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Student Surveys: What Do They Think?

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5.1 Introduction

Many individual faculty have surveyed their students about classroom voting, and they generally report positive results. How robust are these results across a wide variety of students, campuses, instructors, and courses? In this study, a total of 513 students in 26 classes were surveyed regarding the use of classroom voting in their classes. (See Appendix A for the survey form.) Fourteen instructors from ten different schools participated. The classes surveyed were primarily freshman and sophomore level courses in calculus, multivariable calculus, linear algebra, and differential equations. While several questions show the variation in response that one might expect, other questions generate consistent results, showing that student opinion in these areas is uniform across many variables.

5.2 Aggregate Results

The aggregate results are overwhelmingly positive. 93% of the students surveyed say that voting makes the class more fun. While having fun certainly does not equate to learning, it is a good first step and tends to encourage attendance. 90% of the students say that voting helps them engage in the material, and 84% say it helps them learn.

Students love examples and always seem to be clamoring for more. About half of the students surveyed (48%) say that they would be better prepared for the homework and exams if the instructor did more examples on the board and less voting. Given that students are so enamored of examples, this response is not unexpected. Indeed, the fact that half of the students *don't* think that more examples would prepare them better than the voting does seems to be a very positive result. Supporting this idea, 74% of the students said that the amount of voting in their class should remain the same or be increased.

Question	Max % voting Yes	Min % voting Yes	Mean % voting Yes	Standard Deviation %
1. Does the voting help make the class more fun?	100	67	92.5	8.4
2. Does the voting help you engage in the material?	100	70	89.3	9.4

Table 5.1. Questions with smallest variation in survey results

Classroom voting is frequently conducted by having the students discuss a question in a small group, vote, and then participate in a Socratic discussion where the instructor asks individual students to explain their vote to the rest of the class. Some instructors hesitate to put students on the spot by calling on individuals, but 74% of the students indicate that they feel comfortable being called on to explain their vote. Furthermore, the discussion is frequently allowed to continue for several minutes, providing the students with the opportunity to converge on the correct answer themselves, before the instructor confirms the correct answer. Only 24% of the students said they would learn better if the teacher just explained what the right answer was, instead of spending time with discussions after each vote. The value of that discussion has been clearly demonstrated [58], and students recognize the importance as well.

Perhaps most telling of all, 77% of the students surveyed say that given the opportunity, they would choose a voting section of a mathematics class over a non-voting section.

5.3 Course-by-Course Results

When studying the survey results for individual courses, we find that the responses to some questions vary little from course to course, while others vary significantly, perhaps indicating that the response is sensitive to the instructor's teaching style, experience, or some other aspect of the course. Summary statistics are presented in this section, with supporting details in Appendix B.

Table 5.1 presents the results from questions 1 and 2. Here, the "Mean" column is the simple average of the proportion of "yes" votes among the 26 individual classes, and the "Standard Deviation" column is the standard deviation of those proportions. Thus, because we have not weighted these means by class size, they are slightly different than the overall proportions of students discussed in the preceding section.

Questions 1 and 2 show the least variation in results. Regardless of the setting, students universally find that voting makes class more fun and helps them engage in the material. Thus, anyone looking to liven up their class and engage students would likely benefit from incorporating classroom voting.

Questions 4, 6, and 7 show moderate variation in the results (Table 5.2). Here we see that while usually more than half of the students give a positive response, some classes yield a much better outcome than others. (Note that in question 7, a vote of Yes is actually, in our eyes, a negative response, and so we have italicized this row.) These results indicate that something specific to the course or instructor may be impacting the students' satisfaction with classroom voting. The answers to question 4 would be expected to vary based on how the voting is used in class. Answers to questions 6 and 7 likely vary based on the instructor's style and personality.

Question	Max % voting Yes	Min % voting Yes	Mean % voting Yes	Standard Deviation %
4. Does the classroom voting help you learn?	100	57	84.0	11.5
6. Do you feel comfortable being called on to explain your vote to the rest of the class?	94	48	74.5	11.8
7. Would you learn better if the teacher just explained what the right answer was, instead of spending time with discussions after each vote? (<i>Note that a Yes vote does not support the use of clickers.</i>)	48	0	23.8	10.8

Table 5.2. Questions with moderate variation in survey results

The remaining questions, 3, 5, and 8, show wide variation in the responses (Table 5.3). Note that in question 3, a vote of Yes is actually a negative response, and so we have italicized this row as well. Here differences in instructor style, implementation of classroom voting, and other course specifics are certainly at play, impacting whether students view classroom voting positively or negatively. The widely varying responses to all three of these questions indicate that there is much work to be done in understanding the best practices of classroom voting pedagogy and in training faculty to execute it to its greatest potential.

Clearly the responses to question 5 critically depends on how much voting is currently being used, and as this varied considerably among the 26 classes in this study, it is not surprising to see so much variation in student responses to this question. Further, the responses to question 3 depend on this issue as well: If voting is being used extensively, then students will be likely to see fewer examples done on the board, and thus will vote yes on this question. Yet it is still interesting to note that even those classes where majorities of students asked for more examples in question 3 and for less voting in question 7, there were still strong majorities agreeing that voting is fun and helps them engage in the material as indicated by questions 1 and 2.

Question 8 may be the most powerful, in that it asks the students to evaluate voting overall, and decide whether they would prefer a class with voting over one without. The mean response to this question is very positive with 74% saying that they would choose voting, although there is strong variation on this point. There were only three classes that had fewer than 60% of students respond favorably to question 8. Interestingly, we find no common characteristics, as they were three different courses taught at three different schools by instructors with varying degrees of experience using voting.

Question	Max % voting Yes	Min % voting Yes	Mean % voting Yes	Standard Deviation %
3. Would you be better prepared for the homework and exams if the instructor did more examples on the board and less voting? (<i>Note that a Yes vote does not support the use of clickers.</i>)	90	12	50.2	21.7
5. How do you think that the amount of voting used in this class should change? (Yes = Increase/remain same)	100	33	73.8	16.2
8. Suppose that two sections of a math class were offered and one would have classroom voting, while the other would not. Which would you choose? (Yes = Voting)	100	20	74.4	17.7

Table 5.3. Questions with wide variation in survey results

5.4 Student Focus Groups

In an attempt to gain deeper insight into student reactions to classroom voting, several focus groups were conducted with students at Carroll College. Student comments in these small-group sessions support the findings from above and bring up other issues as well.

In all of the classes at Carroll College that use voting, the professors call on students by name to participate in the class-wide discussion instead of asking a question of the class as a whole and waiting for volunteers. Students indicate that this practice does cause some stress, but acknowledge this has a positive effect. They say they are motivated by this stress to take the voting seriously and put effort into discussing the question at their tables so that they are prepared to contribute to the class-wide discussion. Part of making students comfortable with this approach is not judging them based on their answers. Says one student, you can “give your opinion and it’s OK” to be wrong.

The focus groups provided some insight into the variation in responses to question 7, regarding the benefit of the post-vote discussion. Students favor short discussions to long, drawn-out discussions. Several said that if none of the

first three or so students called on gives the right answer, then the instructor should just tell the class the right answer. They believe that long discussions waste time and can be confusing, particularly if they go in the wrong direction for a long time before getting on the right track. So the response to question 7 on the survey likely depends on how long the individual instructor tends to let discussions run, and how quickly the instructor helps point the discussion in the right direction. While professors see some value to letting students wander with an idea for a while and sorting it out on their own, there is a limit to how much time students are willing to do this before they become frustrated and confused.

Students also discussed their opinions on how the questions were used in class and whether that usage was effective. They feel the voting questions are the most useful when asked after a short lecture has been given on a new topic. They say they like the feedback they get from the questions, and after voting they are ready to hear any additional information provided by the instructor. Most of the students in the focus groups expressed frustration when the instructor used voting questions to introduce a new topic. They felt unprepared to answer these questions and indicated that those discussions provided the least benefit. The very strongest students, however, tend to like these questions the most, saying that they like the opportunity to think on their own about a new topic before hearing about it from the instructor. The majority of students said that the best class days are ones where about half of the time is spent on lecture and half on voting.

5.5 Conclusion

There are some important limitations to this study. Although the study encompassed 513 students in 26 classes taught by 14 instructors at 10 different institutions, it is important to note that the largest of these classes had only 33 responses to the survey, and thus our results are only applicable to fairly small classes. Further, 14 of the 26 classes were taught at Carroll College, and the majority of the remaining classes were taught at other private liberal arts colleges. Thus we do not view this study as being definitive, but rather as an initial starting point that we hope will inspire further work and greater collaboration as we continue to study these issues.

Acknowledging these limitations, this study shows that the overall positive reaction of students to classroom voting in individual classes is robust across a wide variety of courses and instructors. Students simply have more fun and are more engaged in a course that incorporates voting. The majority of students also indicate that the voting questions and resulting discussion help them to learn, although there is significant variability in the size of that majority. The challenge, then, is to discover the best practices for this pedagogy to maximize learning for all students.

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Appendix A: Student Survey

Project MathQUEST Student Post-Course Survey

1. Does the voting make the class more fun?
Yes / No
2. Does the voting help you engage in the material?
Yes / No
3. Would you be better prepared for the homework and exams if the instructor did more examples on the board and less voting? **Yes / No**
4. Does the classroom voting help you learn?
Yes / No
5. How do you think that the amount of voting used in this class should change?
increased / decreased / remain the same
6. Do you feel comfortable being called on to explain your vote to the rest of the class?
Yes / No
7. Would you learn better if the teacher just explained what the right answer was, instead of spending time with discussions after each vote?
Yes / No
8. Suppose that two sections of a math class were offered and one would have classroom voting, while the other would not. Which would you choose?
Voting / Non-voting
9. What do you like best or least about classroom voting?

10. How could we make classroom voting better? If we wanted to improve the process, what could we do?

Appendix B: Class-by-Class Survey Results

The number shown in the table is the percentage of students from that class voting “Yes” on that question. For question #5, votes of both “increase” and “remain the same” count as a vote of “Yes.” For question #6, a vote of “Voting” is counted as “Yes.”

	Question:	1	2	3	4	5	6	7	8
Class	# Responses								
1	27	92.6	77.8	63.0	74.1	59.3	81.5	14.8	66.7
2	21	90.5	95.2	42.9	90.5	66.7	85.7	23.8	76.2
3	33	93.9	100.0	12.1	93.9	87.9	63.6	27.3	78.8
4	26	88.5	88.5	65.4	80.8	50.0	76.9	38.5	76.9
5	23	95.7	73.9	56.5	56.5	73.9	73.9	47.8	65.2
6	27	92.6	70.4	77.8	59.3	33.3	77.8	25.9	66.7
7	19	100.0	100.0	63.2	100.0	57.9	89.5	15.8	100.0
8	18	100.0	93.8	47.1	93.8	70.6	94.1	11.8	76.5
9	20	85.0	90.0	50.0	80.0	85.0	55.0	30.0	70.0
10	9	100.0	88.9	55.6	77.8	66.7	66.7	22.2	55.6
11	18	94.4	100.0	50.0	88.9	94.4	61.1	27.8	83.3
12	23	100.0	91.3	56.5	87.0	65.2	91.3	17.4	82.6
13	24	87.5	95.8	25.0	83.3	83.3	75.0	16.7	83.3
14	32	96.9	93.8	37.5	90.6	90.6	68.8	28.1	90.6
15	21	100.0	100.0	14.3	100.0	81.0	85.7	14.3	95.2
16	18	83.3	94.4	64.7	77.8	77.8	76.5	44.4	72.2
17	18	88.9	94.4	38.9	94.4	83.3	88.9	11.1	88.9
18	11	72.7	90.9	45.5	81.8	72.7	81.8	36.4	63.6
19	17	100.0	88.2	17.6	94.1	94.1	88.2	0.0	94.1
20	16	87.5	81.3	68.8	81.3	81.3	68.8	31.3	75.0
21	15	66.7	86.7	80.0	73.3	73.3	66.7	26.7	66.7
22	12	100.0	91.7	50.0	91.7	58.3	66.7	33.3	66.7
23	17	94.1	70.6	88.2	64.7	52.9	64.7	23.5	35.3
24	21	95.2	95.2	23.8	95.2	100.0	47.6	19.0	90.5
25	18	100.0	100.0	22.2	94.4	100.0	61.1	11.1	94.4
26	10	100.0	70.0	90.0	80.0	60.0	80.0	20.0	20.0