To Click or Not To Click: The Impact of Student Response Systems On Political Science Courses

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Introduction.

Student Response System (SRS) is the most common term used to describe a variety of electronic devices designed to collect real-time data from students during the course of a class period. No matter what the brand, the basic pedagogical design is the same. The instructor poses a question, the class responds using the response technology, and the results of the responses are recorded and possibly displayed for the class to see. Student Response System technology can allow for significantly greater levels of active learning and participation on the part of the class, and it can allow the instructor to determine, in the fly, what material needs to be covered in greater detail and which material the students already grasp. While there is already significant research demonstrating the effectiveness of this technology in the physical sciences, the lack of studies in the social sciences raise substantial questions about the applicability of the technology in a more qualitative environment. The purpose of the study is to provide an initial examination of the impact of Student Response System technology in the political science classroom and determine if the level of active learning was sufficiently enhanced to justify further implementations.

Recent Literature.

The technology behind Student Response Systems (a.k.a. “clickers”) has existed for decades and has been in use in academia, in one form or another, for nearly fifty years (Lowery, 2006; Judson & Swarda, 2002). While the original purpose of the technology was for focus groups in product marketing, their use in the higher education classroom can be traced back to hardwired units fixed to desks in the early 1960s (Ward, Reeves & Heath, 2003).

Although there are variations in the options available on the devices across vendors, the primary use of the technology is to measure how well students are grasping the concepts during the course of a class. This system of immediate feedback gives the instructor the opportunity to conduct a form of real-time assessment and alter the course materials during the course of the class period. In addition to instant assessments, the clicker can be used for paced quizzes, opinion polls, and a variety of other interactive assessments.

The greatest limitation to the use of Student Response System technology is that the questions must generally be posed in a multiple-choice or true-false format. Even when the technology theoretically offers the possibility for alpha key entry, the amount of time it takes for students to enter even a sentence or

two (let alone the time to assess the answers on the part of the instructor) makes instant assessment nearly impossible. Given this limitation, Student Response System technology has generally been considered best suited for disciplines in which most of the responses are either a single word or a numerical value. These fields, most in the physical sciences, have been the most willing to adopt SRS technology and, as a result, most of the research on the effectiveness of the clickers has been in these fields.

Research on the use of Student Response System technology in the physical sciences has shown a variety of positive impacts in the classroom. Data clearly show that students feel more engaged, are more likely to attend class, and show improvements on test scores and other objective assessments (Draper & Brown, 2004; Guthrie & Carlin, 2004; Elliott, 2003). Compared to traditional lecture classes, research also indicates that students in Student Response System classes are less likely to drop the course, are more likely to read the assigned texts, and are more willing to ask questions of the instructor. Overall course evaluations for the SRS technology are generally overwhelmingly positive.

All of these results are quite consistent across the research and appear to be driven not only by the greater level of active learning on the part of the student, but also by greater levels of involvement by the instructor (Draper & Brown, 2004). As instructors were forced to re-think their courses to incorporate the new technology, their increased involvement appears to have invigorated the students as well. This does raise the possibility that the impact of the Student Response System technology is simply a consequence of the introduction of a novel element to the course rather than a consistent impact of the technology (Draper & Brown, 2004).

The vast majority of university faculty that currently adopt clicker technology teach in more quantitative disciplines, tending to cluster in the physical sciences and in the methodology courses in the social sciences. These more quantitative courses tend to focus on material that has clear right and wrong answers and use process replication to determine learning outcomes. For example, is far easier to construct a multiple choice question addressing Newton's Second Law in a clicker format compared to a question regarding the application of the Second Amendment to a particular court case. This greater level of ambiguity in the topic area requires a greater level of precision and creativity in how the exercises are created and implemented. Even more importantly, it means that the faculty members using clicker technology in political science must make every effort to measure the impact of the technology to ensure

the validity of the information being tested. Given these issues, the research in political science on the use of SRS technology has been extremely limited

In political science, the published research on the use of Student Response System technology is virtually nonexistent. While there exists a scattering of conference papers (such as Lowery, 2006; Kam & Sommer, 2005) and one published manuscript on the implementation of Student Response System technology in law school (Caron & Gely, 2004), there is a clear dearth of research on the use of the technology in political science. While there is a modicum of research in psychology and sociology that may offer some parallels, the overall assessment is clearly that research in the field is lacking (Lowey, 2006).

Methodology.

This project was designed to provide a pseudo-experimental environment in which to test the impact of SRS technology in a large political science class setting. To create both a control section and an experimental section of American National Government, the sections were scheduled at back-to-back times on the same days and taught by the same instructor. [1] Enrollment numbers indicated the sections filled at the same rates and both sections were closed at capacity with a few hours of each other. A brief examination of the demographics of the two sections showed they were essentially indistinguishable in terms of distribution of majors, overall GPA, gender distribution, and year in school. Both sections were assigned the same reading materials and covered all of the same topical materials. The one substantial difference between the sections was that the 9 AM section used clicker technology in the classroom, while the 10 AM section followed a more traditional lecture format. The students were not informed of the nature of the experiment until the first day of the course, and none of the students in the clicker class dropped to join a non-clicker class or vice versa. All of the students were informed that their test results and quiz results would be used, anonymously, as part of a research project through an informed consent letter approved through the Human Subjects Review Board at the University of Wisconsin Eau Claire.

The measurements in this research come from three examinations and eight brief quizzes. For all of the instruments, some questions were drawn from the reading materials and others from the lecture. In addition, each exam contained ten questions (out of forty-five) that were specifically written to draw upon the examples given in the SRS questions. These questions were included to measure the specific impact of

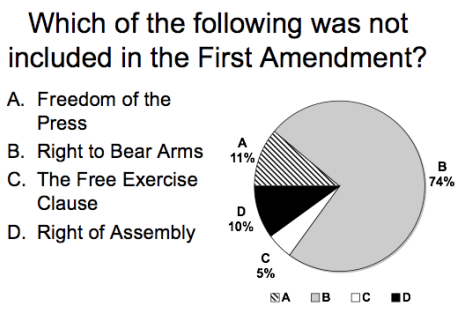
[1] The classes were taught from 9:00-9:50 AM and 10:00-10:50 AM on Mondays, Wednesdays, and Fridays.

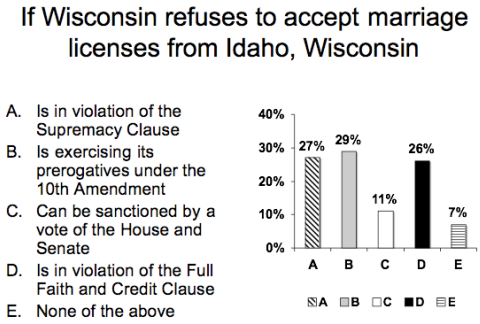
the clicker examples in class. These questions did not simply repeat the SRS questions but drew upon parallel materials to test how well the students could transfer the acquired knowledge. For example, one of the clicker questions asked the class to pick out the correct example of the Free Exercise Clause from the First Amendment, while the exam question asked them to pick out the correct example of the Establishment Clause from the same amendment. Knowing the answer to the SRS question did not give the answer to the test question, but the assumption was that the parallel thought processes would transfer form class to the exam.

Overall, the expectation is that the SRS students will perform better on the test and quiz questions related to the SRS material in class. In addition, the SRS students should not show dramatic improvements on the non-SRS related questions, as that material was covered in the same manner in both sections. If the non-SRS questions also indicate a difference, that is likely caused by real differences between the students in the sections rather than any pedagogical differences. Finally, the results of the common teaching evaluations should find statistically significant differences on the questions regarding interest and engagement.

Pedagogical Techniques.

Both courses were taught using similar formats. The same text was used in both courses and the topical outlines for both sections were the same. In the non-SRS section, the majority of the class period was lecture covering the topic assigned for the day. In the SRS section, the same lecture material was used, but several interactive SRS questions were included in the period. Normally each class period began with one or two brief multiple-choice questions to review either the previous lecture or material from the book. A typical Power Point slide using the SRS technology would look similar to these examples:





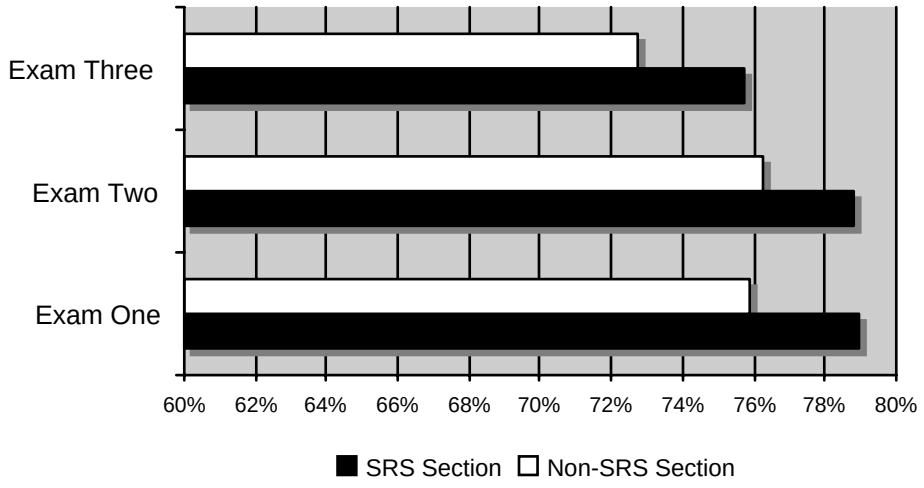
In the first example, a significant majority of the students clearly grasp the content of the First Amendment and the instructor could easily move on to new material. In the second example, it would appear that the students are having difficulty recognizing an example of the Full Faith and Credit Clause. This question might also benefit from a “re-polling” exercise. In this situation, the students are told to talk to the people on either side of them in the lecture hall for thirty seconds to come to consensus about he right answer. The question is then re-polled and the two sets of responses are compared.

The existing research shows that students benefit most from a combination of review questions and opinion questions. To that end, the factual questions, such as those shown above, give more points for choosing the correct answer. In the opinion questions, students were given credit simply for responding to the survey. Through a combination of both types of questions, the class normally answered between four and six SRS responses every class period. At the end of each week, the points were totaled and converted into percentages for grading purposes.

Data and Analysis.

The results of the data analysis show strong support for the use of the Student Response System technology in the classroom. Overall, the clicker class had slightly higher overall average exam scores on all three instruments over the course of the semester, but those differences were not statistically significant.[2]

Figure 1: Mean Exam Scores By Section



[2] Students that did not have recorded grades were dropped from this and all subsequent analyses.

Table 1: Overall Exam Means

	SRS Section (N=112)	Non-SRS Section (N=110)	Difference	t-score	*p#*
Test 1	78.92	75.85	3.07	2.081	0.039
Test 2	78.80	76.27	2.53	2.083	0.038
Test 3	75.74	72.73	3.01	2.031	0.044

Perhaps most intriguing is the consistency of the divisions between the two sections. The results are even stronger for the SRS parallel questions

Figure 2: Mean Exam Scores By Section For SRS Subset

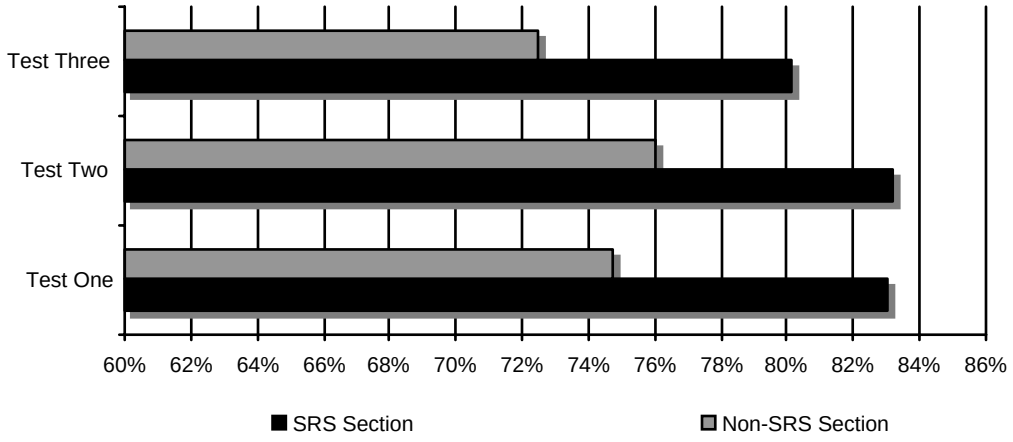


Table 2: Means For SRS Parallel Questions Subset

	SRS Section	Non-SRS Section	Difference	t-score	*p#*
Test 1 Subset	83.04	74.73	8.31	5.205	0.001
Test 2 Subset	83.21	76.00	7.21	4.826	0.001
Test 3 Subset	80.09	72.46	7.63	4.751	0.001

These results show dramatic differences between the two sections. The clicker students performed substantially better than the non-clicker students on the SRS parallel questions across all three exams. The data also indicate that these differences are not simply an artifice created by the clicker section having an overall higher rate of academic performance. The following three tables show the differences between the clicker-paralleled questions and the non-paralleled questions by section.

Table 3: Paired Means Test for SRS and Non-SRS Questions, Non-SRS Section

	Mean	Std. Deviation	t-score	*p#*
Test 1 Non-SRS &Test 1 SRS	-0.52727	3.21610	-1.720	.088
Test 2 Non-SRS &Test 2 SRS	0.22727	3.36648	0.708	.480
Test 3 Non-SRS &Test 3 SRS	-0.17273	3.34790	-0.541	.590

Table 4: Paired Means Test for SRS and Non-SRS Questions, SRS Section

	Mean	Std. Deviation	t-score	*p#*
Test 1 Non-SRS &Test 1 SRS	-4.33929	3.57053	-12.862	0.001
Test 2 Non-SRS &Test 2 SRS	-5.04464	3.23380	-16.509	0.001
Test 3 Non-SRS &Test 3 SRS	-5.08036	3.36152	-15.994	0.001

These results in Table 3 show that in the non-SRS section, the means for the clicker portion of the exam was statistically indistinguishable from the remainder of the exam. Table 4, on the other hand, clearly shows that the SRS class performed significantly better on the clicker questions than on the non-SRS questions.

Table 5: Means Test for SRS and Non-SRS Section on Non-SRS Questions

	SRS Section (N=112)	Non-SRS Section (N=110)	t-score	*p#*
Test 1	74.04	72.36	1.478	0.178
Test 2	74.89	72.69	1.875	0.062
Test 3	71.96	69.95	1.137	0.241

As a final test of the exams, Table 5 shows the mean scores for the SRS and non-SRS sections on the non-clicker questions are statistically indistinguishable form each other. All together, the data up to this point paint a reasonably clear picture showing the clicker technology as having a demonstrable impact on the performance of the students.

The results are further verified by the performance of the students on the quizzes. Each quiz consisted of five multiple-choice questions. Within each set of five questions, one question was written as a parallel to the clicker material in class.

Table 6: Quiz Means, All Questions

	Section	Mean	t-score	*p#*
Quiz Overall	SRS Section Non-SRS Section	76.3036 73.9455	2.592	0.018

Table 7: Quiz Means, SRS Parallel Questions

	Section	Mean	t-score	*p#*
SRS Quiz	SRS Section Non-SRS Section	84.3750 73.5000	6.961	0.001

Table 8: Quiz Means, Non-SRS Questions

	Section	Mean	t-score	*p#*
Non-SRS Quiz	SRS Section Non-SRS Section	75.0750 74.2000	1.467	0.117

The results from the quiz scores mirror the results from the exams. The SRS students performed significantly better on the questions that paralleled the material in class, but there is no evidence to indicate their performance was simply a matter of being better academic performers overall.

Conclusions.

Taken as a whole, these results provide compelling evidence to support the use of Student Response System technology in the classroom. The data show that the two sections were, for the purposes of this analysis, similar. Their statistically identical performances on the questions not related to the clicker material indicate that the increases in their overall exam and quiz grades is a direct product of the use of the clicker technology rather than any innate ability on the part of the students.

At this point in the research, it is clear that SRS technology can make a substantial difference in terms of the overall performance in political science lecture classes. The next step is beginning to assess which types of questions and uses of the technology best serve the needs of political science instructors and students. Now that we can safely ay that SRS technology has a place in the discipline, we must begin to examine how it can and should be tailored to meet our disciplinary goals.

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