3 of this study relates to whether students preferred the BK questions described here, or the IT questions described in a prior work [1] during the mid-lecture break during the 75-minute class period. Results from protocol coding of the second custom course evaluation question using the codes previously described in Section 2.4 are shown in Table 2. Table 2 shows that students were somewhat split between which type of questions with which they prefer to engage in the breaks, though no responses indicated that the practice should be discontinued, as may be expected from the results discussed in Section 3.2. Example comments describing these mixed feelings are given below:

“It was more fun to try to guess things about [the instructor], and exciting when we got it right!”

“I engaged with more classmates for [Instructor] Trivia (...) we turned it into a bragging rights competition.”

“Better Know Your Fellow Students because it gives us a better chance to talk amongst ourselves and get to know the people around us.”

“I would choose “Better Know Your Fellow Students” narrowly above [Instructor] Trivia purely for the reason that it could have a wider availability of subjects (...)”

“I think the mix of both was perfect.”

The results shown in Table 2 indicate that if only one type of question can be offered in the future, that Instructor Trivia question would please the most students. However, based on the findings of this work it is clear that students enjoy BK questions in addition to their previously-found fondness for Instructor Trivia questions [1]. These results encourage offering both types of questions in courses moving forward.

Table 2. Results of protocol coding of Research Question 3, “If only one of BK or IT questions were offered in the future, which type of questions would students prefer?”

Better Know Your Fellow Students	Instructor Trivia	Both / Can’t Decide	Neither
7	17	3	0

3.4. Concerns and Future Work

The results of this study indicate that the practice of offering BK and IT questions are well-received by students. However, there are many avenues of research around this practice which require further investigation beyond the scope of this work. As mentioned in Section 2.6 it is possible that the positive experiences / perspectives described here may change for faculty (and students) with backgrounds and demographics differing from that of the author and the studied class. Since the student feedback collected in this study represents only a fraction of students enrolled in the studied course, it is possible that all students do not necessarily gain of sense of community, and some students may even feel left out if they find they do not share an opinion with their classmates. Framing this work in contexts of academic motivation, intrinsic value, competency of learning outcomes, etc. would also be worthy of investigation beyond sense of community and student/instructor enjoyment. All of these topics represent valuable avenues for future work around the described practices beyond the initial investigation undertaken in this work.

4. Conclusions

This study investigated student perspectives on the use of ungraded Top Hat questions aimed toward improving the sense of classroom community and the student-teacher relationship. The focus of this study was the use of multiple-choice “Better Get to Know Your Fellow Students” questions, which poll student opinions on various topics and present these aggregate polling results to the class. Qualitative analysis via thematic coding of student responses to end-of-semester course evaluation survey questions showed that students felt the practice was effective toward building community through sparking conversations with students around them with whom they may have otherwise not engaged. Students also indicated they thought the questions represented a fun break from the technical material taught in the studied thermodynamics course. A fraction of students also gave responses showing that they felt the questions fostered an inclusive classroom environment. It was found that students overwhelmingly thought that offering Better Get to Know Your Fellow Students questions should continue in future semesters. When asked which type of ungraded Top Hat question students preferred between Better Get to Know Your Fellow Students versus trivia questions about their instructor’s personal life, opinions were split; the author expects to continue offering both types of questions

in future course as a way to improve classroom community and the student-teacher relationship in the post-pandemic learning environment.

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