

The Rotating Front Row Increases Student-Reported Participation during Discussion

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INTRODUCTION

Didactic lecture is a prevalent means of teaching undergraduate science, technology, engineering, and math (STEM) courses (1). Discussion is one of the most common methods used to engage students, particularly in large-enrollment classes. Voluntary student participation is a quick and easy metric of student engagement, yet discussion is inequitable when reliant on voluntary participation. Gender gaps exist within large science classes, with male-identified students participating at a disproportionate rate compared to female-identified students (2). Equitable student participation occurs if all students have an opportunity to speak and be respected (3). Rubrics which assess and assign point values to discussion are often used for this purpose.

Yet students choose to lose points rather than participate in discussion. Students may dread the class and negatively associate their experience with the content and/or the instructor. Penalization for lack of participation fails to address causes which inhibit student participation, such as perceived lack of confidence or knowledge, imposter syndrome, self-consciousness, mental health disorders (4), or cultural differences. Mandatory discussion can create a biased classroom culture which rewards confident students while marginalizing students that struggle with public speaking. There exist few published techniques to encourage student participation while mitigating anxiety regarding verbal participation.

One equitable participation technique is cold-calling, defined as calling on a student that has not cued a willingness to participate (i.e., has not raised their hand). This technique causes dread in many students (5) and instructors alike, yet a high frequency of cold-calling increases voluntary student participation over

time (6) and increases overall student performance without decreasing student satisfaction within a course (7).

This study addressed how to increase participation within class discussion while easing student distress surrounding verbal participation. The rotating front row (RFR) blends inclusivity and mandatory participation. This technique assigns students to several lecture periods in which they are expected to contribute to class discussion and scored for participation in an “all-or-none” fashion. The RFR differs from the cold-call approach, as students determine when (within a given time frame) to participate. Informed students plan, practice, and study the material to alleviate anxiety surrounding participation. The RFR ensures equity in student participation, as all students are expected to contribute to class discussion.

PROCEDURE

The RFR is a flexible technique with a time requirement determined by the amount of time allocated to course discussion. Students were given guidelines and a schedule (see Appendices S1 and S2 in the supplemental material). Students were assigned three lecture periods in which they could participate in the RFR. Within a 50-min lecture, 10 to 15 min was spent on the RFR, with approximately 10 students participating. Student time spent preparing for the RFR varied from no outside preparation to >30 min reviewing course content (as reported by students). This exercise was tested in lectures, but it will work in a laboratory, field, hybrid, or online course in which participation contributes to student grades.

The RFR was tested in 2019 with nonmajors (LIFE205 Microbial Biology) and microbiology majors (MIP250 Eukaryotic Microbiology). Sixty-six LIFE205 students participated on the RFR over 21 sessions (the RFR was unavailable for 16 sessions), with a 92.4% completion rate. Participation in the RFR was worth 1.25% of the total grade. Seventy-six MIP250 students participated on the RFR over 17 course sessions (the RFR was unavailable for 16 sessions), with a 93.4% completion rate. Participation in the RFR was worth 1.1% of the total grade.

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TABLE 1

Categorization of positive and negative student responses to survey question 1, “Consider the rotating front row; did participation in the rotating front row encourage you to participate more during lecture (either in this class or another class)?”

Positive responses	Authentic participation: participation led to more engagement with the course (either a better understanding of the material or more participation from students)	Authentic to complicit participation: more likely to participate in future courses or sessions after completion of RFR, yet still focused on earning points	Complicit participation: participation was to earn points or save face by answering correctly or knowledgeably
Negative responses	Regular participation: no increase in participation due to previously high levels of participation	Inhibited participation: anxiety about sharing incorrect answers or nervousness regarding public speaking	Unhelpful for participation: RFR was an unhelpful method to increase participation

A learning assistant (a student not enrolled in the course yet attended all sessions) tracked student participation. Students that answered with insufficient (typically one-word) answers were prompted to elaborate their response or given the option to participate with a different response. A participation rubric could be adapted for use in the RFR but was not used during field testing. All participants earned credit for the RFR. Students were surveyed at the end of the semester about their perceptions of participation and learning when engaged in the RFR. (The survey is in Appendix S3). Instructor guidelines are discussed in Appendix S4, and potential modifications to the RFR are discussed in Appendix S5. A potential grading rubric is described in Appendix S6.

Ethics statement and safety issues

There are no known safety issues with the RFR. This research was given an exempt status through the Research Integrity and Compliance Review Office. The IRB protocol number is 19-8974H.

Data analysis

Student responses were categorized as either positive (indicating that the RFR was beneficial) or negative (indicating that the RFR was not beneficial). Positive and negative responses were further subcategorized (Tables 1 and 2). Categorized student responses are available as a supplemental file (see Appendices S7 and S8).

Survey results

A majority of LIFE205 (77.1%) and MIP250 (76.1%) student responses indicated the RFR encouraged more participation during discussion (Table 3). Authentic participation was reported in 39.3% (LIFE205) and 39.4% (MIP250) of the responses. Many authentic responses mentioned moving out of comfort zones or an increased comfort with speaking in front of the class. Sample responses include “I don’t usually answer questions in class but after doing the RFR I felt more confident to speak up. It also helped hearing other people contribute” and “. . .creating a safe welcoming environment to answer questions I felt more inclined to participate.” Authentic to complicit participation was reported in 13.1% (LIFE205) and 14.1% (MIP250) of responses. Such responses indicated that the RFR was helpful, but the motivation to participate was based on earning points or saving face. One such response stated “The RFR did encourage me to participate more during lecture because it gave me the extra ‘nudge’ to speak up when I normally would not. It was also nice to have that extra grade in the gradebook.” Complicit participation was reported in 24.6% (LIFE205) and 24.0% (MIP250) of responses, which indicated students participated solely to earn points or save face. Example responses included “. . .only to achieve the points because they were easy points” and “. . .even though I often knew the answer to the question, I would not raise my hand for fear of being wrong.” Negative responses (indicating that the RFR did not increase participation) were reported by 23% (LIFE205) and 24% (MIP250) of student respondents. Of the negative responses, 9.8% (LIFE205) and 8.5% (MIP250) of respondents indicated no increase in participation due to previous high

TABLE 2

Categorization of positive and negative student responses to survey question 2, “Consider your turn on the rotating front row; did you better understand the lecture material covered during your turn on the rotating front row (in comparison to material covered on days when you were not part of the rotating front row)?”

Positive responses	Authentic understanding: students better understood course material when participating in RFR	Complicit understanding: students understood course material better to earn points or answer correctly	
Negative responses	Always understood: did not better understand material because always understood material	No difference: no change in understanding of material when participating in the RFR	No benefit: the RFR was of little educational use

TABLE 3
Survey question 1 student responses by course

Category	LIFE 205 (spring 2019)		MIP 250 (fall 2019)	
	Count	% ^a	Count	%
Response rate	61	92.4%	71	93.4%
Total positive responses ^b	47	77.1% (0.71)	54	76.1%
Authentic participation	24	39.3% (0.07)	28	39.4%
Authentic to complicit participation	8	13.1% (0.07)	10	14.1%
Complicit participation	15	24.6% (1.49)	16	22.5%
Total negative responses ^c	14	23.0% (0.71)	17	24.0%
Regular participation	6	9.8% (0.92)	6	8.5%
Inhibited participation	5	8.2% (1.84)	4	5.6%
Unhelpful for participation	3	5.0% (3.47)	7	9.9%

^aStandard deviations are shown in parentheses and were based on percentages.

^bPositive responses were categorized as follows: authentic participation (responses indicated that the RFR increased understanding of the course material or increased participation), authentic to complicit participation (responses indicated an increased likelihood to participate after the RFR yet still focused on points), and complicit participation (responses indicated participation in the RFR to earn points or answer knowledgeably).

^cNegative responses were categorized as follows: regular participation (no increase in participation due to previous high levels of participation), inhibited participation (anxiety about public speaking or sharing incorrect answers), unhelpful for participation (the RFR was an unhelpful method to increase participation).

levels of participation, 8.2% (LIFE205) and 5.6% (MIP250) reported feelings of anxiousness about answering incorrectly or public speaking, and 5.0% (LIFE205) and 9.9% (MIP250) found the RFR to be an unhelpful method to increase participation. Sample negative responses included “Not really, I’m super shy and only participate if I have to” and “. . .because I participate a lot anyways despite the RFR.”

A slight majority, 55.7% of LIFE205 and 55.1% of MIP250 students, indicated increased understanding of the course material while participating in the RFR (Table 4). Authentic understanding was reported by 39.3% (LIFE205) and 37.7% (MIP250)

of respondents. Such responses frequently cited studying notes or practicing the course material prior to class to better understand and prepare for discussion. Sample responses include “It helped me understand the lecture material before and after class. I was able to come prepared and practice the material. . .” and “It made me review my notes before coming to class.” Complicit understanding was reported by 16.4% (LIFE205) and 17.4% (MIP250) of respondents, indicating an increased understanding of the material to earn points or answer correctly, such as, “Yes, as I had to think of a question to ask about the material or to understand the material enough to answer a

TABLE 4
Survey question 2 student responses by course

Category	LIFE205 (spring 2019)		MIP250 (fall 2019)	
	Count	% ^a	Count	%
Response rate	61 ^b	92.4%	69	90.8%
Total positive responses ^c	34	55.7% (0.42)	38	55.1%
Authentic understanding	24	39.3% (1.13)	26	37.7%
Complicit understanding	10	16.4% (0.71)	12	17.4%
Total negative responses ^d	25	41.0% (2.76)	31	44.9%
Understood always	9	14.8% (1.48)	9	12.7%
No difference in understanding	11	18.0% (2.48)	10	14.5%
Unhelpful for understanding	5	8.2% (4.95)	12	17.4%

^aStandard deviations are shown in parentheses and were based on percentages.

^bDiscrepancy from survey question 1 for MIP250, as one response was blank and the other response indicated the student did not remember.

^cPositive responses were categorized as follows: authentic understanding (better understanding of course material when on the RFR) and complicit understanding (better understanding to earn points or answer correctly).

^dNegative responses were categorized as follows: always understood (did not better understand because always understood), no difference in understanding (no change in understanding of the material when participating in the RFR), and no benefit (the RFR was of little educational use).

question.” Negative responses were reported by 41.0% (LIFE205) and 44.9% (MIP250) of respondents. Within these negative responses, 14.8% (LIFE205) and 12.7% (MIP250) indicated no increase in understanding of the course material due to study habits employed beyond the RFR, 18% (LIFE205) and 14.5% (MIP250) indicated there was no difference in their understanding of the material due to the RFR, and 8.2% (LIFE205) and 17.4% (MIP25) indicated that the RFR held no educational benefit or increased understanding of the material. Example negative responses included “I did not notice a difference, but that has to do with study habits and work ethic,” and “No, because I always speak up in class.”

CONCLUSION

Engaged students reap the most benefits from their education. Engagement in STEM fields is positively linked to critical thinking skills (8), student persistence (9), and better grade outcomes (10). New pedagogical techniques are required to address the population shift in higher education from traditional (categorized as 19 year olds, newly graduated from high school, most from families of medium to high sociocultural status) to nontraditional students (11). Nontraditional students face higher attrition rates and may benefit from pedagogical techniques that leverage and include their unique backgrounds (11). Other engagement techniques, such as the think-pair-share, are known to increase student comfort with material and increase student participation in discussion (12). The RFR is another student-centered technique which sets an expectation of participation in an inclusive environment.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

SUPPLEMENTAL FILE 1, PDF file, 0.3 MB.

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