Pointing With Power Or Creating With Chalk

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ABSTRACT

This study examines the attitudes of students on the use of PowerPoint and chalk/white boards in college science lecture classes. Students were asked to complete a survey regarding their experiences with PowerPoint and chalk/white boards in their science classes. Both multiple-choice and short answer questions were used. The multiple-choice questions were analyzed quantitatively. The short answer questions were coded into similar groups qualitatively and then recoded quantitatively in order to best compare data. The students report that the majority of presentations in their college science classes use PowerPoint. Their responses show that they clearly prefer the use of chalk/white boards and overwhelmingly say that PowerPoint does not keep their attention in comparison.

Keywords: PowerPoint; Student Engagement; Teaching Methods; Higher Education

INTRODUCTION

PowerPoint was introduced in 1987 as a tool for business presentations, but it was quickly adopted by many college professors to replace overhead displays of their lecture notes. Faculty invest a great effort putting their lectures into PowerPoint. They find that it is flexible and that graphics, videos, and charts can easily be added. PowerPoint can be attractive and stimulating, quickly produced and modified, and easy to share through the Internet. Students seem to like it because it is organized, easy to follow, and highlights key concepts. While business faculty were the first to embrace PowerPoint, it rapidly spread throughout academia as a presentation tool and was embraced by the science faculty. PowerPoint should be ideal for the sciences. With PowerPoint a video of the dramatic evolution of a star from birth to supernova can be easily embedded in the lecture notes. A microscope slide in a biology class can be displayed where each label shows up one by one. A diagram of a super-cell thunderstorm can be enlarged and examined from all sides so the entire class can visualize it in 3-D. Chemistry equations can be revealed step by step. However, in any discipline PowerPoint has the potential of distracting learners. It requires more equipment, it can reduce active learning, and when technical difficulties ensue, it can ruin a lesson completely (Yu and Smith, 2008).

While there is an abundance of literature regarding the usage of PowerPoint, there is very little specifically regarding its use in science lecture classes or comparing it to chalk/white boards. In addition, the majority of the literature is from when PowerPoint was a new tool and was just starting to be introduced in classrooms. There has been discussion over whether PowerPoint is a useful tool in the classroom or if the more traditional chalk/white board lectures are better for student learning. There is speculation that the learning from PowerPoint presentations can be influenced by the construction of the lesson (Craig and Amernic, 2006; Levasseur and Sawyer, 2006; Yu and Chen, 2008). This viewpoint assumes that the colors, transitions, and displays of information will make a positive difference in the learning of students. Ultimately, technology was created to help educators make their materials more interactive and effective (Yu and Chen, 2008). In this paper we examine if PowerPoint has succeeded in enhancing learning in the science classroom of if it is detrimental.

THE LITERATURE ON STUDENT ENGAGEMENT AND PREFERECE

Initial Student Response to PowerPoint

Several studies examined student engagement when PowerPoint is used in the classroom. They used surveys and asked students if they found the use of PowerPoint more interesting than the traditional lecture or a lecture aided with an overhead projector. In nearly all cases, the students indicated that they preferred and enjoyed PowerPoint in the classroom (Bartsch and Cobern, 2003; Hill et al., 2012; Lowry, 1999; Perry and Perry, 1998; Savory et al., 2009; Susskind, 2005; Szabo and Hastings, 2000). One explanation for this is that PowerPoint may allow students to have a better idea of what information is pertinent and important. It also helps them with taking notes by displaying the information in an organized, coherent structure (Levasseur and Sawyer, 2006). Students also appreciate handouts of the PowerPoint presentations given in advance of class so they can focus on the actual lecture instead of writing down all of the information. Many students like PowerPoint simply because it makes gathering information from class and note taking easier (Nicolson, 2002).

Student Motivation

While the initial student response to PowerPoint was positive, from the onset there were concerns about the use of presentation software in the classroom. Some of the first studies looked at the impact on attendance. After changing from traditional to PowerPoint presentations, over sixty-five percent of the sports science and administration students surveyed by Szabo and Hastings (2000) said the latter motivated them to come to lecture. The students said this new presentation method was more interesting and attention capturing. However, Susskind (2005) found no difference in the motivation students felt to come to his introductory psychology class. One section class was taught using PowerPoint for the first five weeks, then switched to traditional methods for the second five weeks of the semester. In the second section the students experienced the reverse. Both sections reported being more motivated to come to class at the beginning of the semester, and this motivation waned in both groups during the second five weeks.

Many of the studies regarding PowerPoint are dated and there have not been many recent studies that look at student preference of PowerPoint. It is possible that the majority of students enjoyed PowerPoint at first because it was a new and exciting creation. There could be a "novelty factor" involved. This idea originated with Clark in 1983 (Nouri and Shahid, 2005). When the novelty wears off, students may not identify PowerPoint as an engaging classroom technology (Craig and Amernic, 2006; Levasseur and Sawyer, 2006; Lowry, 1999). College students have almost begun to expect the use of PowerPoint in their classes (Levasseur and Sawyer, 2006). "The challenge in the new millennium is not to entertain students … but to improve or to facilitate learning" (Szabo and Hastings, 2000).

Learning Enhancement

Nearly all of the studies show that students have a greater self-efficacy when PowerPoint is used in the classroom (Bartsch and Cobern, 2003; Lowry, 1999; Nouri and Shahid, 2005; Perry and Perry, 1998; Susskind, 2005; Szabo and Hastings, 2000). Most students believe that they take better notes with the aid of PowerPoint and ergo, they believe that the material becomes easier to understand, comprehend, and retain. If this were the case, their grades would reflect these beliefs. However, there is a large divide in the outcome of studies regarding student learning enhancement in PowerPoint. One study has data showing that the traditional lectures are more beneficial to student learning in engineering classrooms (Savory et al., 2009). These studies assessed students and ultimately showed that with the introduction of PowerPoint, there is a decline in the outcomes of quiz and exam scores. The majority of studies have shown no difference in the scores of students after the introduction of PowerPoint; these studies have taken place in social psychology, economics, general psychology, and sport science and administration classes (Bartsch and Cobern, 2003; Rankin and Hoaas, 2001; Susskind, 2005; Szabo and Hastings, 2000). These studies support the idea that the presentation technology is not as important as the teacher's way of explanation and teaching. Szabo and Hastings (2000) point out that, "There is little or no advantage in lectures where simply the process or the delivery medium is changed." Nicholson (2002) agrees by strongly stating that "the medium is NOT the message! The style of presentation is important because it influences organisation and structure of delivery but it is the content which is paramount." Bartsch and Cobern (2003) investigated the effect on student retention with

traditional lectures, PowerPoint lectures, and PowerPoint lectures with additional information inserted that was not relevant. They found that there was no difference between traditional and PowerPoint lectures and there was a decrease in retention when unnecessary information is presented. There is one study that shows an increase in the scores of students with PowerPoint (Lowry, 1999). This was one of the first published studies on PowerPoint. The instructors simply transferred lecture material from the overhead to PowerPoint, gauged student perception, and measured examination performance. Students commented that using PowerPoint made material more clear and structured and exam scores improved measurably. Szabo and Hastings (2000) tested the idea that PowerPoint in conjunction with the distribution of lecture notes would improve retention. It was found that giving students lecture notes before class made no difference in testing results (Szabo and Hastings, 2000).

PowerPoint under Scrutiny

Craig and Amernic (2006) argue that the presenter, rather than the PowerPoint, is the difference between effective and ineffective learning. "Good presenters will most likely still be the centre of attention, using PowerPoint appropriately as a valuable communication aid to buttress their rhetoric. Poor presenters…will most likely be stagehands, with PowerPoint used as a dominating prop and their visual presence barely discernible." PowerPoint was created to help display information that the presenter was lecturing about, however the "PowerPoint slideshow [may have] become the curriculum" (Craig and Amernic, 2006).

There is a healthy debate occurring over the educational value of PowerPoint. Educators want to know if PowerPoint is a valuable resource to their students or if it is a distraction to their learning experience. Students are beginning to expect PowerPoint presentations when they walk into the classroom and most professors rely on them for every lecture they give. It is important that the usefulness of PowerPoint is analyzed so that professors can truly know if PowerPoint helps their students learn. While there are some studies that have explored this idea, not many have concentrated on students in science disciplines and those that have do not look at the quantitative sciences. Lowry (1999) focused his study on environmental science and Szabo and Hastings (2000) focused on sport science and administration, but these studies are dated. All of the more recent studies look at other disciplines; Savory et al. (2009) studied a human factors in engineering class, Nouri and Shahid (2005) accounting, Bartsch and Cobern (2003) social psychology, Susskind (2005) psychology, Hill et al. (2012) sociology, and Rankin and Hoaas (2001) economics. This current study looks at all science disciplines and compares PowerPoint to the traditional chalk/white board presentations. We investigate which method enhances students' classroom experience and which best holds their attention. Additionally, the students express which technique is more effective and which they prefer.

SURVEY

Authorization

In this study a survey was conducted to assess the attitudes of college students in science classes regarding their experiences with PowerPoint and chalk/white boards. Because human subjects were involved in the research, the project had to be reviewed and approved by the institution's Institutional Review Board (IRB) prior to the initiation of the project. It was determined that the study posed no risk to the participants, hence exemption status was received from the Central Michigan University IRB. Both researchers completed the Collaborative Institutional Training Initiative (CITI) Human Subjects Research course and were updated on the current regulatory and ethical issues on this topic.

Instrument

Data was collected using a SurveyMonkey Gold subscription. SurveyMonkey is an online tool that allows users to create multiple choice and short answer questions and proceeds to collect the responses to the surveys. The researcher is given a unique URL link that can be emailed out to participants. SurveyMonkey also allows all responses to be kept anonymous. With the Gold subscription, researchers can create as many questions as needed, while the basic user can only create 10. In addition, the Gold subscription can also be used to help analyze the data and display results.

The survey consisted of twelve multiple-choice questions and four short answer questions. The first three multiple-choice questions asked where the students received the information about the survey, what their class standing was, and what science classes they have taken. The fourth and fifth questions asked how often PowerPoint and white/chalk boards are used in the participant's science classes. This helped the researchers ensure that both methods were used in the participant's science classes. The sixth and seventh questions asked how often participants copy PowerPoint and chalk/white board notes word for word. This was to give the researchers insight as to whether or not there is a difference in the way notes are taken depending on the type of lecture presentation that is used. The eighth, ninth, and tenth questions all asked participants to choose which type of lecture they felt was most effective for exam review, comprehending material, and keeping their attention. This was to help the researchers better understand why participants preferred a certain type of lecture presentation. The eleventh and twelfth questions were meant to show which method students preferred overall and which they felt best enhanced their experience in science lecture classes. These questions were the most directly attached to the research question. The four short answer questions were valuable because they allowed participants to expand on why they liked and disliked both methods of lecture. The short answer questions were randomized so that participants were not led in either a PowerPoint or chalk/white board direction. The short answer questions were asked in a way that encouraged participants to share at least one thing they liked about PowerPoints and chalk/white boards and one thing they disliked about PowerPoints and chalk/white boards.

Subjects

Participants were recruited from two specific groups. The first group consisted of current and former students of one of the researchers, Dr. Joseph Finck. He is a professor of physics and teaches the large College Physics I and II lecture based courses at Central Michigan University. The second group contacted were all the current students from the Honors College at Central Michigan University. Although all students enrolled in the Honors College received an email about the study, only those who had taken a science class were asked to complete the survey.

Participants were contacted via E-mail. The current and former students of Dr. Finck were sent an E-mail from Dr. Finck through their Central Michigan University account. These E-mail addresses were obtained through Blackboard course shells. Current students of Dr. Finck were informed about the study briefly during class. Students were reminded that the study would be anonymous and their grades would in no way be affected if they chose to participate. The Honors community was reached through the Honors Program Director via E-mail. There were 546 college physics students and 742 Honors students contacted. About 19% of Honors students and 23% of physics students completed the survey. Surveys distributed through E-mail and online are likely to get lower response rates than face-to-face and paper surveys (Nulty, 2008). An average response rate for this type of survey is about 30%, however 20% is considered a "good" response rate (Response Rates, 2007). This response rate has less than a 10% margin of error (Nulty, 2008).

SURVEY RESULTS

Demographic Data

This survey was given to both Honors students who had completed a science lecture course as well as current and former physics students of Dr. Finck at Central Michigan University. There was some overlap between the two categories but students were instructed to only fill out the survey once. There was no difference found in the results of the Honors students compared to the physics students. There was also no difference in the students who were both Honors students and students of Dr. Finck. All results were then viewed as equal and aggregated. The distribution of the participants' class standings can be seen below in Figure 1. Class standing also showed no differences in responses to any of the survey questions.

Figure 1. Class Standing of Survey Participants

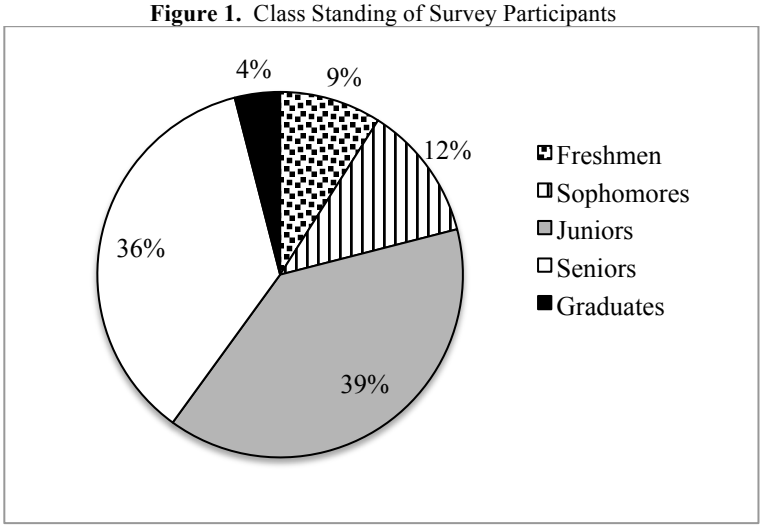


Table 1. Participant Course Distribution

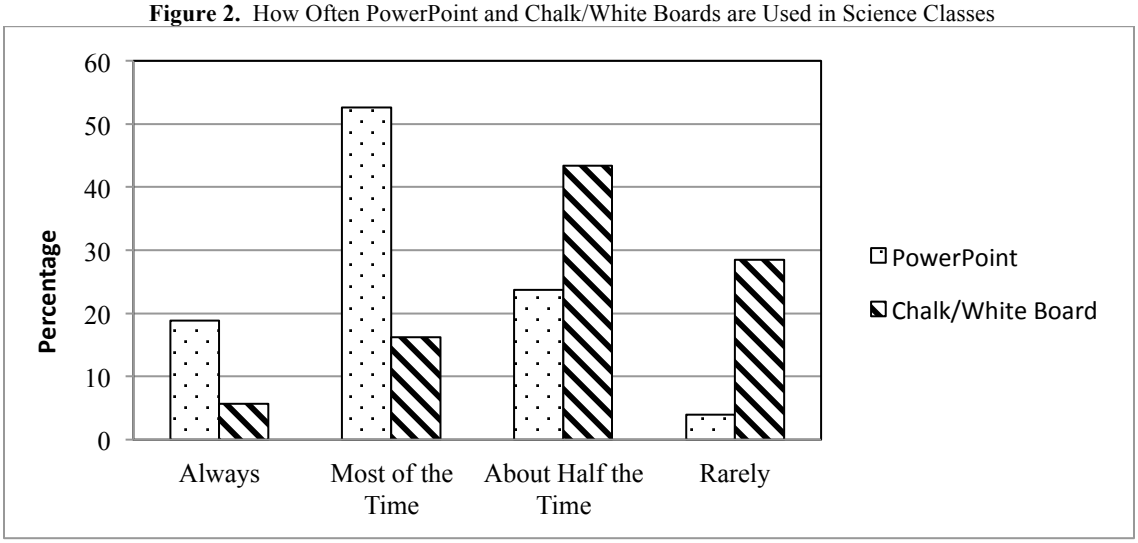
Course	Percentage (%)
Astronomy	10
Biology	81
Chemistry	80
Computer Science	11
Engineering	4
Geography	20
Geology	19
Health Science	45
Physics	65

Students were asked to identify what type of science classes they had taken. The distribution can be seen in Table 1. All of the respondents took at least one science class and 72% of them completed classes in 3 or more science disciplines. It should be noted that many students have completed more than one class in each science department. For example, an integrated science major in the class completed two astronomy, five biology, two chemistry, one geography, one geology, and four physics classes. Additionally, a large portion of the students are in a premedical curriculum and would have taken two biology classes, two general chemistry classes, two organic chemistry classes, and two physics classes.

Student Experiences with PowerPoint and Chalk/White Boards

Participants were asked how often PowerPoint and chalk/white boards were used in their science lecture classes. As seen in Figure 2, the students reported that PowerPoint is the dominant presentation tool used in their science lecture classes. Over 70% of the time PowerPoint was used always or most of the time, and over one-third of the time the chalk/white board rarely or never used. Less than 1% reported that they had never encountered a PowerPoint in their science lecture courses.

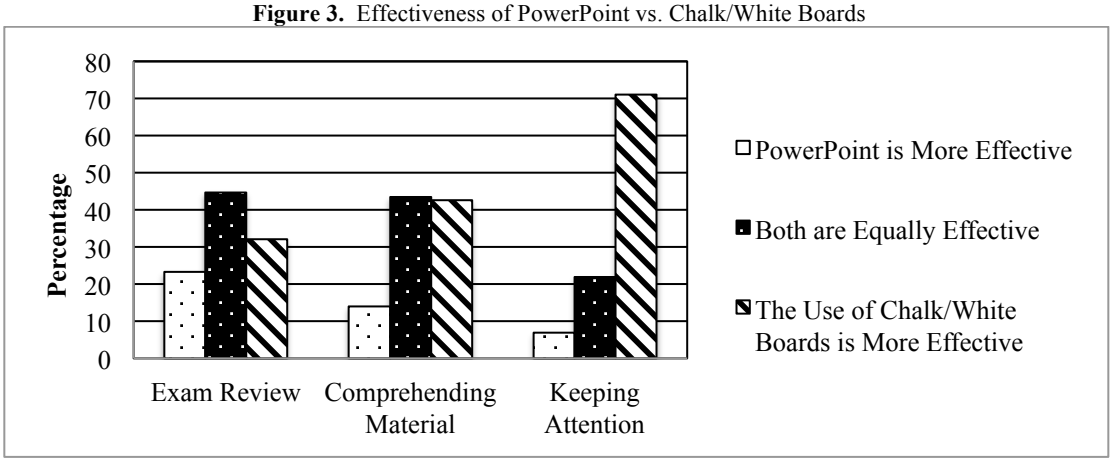
Figure 2. How Often PowerPoint and Chalk/White Boards are Used in Science Classes



Effectiveness

Participants were asked whether PowerPoint or chalk/white boards were more effective for exam review, comprehending material, and keeping their attention. These results are displayed in Figure 3. For exam review, nearly half of the participants indicted that PowerPoint and chalk/white boards were equally effective. However, more respondents indicated that chalk/white boards were the most effective. For comprehending material, only 14% of the students found PowerPoint more effective, 43% indicated that the two methods were equally effective and 43% said that chalk/white boards were more effective. Finally, for keeping attention in class the most significant margin was measured. Over 70% of participants believed that chalk/white boards most effectively kept their attention, while 22% believed that both were equally effective, and 7% believed that PowerPoint was the most effective.

Figure 3. Effectiveness of PowerPoint vs. Chalk/White Boards

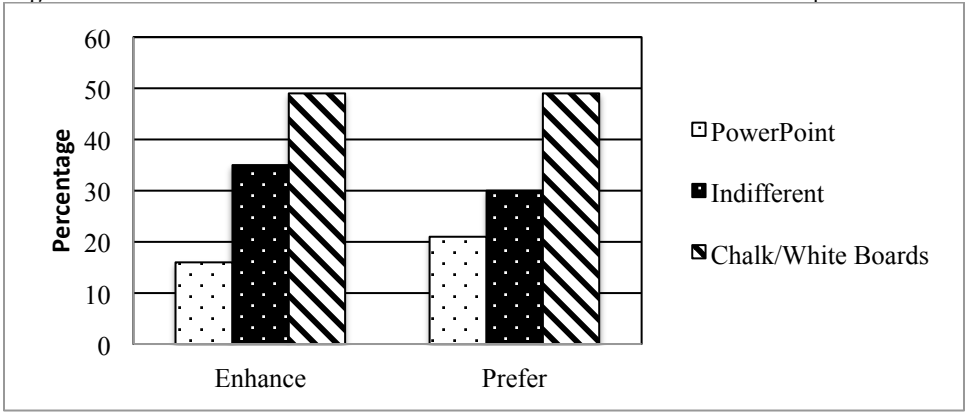


Preference and Enhancement of the Classroom Experience

Participants were asked which medium enhances their classroom experience the most. As seen in Figure 4 about half of the responses showed that chalk/white boards were best, while only 16% of responses indicated that PowerPoint is most effective.

Participants were also asked whether they ultimately preferred PowerPoint, chalk/white boards, or if they were indifferent. Their response mirrors the "enhancement" question. Figure 4 shows nearly half of the participants preferred chalk/white boards while about one-fifth of the students preferred PowerPoint in their science lecture classes.

Figure 4. PowerPoint and Chalk/White Board Classroom Enhancement and Participant Preference



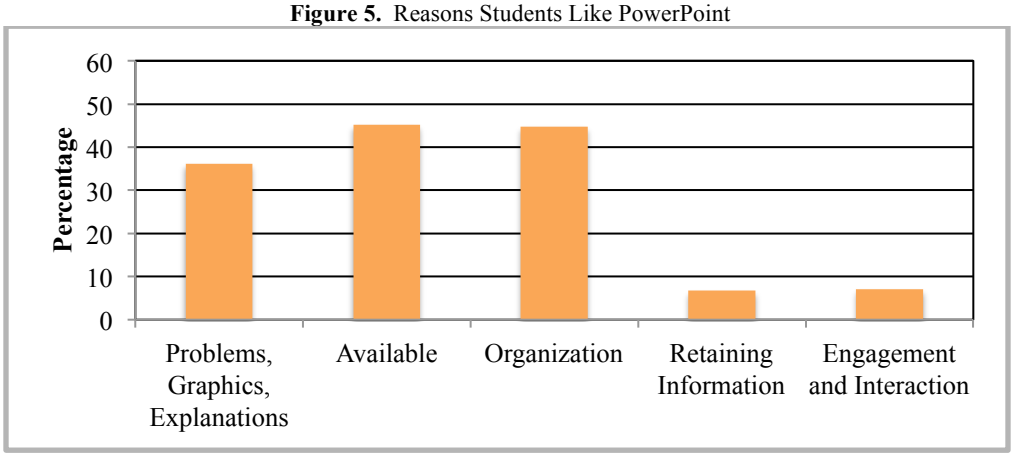
Short Answer

Participants were asked to respond to four short answer questions that would help the researchers better understand how they felt about both PowerPoint and chalk/white boards. Students were simply asked what they liked and disliked about each medium. They were not given answer choices. The qualitative student responses were coded by identifying the most commonly mentioned topics and then analyzed quantitatively.

What Students Like About PowerPoint Presentations

Participants were asked what they liked about presentations in science classes that use PowerPoint. The distribution of the answers can be seen below in Figure 5. About 45% of respondents expressed that they enjoyed the availability of PowerPoint and the organization of PowerPoint. As one participant stated, "Most of the time the slides are posted on Blackboard so you can gather any information you may have missed and if you print them off ahead of time you can easily add your own notes to them during class." Around 35% of respondents indicated that they liked the way problems, graphics, and explanations when displayed with PowerPoint. As one respondent said, "Pictures and diagrams are more descriptive." Less than 10% of respondents mentioned that they liked how PowerPoint presentations were engaging, interactive, and helped with retaining information.

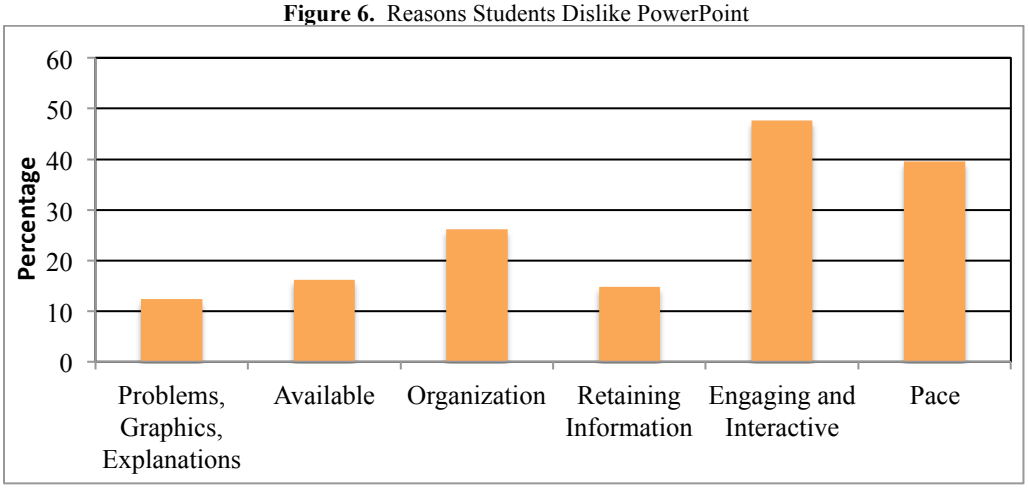
Figure 5. Reasons Students Like PowerPoint



What Students Dislike About PowerPoint Presentations

Participants were also asked to identify what they disliked about presentations in science classes that use PowerPoint. These results can be seen below in Figure 6. Almost 50% of respondents indicated that they did not like PowerPoint because it was not interactive or engaging. The second most common response was that they disliked the pace that was used with PowerPoint presentations, while over 25% disliked the organization of PowerPoint. About 15% or less of participants indicated that they disliked the way problems, graphics, and explanations took place with PowerPoint, as well as the lack of availability, and retaining information presented with PowerPoint.

Figure 6. Reasons Students Dislike PowerPoint

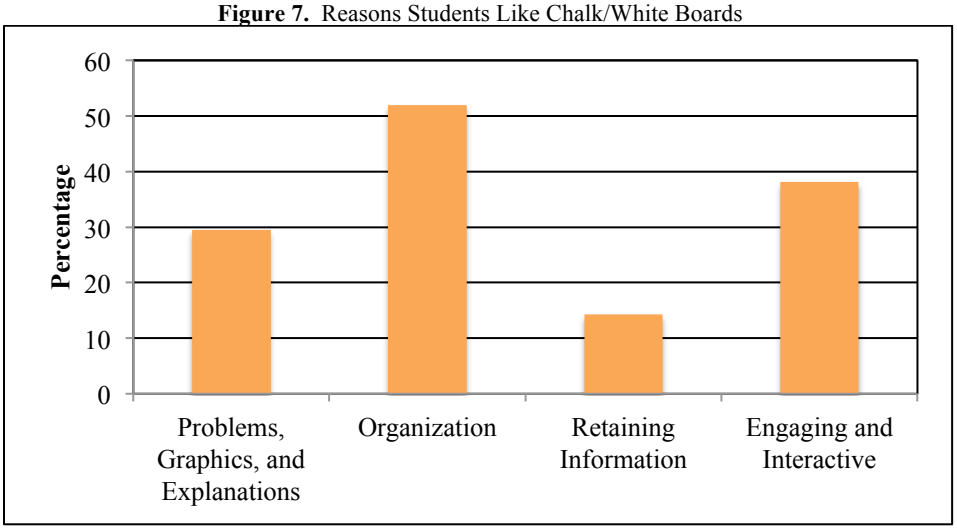


As one participant summed up, "There is just so much information to gather at once, that I often feel like I'm a transcriber, rather than an engaged student. I usually copy down every word, because lecturers often think they can move more quickly through the material. However, this leaves me feeling rushed, stressed, and resorting to copying down slides, and even taking pictures of them with my phone. Nearly 100% of my learning takes place outside of the classroom, when I review my notes and attempt to pick out what's the most important and what's not." Another respondent stated, "I do not like it when instructors do not interact with the PowerPoint and merely read them. I do not like it when the instructor attempts to fly through too many slides in 50 minutes. I do not like it when instructors do not provide PowerPoints for students ahead of time. I do not like it when there aren't any pertinent images embedded within the PowerPoints."

What Students Like About Chalk/White Board Presentations

Participants were asked what they liked about presentations in science classes that use chalk or white boards. The results distribution can be seen blow in Figure 7. Over 50% of participants indicated that they liked the organization used with chalk and white boards. As one participant said, "The more pertinent information tends to be presented in a better fashion." Almost 40% of participants enjoyed how interactive and engaging chalk/white boards are. Nearly 30% of participants expressed how they liked the way problems, graphics, and explanations are displayed using chalk/white boards, and how chalk/white boards help in retaining information. One participant summarized by stating, "I like that the professor writes notes down at a good speed and keeps me focused and on task. It helps me keep pace with the material, rather than rush to get all the notes on slides written down when we are not finished discussing the previous bullet point or topic. I like that it forces me to actually write down the notes or actually complete example problems, rather than just reading printed out PowerPoint slides and just adding my own notes to it. I think it helps me understand concepts much better, especially for math problems. I also like that it helps professors narrow down the material to just the main points and doesn't leave me guessing what I need to study – because obviously most of it was important or time wouldn't be wasted on it."

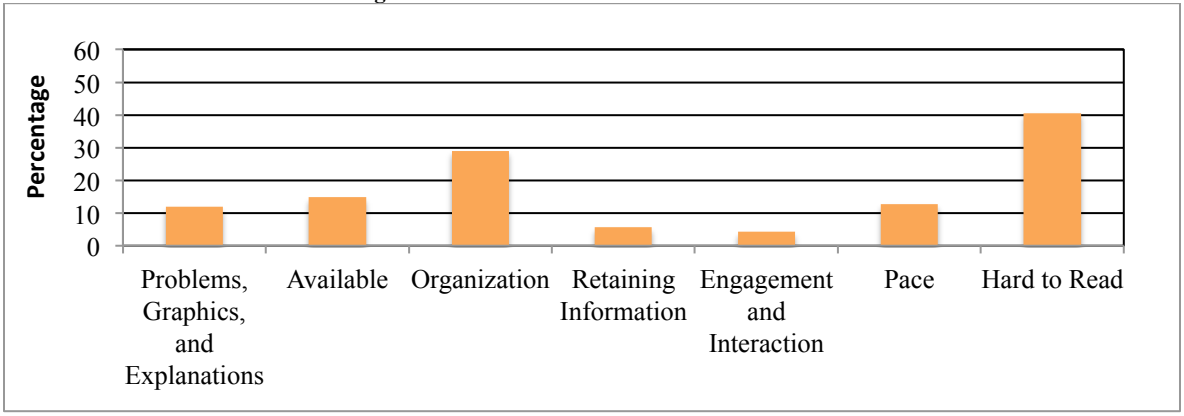
Figure 7. Reasons Students Like Chalk/White Boards



What Students Dislike About Chalk/White Board Presentations

Participants were also asked what they disliked about presentations in science classes that use chalk/white boards. The results can be seen below in Figure 8. About 40% of participants complained that chalk/white boards were hard to read. As one participant stated, "Some professors have really bad handwriting so it is easier to miss things or misunderstand because of legibility problems." Nearly 30% of respondents complained about the organization of chalk/white boards. Fewer than 15% of participants disliked the way problems, graphics, and explanations are used on chalk/white boards, the lack of online note availability of chalk/white boards, or the pacing used during chalk/white board presentations. Only 5% of the students mentioned the lack of engagement and interaction, or the difficultly in retaining information when material is presented on chalk/white boards. As one participant summarized, "I dislike that it is more difficult to get the notes if you happen to miss class. Also, sometimes hand drawings are difficult for some people and PowerPoint photos or videos would be better or quicker for explaining certain concepts. I don't like that it can sometimes be slow to move through material and doesn't leave much room for questions or extra interesting material that isn't as important for tests."

Figure 8. Reasons Students Dislike Chalk/White Boards



ANALYSIS

It is clear that PowerPoint has taken over the classroom as the primary tool for lecture. Chalk and white boards are slowly being left behind. However, this turn to technology may not be in the best interest of the students.

As seen in Figure 3, the effectiveness of PowerPoint should be questioned. Clearly, PowerPoint does not keep the attention of students while chalk/white boards do. Students are more likely to pay attention to chalk/white boards because the material being presented cannot be uploaded online. For comprehending material, chalk/white boards are also preferred. Students are not inclined to say that PowerPoint is the best way to comprehend class lectures. For exam review, the results are not quite as clear. Forty-five percent of the students feel that the two methods of presentation are equally effective when they were preparing for their exams. However, there is less than a 10% difference between those that said they prefer PowerPoint and those that said they prefer chalk/white boards. In contrast, 56% of the sociology students in the study by Hill et al. (2012) found PowerPoint to be more effective. A possible explanation for these conflicting results is a difference in content area.

Students prefer chalk/white boards to PowerPoints in their science classrooms by a large margin. Over double the amount of students indicated this. By an even larger margin, students also believe that chalk/white boards enhance their classroom experience. When students must choose between PowerPoint and chalk/white boards, they tend to choose the latter.

Participants were asked what they liked and disliked about PowerPoint. These results can be seen above in Figures 5 and 6. The organization, availability, and the way problems, graphics, and explanations are presented on PowerPoint were all shown to be positive attributes. However, students made clear their dislike of the pace and lack of engagement and interaction associated with PowerPoint. It should be kept in mind that while about 45% of participants mentioned that they liked the organization of PowerPoint, over 25% still mentioned their distaste.

Participants were also asked what they liked and disliked about chalk/white boards. These results can be seen in Figures 7 and 8. The organization as well as engagement and interaction associated with chalk/white boards stood out as positives. Participants made clear that they disliked when chalk/white boards were hard to read, typically due to the professor's handwriting. It should again be noted that while over 50% of respondents liked the organization of chalk/white boards, nearly 30% disliked it. Due to the ambiguity of the organization aspect of the short answer portion, it can be assumed that the delivery mode is not the primary influence on the organization of a lesson or class.

CONCLUSION

One explanation as to why former studies tend to show the student body preferring PowerPoint to traditional lectures is the "novelty" factor. PowerPoint is not longer a new program. Students are beginning to believe that PowerPoint is not engaging and interactive enough. Many believe that the pace is too fast and it can be

harder to retain information. Participants reported that they enjoy how engaging and interactive chalk/white boards are. Many believe they are better for presenting solutions to common science examples. Chalk/white boards allow the professor to work out a problem at the same time as the students, this gives students the opportunity to ask questions and clear up any confusion.

There are opportunities to further this research. Studies could concentrate on single disciplines such as chemistry, political science, anthropology, etc. and determine if certain media tools are better in some content areas than others. Research could be done to focus on the ways to change PowerPoint to be more beneficial to science students. Finally, research could be completed to determine how to match individual professors with the medium that is best suited for their class.

AUTHOR INFORMATION

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NOTES