The Effects of Technology in an Inclusive Classroom

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Abstract

While some research indicates that the use of technology, such as PowerPoint presentation software and student response systems (SRS), in the classroom improves students’ engagement, enjoyment, and learning, other research suggests that technology provides no advantage. In this study, outcomes were compared for DPS students—students identified as needing varying levels of educational accomodations— and non-DPS students in two sections of an Automotive Technology course. In one section technology was used for instruction and in the other section traditional teaching methods were used. The results showed that the use of technology did not improve students’ learning of the subject matter or enjoyment of the presentation. At the same time, DPS students in the technology section rated their enjoyment of the lesson lower than non-DPS students in the same section. The findings of this study indicate that the use of technology provides no educational advantages for DPS students or non-DPS students.

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The Effects of Technology in an Inclusive Classroom

**Introduction**

**General Statement of the Problem**

With the incredible advance of technology in the last decade or so, educators have endeavored to keep up with modern developments and use the most effective resources in order to assist students’ learning, making older technologies such as overhead projectors nearly obsolete. Considering that the majority of students and young adults are exposed to technology on a daily basis, educators see the inclusion of technology in the classroom as a way of capturing the students’ attention in order to maximize student participation and engagement. Many newer pieces of equipment, such as ELMO projectors and Smartboards, facilitate lessons though ease of access. Teachers regularly undergo training in order to learn how to use this equipment to its fullest capability, ensuring they can fully incorporate it into their lesson plans for maximum student learning. One such new technology is the use of Student Response Systems (SRS) that allow students to quickly answer scaled or multiple choice questions embedded in a lesson, giving the teacher a quick, electronic means of assessing and recording student learning. However, while there is a growing amount of literature claiming that the inclusion of technology in the classroom is a benefit to learning, there is also research that suggests it is not as beneficial as it is assumed to be.

**Review of Related Literature**

In addition to the desired engagement that comes with new technology, the inclusion of SRS devices in the classroom allows active participation while giving students the anonymity to respond to questions freely and truthfully, providing the potential for more accurate assessments. In a study conducted by Stowell, Oldham, and Bennet (2010), researchers found that the use of SRS devices helped to diminish the effect of conformity when responding to questions posed in a classroom environment. The study focused on 128 students. Eighty-six percent were either freshmen or sophomores of a college psychology department where it was believed that students’ responses would show greater variance when students used the SRS devices as opposed to hand-raising. Participants were given one survey at the beginning of the study and another at the end of the study to measure classroom anxiety. The experiment also tracked the students’ responses through both the use of SRS and hand-raising to 50 controversial questions.

As expected, the SRS devices produced a wider range of responses and showed less signs of conformity. Also, the research found that students who experienced classroom shyness had a generally positive experience with the use of the SRS devices, as measured by the post-experiment survey. These results suggest that the inclusion of SRS devices helps engage students, facilitates a sense of security, and promotes honesty in students’ assessment responses.

In a study done by Fortner-Wood, Armistead, Marchand, and Morris (2013), researchers found that undergraduate students had less absenteeism, reported higher levels of satisfaction on class evaluations, and reported higher levels of engagement when SRS were implemented in the classroom. Two sections of a 200-level developmental psychology course and two sections of a 500-level behavior modifications course were randomly assigned to experience either a classroom using SRS or a traditional classroom. In SRS sections, students were asked probing questions on content and opinion throughout the lectures using LCD projections. Students’ responses were tallied using SRS devicesand reported back to the class immediately.

Various sets of data were collected for the study. Attendance records were kept by the professors over the course of a semester. A Communication Apprehension Survey was given by professors to each participant at the beginning of the semester. The final class grades were recorded. At the end of the semester, an Engagement Survey and a Course Evaluation Survey were given to each participant.

The researchers concluded that the findings of this study augment the evidence found by prior researchers regarding students’ experiences and performances in classes using SRS. Students using SRS were more engaged and rated the class and professor higher on class evaluations. Attendance was better in sections using SRS, which would indicate that students using SRS had a higher level of satisfaction compared to students in traditional sections. Undergraduate students in the 500-level section using SRS finished the course with higher grades than undergraduate students in the traditional 500-level section.

Harper (2009) found that undergraduate students in a course implementing SRS with PowerPoint presentations were more likely to maintain a focus on learning, experienced higher levels of engagement, participated at a higher rate, and were more likely to read carefully in preparation for class when compared with students in a course implementing only PowerPoint presentations. Two sections of an undergraduate educational psychology course were randomly assigned to participate in either a class implementing SRS with PowerPoint presentations or a class implementing only PowerPoint presentations. In the classroom using SRS with PowerPoint, high and low-level interactive questions were interspersed throughout presentations over the course of a semester. On the first day of class, students were informed that their participation and success in responding to the above mentioned questions would be included as part of their grade. In each class session, students responded to questions using SRS devices and their responses were immediately reviewed and discussed in class.

Several sets of data were collected for the study. At the beginning of every class session a Likert-scale survey was conducted asking students how carefully they had reviewed the reading assignments on a scale of one to ten. In each section, students’ verbal responses during lectures were tallied by a student volunteer over the course of a semester. Attendance was recorded at each class. Mean scores for four multiple choice examinations were calculated for each section of the class. At the end of the semester, participants responded to a Likert-scale survey which asked how much they enjoyed the class on a scale of one to ten.

Harper (2009) concluded that the interactive climate and immediate feedback promoted by SRS encouraged students to be more actively engaged in learning. Harper points out that carefully reviewing reading assignments, class participation, and regular attendance are behaviors that increase academic success. Undergraduate students in the SRS section had higher mean scores on enjoyment surveys, reading preparation surveys, verbal response tallies, attendance records, and class examination grades.

In a study of collaborative learning conducted by Mavrou, Lewis, and Douglas (2010), an equal number of disabled and non-disabled students were combined in pairs and asked to perform various exercises on computers. Their performance was tracked and compared with the individual accomplishments of the students when working solo. Those conducting the study found that non-disabled and disabled students alike actually performed better when working in pairs. It was speculated that the non-disabled students assumed a teaching role, possibly absorbing the material to a greater degree, and the disabled students benefitted from the one-on-one interaction. Surprising the researchers was the fact that the technology, which was previously considered simply a tool facilitating the interaction, became a third critical component of success for the students. This seems to support the idea that technology can facilitate a positive learning experience in inclusive classrooms in expected and unexpected ways.

A study conducted by Savasci Acikalin (2011) investigated pre-service teachers’ attitudes toward PowerPoint presentations. The study found that 89% of the participants have positive attitudes toward PowerPoint presentations. Students agreed that PowerPoint presentations make courses more interesting, easy to follow and helpful for taking notes in preparation for exams.

In a study performed by Windschitl and Sahl (2002), the students from three classes at a middle school were each provided with a laptop. The school population consisted of select students who were from supportive, highly-educated, affluent families. The typical class consisted of 18 highly motivated students of average or above average ability. The classes chosen for the study were selected due to the teachers’ willingness and demonstrated abilities to include technology as a necessary component of their instruction, with the idea that they would advance their teaching strategies with constructivist pedagogy due to the apparent panacea created whereby all students and teachers possessed laptops for class use. The study found that after the initial upshot of pedagogical development, classes eventually settled into the mindset that although computers were nice to have, mixed results were obtained due to their presence, with some forming the opinion that they were a distraction. Even one instructor who appeared to advance her instructional strategies was thought to have done so with or without the technological inclusion. This seems to refute the presumption that technology always improves instruction.

In a study performed by Cole (2008), it was assumed that technology would help classrooms keep up in the digital age and have a positive impact on student engagement. However, the use of social technology, specifically Wiki Technology, was examined for just this purpose and proved to have an adverse effect on student engagement. The study focused on 75 students and followed them for a period of 5 weeks during which students were assigned to go onto the Wiki site and post comments.

The expectation that Wiki Technology would improve student participation was found to be a false assumption. Voluntary surveys, which resulted in only 51 of the 75 students responding, reported that two thirds of the students visited the site but declined to interact for various reasons. Twenty percent of the students admitted that their failure to participate was out of sheer disinterest, supporting the fact that the implementation of technology was a negative factor in generating student enthusiasm.

Research conducted by Hardin (2007) empirically tests whether PowerPoint presentation software leads to better academic progress. While the results showed several main benefits of having an effective instructor, Hardin reports in his study that the presence or absence of PowerPoint “… had no effect on how much students liked their introductory psychology course, their interest in psychology, intentions to take additional psychology courses, or objective or perceived learning” (2007, p. 55). However, there was a significant difference in the effect of PowerPoint presentations depending on the instructor. Hardin states, “PowerPoint reduced perceived learning for one instructor, but increased interest in psychology for another. The results are a reminder that good teaching depends more on the instructor than the technology“ (2007, abstract).

**Assumptions**

Students using SRS technology in the classroom experience higher levels of participation. When students feel that lesson presentations are effective and enjoyable, they are more likely to be engaged in learning. When students are engaged during lessons, they will attain higher levels of success in the classroom.

**Research Question**

It is no secret that technology has been implemented in the classroom under the notion that it will help students' achievement. While some technology does seem useful, what we propose to study is whether some of the nuances, such as PowerPoint versus paper handouts and whiteboards versus SRS devices, have a measurable effect on student learning, especially in an inclusive classroom environment. The purpose of this study is to examine the relationship between the use of technology in the classroom and the academic achievement of students with and without learning disabilities. Does the use of technology in an inclusive classroom improve student learning?

**Foreshadowed Problems**

Since this experiment is conducted in one singular test, there might be some effect from adapting to a new set of circumstances. For example, students who have not used the SRS devices previously might have difficulty getting used to them, which could have an adverse effect on their performance. The fact that this study is only a single test gives more weight to the variables, which could bring into question our findings. If the study was conducted in series of lessons, than the effects of SRS devices might prove to be a more legitimate.

**Definition of Terms**

For this study, the following definitions apply....

1. DPS students are those students either diagnosed or requesting and subsequently being granted various accommodations to assist them in their learning.
2. Non-DPS students refer to those not receiving accommodations.
3. Microsoft PowerPoint is a presentation software commonly used in classrooms.
4. Student response systems (SRS) are wireless, electronic systems used to collect and record students’ responses to questions embedded within a PowerPoint presentation by incorporating small, hand-held devices called student response system devices or clickers.

**Significance of the Study**

This study, if successful, would give additional credence to the notion that technology does have inherent advantages over the traditional paper and pencil forms of student engagement and assessment in terms of overall appeal and effectiveness. If DPS students who experience the lesson with technology demonstrate superior outcomes when compared to DPS students who go without, then SRS and PowerPoint presentations might warrant consideration as special education interventions, alongside strategies such as the use of sentence frames and realia.

**Design and Methodology**

**Subjects**

Two sections of an automotive technology course were used for this study. Each section consisted of approximately 21 students. Subjects are race and ethnicity mixed adults mostly 18-22 years of age. There is a small minority of females, considered to be non-traditional students in the automotive field. Each section has 5 to 6 DPS students.

**Data Collection**

The structure of the research is of a Quasi-experimental design. The study uses an Analysis of Variance (ANOVA) method to gather numerical data as it applies to DPS and non-DPS students and their comprehension of subject matter when technology is used for instruction. It attempted to determine cause and effect; what effect a technological change in the delivery and assessment of information causes in the actual comprehension of material on a specific population of students. There was a direct manipulation of conditions via inclusion or exclusion of technology. Students from two sections of an existing course were used so there was no random assignment of students. The classes were pre-organized and the instructor was the same for both classes. There was a control section and an experimental section, referred to as the technology section in this report.

Two identical lessons were presented to students. PowerPoint was used to support the information and activities in the lesson given to the technology section, while a whiteboard and mechanical trainer were used in the control class. For the purpose of assessment, the technology section was given a quiz using SRS technology with the instructor reading the questions to the class from the PowerPoint presentation. The control class was given a traditional paper and pencil test.

**Data Treatment**

A post-lesson survey was provided and collected from the students, and data was assembled and presented separating DPS and Non-DPS students into individual categories. In addition to the survey, a post test was given to measure students’ comprehension of the subject matter presented in the lesson. Data was collected with a similar separation treatment to identify the degree of comprehension by each section as a whole, as well as individual DPS and Non-DPS groupings.

**Presentation of Findings**

The results from this study suggest that the technology used in this study had a negative impact on the students’ level of comprehension. The data from the post test suggests that students in the technology section did not understand the material in the lesson as well as the students in the control section. The students in the technology section scored significantly lower on the 10 question post test than the students in the control section. The mean scores for DPS/non-DPS students in the technology section were 5.80/5.77 versus 7.40/7.31 for students in the control section (see table 1).

While the results suggest a significant difference in the understanding of the material between the technology section and the control section, there was no significant difference in comprehension when comparing the mean scores of DPS students with non-DPS students within the same section. In the technology section, the mean scores on the post test for DPS and non-DPS students were 5.80 versus 5.77. Meanwhile, in the control section, the mean scores for DPS and non-DPS students were 7.40 versus 7.31 (see table 1).

According to the data collected from the satisfaction survey, DPS students in the technology section felt that the lesson was less effective and less enjoyable than non-DPS students in the same section. DPS students in the technology section rated the activities used in the lesson, lesson organization, and their enjoyment of the lesson lower than non-DPS students. On a scale of one to five, the mean ratings of lesson organization were 4.17 for DPS students versus 4.40 for non-DPS students. The mean ratings of the activities used in the lesson were 4.33 for DPS students versus 4.73 for non-DPS students on a scale of one to five. Finally, the mean ratings for enjoyment of the lesson were 4.17 for DPS students versus 4.40 for non-DPS students on a scale of one to five (see table 2).

While the results suggest that DPS students in the technology section did not enjoy the lesson as much as non-DPS students in the same section, there was no significant difference in the mean ratings of enjoyment when comparing students in the technology section with students in the control section. The mean rating of all students in the technology section was 4.33 versus 4.32 for all students in the control section (see tables 2 and 3).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table 1** | | | | | |
| **Post Test Results** | | | | | |
|  | | | | | |
| Technology Section | | | | Control Section | |
| Non-DPS Score | DPS Score | | | Non-DPS Score | DPS Score |
| 6 | 5 | | | 10 | 7 |
| 6 | 5 | | | 5 | 7 |
| 7 | 6 | | | 9 | 9 |
| 7 | 7 | | | 7 | 4 |
| 4 | 6 | | | 7 | 10 |
| 6 | **29** | | | 6 | **37** |
| 4 | **29/5=5.80** | | | 6 | **37/5=7.40** |
| 6 | **Mean Score 5.80** | | | 9 | **Mean Score 7.40** |
| 6 |  | | | 10 |  |
| 7 |  | | | 10 |  |
| 4 |  | | | 6 |  |
| 7 |  | | | 7 |  |
| 5 |  | | | 5 |  |
| **75** |  | | | 6 |  |
| **75/13=5.77** |  | | | 6 |  |
| **Mean Score 5.77** |  | | | 8 |  |
|  |  | | | **117** |  |
|  |  | | | **117/16=7.31** |  |
|  |  | | | **Mean Score 7.31** |  |
|  |  | | |  |  |
|  |  | | |  |  |
| **Post Test Median Scores** | | | | | |
|  | | | | |  |
|  | | | | |  |
| Technology Section | | | Control Section | | |
| Non-DPS Score | | DPS Score | Non-DPS Score | | DPS Score |
| **6** | | **6** | **7** | | **7** |
|  | |  |  | |  |
|  | |  |  | |  |
| **Post Test Mode Scores** | | | | | |
|  | | | | |  |
|  | | | | |  |
| Technology Section | | | Control Section | | |
| Non-DPS Score | | DPS Score | Non-DPS Score | | DPS Score |
| **6** | | **5 & 6** | **6** | | **7** |

**Table 2**

**Satisfaction Survey Results for the Technology Section**

Course Autotec 15 Days Monday/Wednesday

1. The lesson was organized in a way that improved my learning.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 8 | 12 | 1 |  |  | 4.33 |
| DPS | 2 | 3 | 1 |  |  | 4.17 |
| Non-DPS | 6 | 9 |  |  |  | 4.40 |

1. The activities helped me understand the information better.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 14 | 6 | 1 |  |  | 4.62 |
| DPS | 3 | 2 | 1 |  |  | 4.33 |
| Non-DPS | 11 | 4 |  |  |  | 4.73 |

1. The lesson was enjoyable.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 10 | 9 | 1 | 1 |  | 4.33 |
| DPS | 3 | 2 |  | 1 |  | 4.17 |
| Non-DPS | 7 | 7 | 1 |  |  | 4.40 |

1. The length of the lesson was appropriate for the amount of information covered.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 7 | 12 | 2 |  |  | 4.24 |
| DPS | 2 | 4 |  |  |  | 4.33 |
| Non-DPS | 5 | 8 | 2 |  |  | 4.20 |

**Table 3**

**Satisfaction Survey Results for the Control Section**

Course Autotec 15 Days Tuesday/Thursday

1. The lesson was organized in a way that improved my learning.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 9 | 13 |  |  |  | 4.41 |
| DPS | 3 | 2 |  |  |  | 4.60 |
| Non-DPS | 6 | 11 |  |  |  | 4.35 |

1. The activities helped me understand the information better.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 12 | 9 | 1 |  |  | 4.50 |
| DPS | 2 | 3 |  |  |  | 4.40 |
| Non-DPS | 10 | 6 | 1 |  |  | 4.53 |

1. The lesson was enjoyable.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 9 | 11 | 2 |  |  | 4.32 |
| DPS | 2 | 2 | 1 |  |  | 4.20 |
| Non-DPS | 7 | 9 | 1 |  |  | 4.35 |

1. The length of the lesson was appropriate for the amount of information covered.

Strongly Agree Agree Neutral Disagree Strongly Disagree Mean

5 4 3 2 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total | 5 | 16 | 1 |  |  | 4.18 |
| DPS | 1 | 4 |  |  |  | 4.20 |
| Non-DPS | 4 | 12 | 1 |  |  | 4.18 |

**Limitations of the Design**

While efforts were made to avoid flaws in the design, the study was limited in two ways. First, the sample sizes for the control and experimental groups were relatively small. Each group had approximately 21 participants. Only five or six DPS students were identified in each group. It was determined that the control and the experimental groups should be enrolled in two different sections of the same class. In order to control as many variables as possible, both sections would have the same professor. All of the participants in the study were enrolled through normal matriculation procedures. The researchers had no control over the section sizes or the demographics of the population.

The study was also limited by time constraints. Because the study had to be completed in a short amount of time and creating PowerPoint presentations for the study would be time consuming, it was determined that only one test would be performed for the study. If more time were available, a study could have been performed over the course of a semester similar to the studies performed by Fortner-Wood et al. (2013) and Harper (2009). Because only one test was performed, it could be said that the results of the test were coincidental. If a second test were performed, then the results of the second test might concur with or contest the results of the first test. If further tests were performed over a longer period of time, then the results would be significantly more reliable.

**Conclusion**

The goal of this study was to determine whether or not the use of technology in an inclusive classroom could help improve students’ learning. It was anticipated that the use of technology to present a lesson would enhance students’ learning and enjoyment of the lesson due to increased levels of engagement. The findings indicate that the use of technology in this study did not improve students’ learning. The students in the technology section scored significantly lower on the post test than students in the control section. Additionally, the students in the technology section did not enjoy the lesson any more than students in the control section. Finally, DPS students in the technology section rated the activities used in the lesson, lesson organization, and their enjoyment of the lesson lower than non-DPS students. The findings of this study indicate that the use of technology in the inclusive classroom provides no educational advantages for DPS students or non-DPS students.

**Recommendations for Further Research**

While the overall findings of the research proved surprising, there is some question as to which variable had the greatest impact. The study included both PowerPoint and SRS variables providing a somewhat diminished clarity due to the inability to distinguish each variable’s individual impact and contribution to the students’ success. Therefore, the results might be more concise if the study focused on one variable at a time. Another option to consider is using three different sections of the same course, each with a variation of technology, which would possibly highlight the differences on an individual basis. One class could include a traditional lecture with paper and pencil assessment, as used in the control section for this study. Another class might include PowerPoint for instruction, but retain non-technological methods for response and assessment. Finally, a third class could include both PowerPoint and SRS as used in the technology section for this study. The increased separation of technological levels could provide evaluations centered on a specific influence.

Additionally, the findings of this study are the result of a single test using a small sample size, and are therefore not as statistically significant as an expanded study. In an attempt to confirm a similar effect, extending the study over a long period of time on a larger sample size would increase the reliability and credibility of the results.

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**Appendix**

Satisfaction Survey

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Course Autotec 15

**Directions:** Please circle the number below the answer that best matches your opinion of the statement.

1. The lesson was organized in a way that improved my learning.

Strongly Agree Agree Neutral Disagree Strongly Disagree

5 4 3 2 1

2. The activities helped me understand the information better.

Strongly Agree Agree Neutral Disagree Strongly Disagree

5 4 3 2 1

3. The lesson was enjoyable.

Strongly Agree Agree Neutral Disagree Strongly Disagree

5 4 3 2 1

4. The length of the lesson was appropriate for the amount of information covered.

Strongly Agree Agree Neutral Disagree Strongly Disagree

5 4 3 2 1