Student Perceptions of How Technology Impacts the Quality of Instruction and Learning

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Abstract

This paper summarizes the results of a survey administered to students enrolled in selected business courses at a Midwestern university pertaining to technology use in the classroom. Students were asked how the moderate or extensive use of technology (such as PowerPoint) would impact the overall quality of a "hypothetical course with the same features and characteristics of the course" in which they received the survey as well as how they might evaluate the instructor. Students were also asked how technology would impact their own learning. In general, students perceive the use of technology positively.

Keywords: class technology, course quality, instructor quality, student learning

Introduction

Ponder for a moment the age-old question as to which came first, the chicken or the egg. Such a simple question can spur considerable thought and in-depth analysis, yet it is not necessarily susceptible to a clear-cut or obvious answer. One could make the argument that the chicken must exist in order for the egg to be conceived, but just where did that chicken come from in the first place? What a quandary.

In academia another question, albeit perhaps not as mind-boggling or thought-provoking, generates considerable debate. That is, what adds more to the learning process, the message or the medium? Perhaps the answer lies in which school of thought regarding teaching and learning the philosopher adheres to – objectivist or constructionist. Yet no matter one's own opinion, it is unlikely that she will be able to convince another of opposite mind of the wisdom of her particular position. However, if pressed, each party might reluctantly acknowledge that some modicum of merit could legitimately be attributed to the contrary argument. Yet the vigorous debate continues.

Formal education has long been dominated by the traditional lecture, where the learned few impart wisdom to the passive masses through well-conceived but oftentimes long and dry oratories. Lowerison et al. (2006) notes that faculty have tended to rely on lectures and readings from texts that culminate with a final exam to measure achievement. As a result, the student may essentially be a passive recipient of information, raising concerns that the focus is more on rote learning whereby students only memorize facts in preparation for tests.

Fortunately (most would argue) recent advances in academia have exposed the weaknesses of such a static approach. Teaching, it seems, may not always be equivalent to learning. Current thought suggests that students must be active participants in their own education in order for knowledge "to take." If the objective or goal of the educational process is the development higher-order learning skills, then the student must be engaged rather than recumbent.

In the last fifteen years or so, the use of computer-based presentation graphics or "non-interactive educational technology," such as PowerPoint presentations, has gained widespread acceptance in the university setting. Craig and Amernic (2006) reported that more than 400 million copies of PowerPoint were in circulation in 2002, a number that has certainly continued to grow since then. Classrooms across the nation are commonly becoming "wired," and today's textbooks are nearly always packaged with a plethora of computerized teaching supplements. While the traditional "chalk and talk" continues to be an academic mainstay, innovative educators continuously seek ways to enhance the classroom experience in an attempt to facilitate student learning.

Given that not all students learn in the same fashion, many professors proactively adopt new teaching methodologies in an attempt to help more students gain a better understanding of the substantive material being taught in a particular class. When faced with a student body that is more tech-savvy and visually-adept than ever before thanks to video games and similar devices, it is argued that form or presentation can no longer take a backseat to substance. Lowerison posits the belief that technology has the potential to transform the learning environment from one that is passive to one that is more active and subject to the control of the learner. McCombs (2000) suggests further that computer technology can potentially support diverse needs and capacities of

students, giving them more control and the potential for deeper processing and understanding of information. Yet, technology-based tools must accompany appropriate pedagogy to be effective (Laurillard, 2002).

Lowerison credits Roblyer (2003) for identifying two changes that have resulted from the integration of technology in education. The first has been the increase in the amount and type of resources that are now available to both the educator and student, while the second is the shift in learning strategies that computer technology has allowed. “Traditional instruction generally involved an instructor-led, didactic approach to learning. The introduction of computers into the classroom has come with promises to change the passive learning approach by introducing interactive and dynamic capabilities into the classroom. This, it is argued, will provide a richer learning environment where the learner can be more actively involved in his or her own learning.”

As will be seen, the transition to a more technologically advanced teaching environment has not been entirely smooth, and the move has not been without its critics. Also, while much of the focus of prior studies has been on the impact of technology on learning, workload-related issues being encountered by lecturers must be considered. As with most instructional innovations, academicians must balance the costs and benefits of utilizing technology in their classes.

Prior Research

The use of technology in an educational setting has sparked considerable interest on the part of researchers. In addition to articles providing “how-to” technical advice on the use of PowerPoint and other teaching tools, a number of studies have focused on the pluses and minuses of technology use. While many of the claimed advantages are perceptual in nature, empirical findings regarding the existence of a positive or negative technology impact on student learning have been mixed. Results from the second line of works are summarized below.

According to Szabo and Hastings (2000), the use of presentation graphics such as PowerPoint increases student interest in the subject matter, making the classroom experience more enjoyable. PowerPoint is perceived as adding structure to a presentation, aiding in the order and pacing of a lecture (Hlynka and Mason, 1998). This enables the lecturer to present clear summaries (Lowry, 1999), which can impact how much students learn from the presentation (Miller and McCown, 1986), as well as their retention (Garner, 1992). Students believe that they take better notes during lectures aided with PowerPoint slides, and the notes tend to be more organized, easier to understand, and useful when studying for tests (Susskind, 2005, 2008). Further, Szabo and Hastings, as well as Susskind, reported that PowerPoint presentations motivate students to attend class, albeit a finding contrary to what was found by Frey and Birnbaum (2002).

Several studies have also reported benefits accruing to the instructor who uses computer based technology. Atkins-Sayre et al. (1998) found that the use of technology enhances an instructor’s delivery and adds to his/her credibility. Lecturers can manage class time more efficiently as less time is spent writing on whiteboards or changing transparencies (Daniels, 1999, Mantei, 2000), and thus lectures may flow better.

Students may also like the professor more, be more inclined to take additional classes from him or her, and evaluate instructor behaviors more highly even though such actions are unrelated to the use of technology (e.g., perceived more timely return of assignments including helpful feedback, or assignments being viewed as involving higher-order tasks needing critical or creative thought.) (Apperson, et al., 2006.) At least some of these findings have been attributed to technology's claimed ability to generate positive attitudes and enhanced self efficacy in students.

Despite these positive reviews, technology usage has not always resulted in better teaching evaluations for faculty. In the study conducted by Lowerison, et al, the authors found no significant relationship between actual computer use in general or perceived effective computer usage on course evaluations (2006). Several explanations were proffered for this unexpected outcome, including that students may now view technology use in the classroom as being commonplace. In addition, students may have reached the point where effective technology use is expected and no longer seen as something that promotes learning. It may also be the case that technology is not being used in an appropriate manner, that is, as a transformative, student centered tool for learning.

Some researchers have been hesitant to jump on the technology bandwagon, with most of the criticism relating to how technology is being used in the classroom. Critics claim that form has been elevated over content (Tufte, 2003), and that technology has replaced "clear thought with unnecessary animations, serious ideas with ten-word bullet points, substance with tacky, confusing style" (Coursey, 2003). Further, PowerPoint has been denounced for its detrimental impact on "dialogue, interaction and thoughtful consideration of ideas," (Cyphert, 2004) and for its impact on the creation of long and annoying presentations. Perhaps of more concern, technology is used by some to accomplish a one-directional transmission of knowledge, enabling students to once again be passive and avoid participating in the learning process. In these cases, technology-based presentations, while perhaps more entertaining than stand-alone lectures, suffer from the same shortfalls as the traditional delivery mode. Technology, it seems, can serve as a crutch for the instructor. Perhaps technology has become the new, intangible version of the podium which to hide behind. Further, if the "what" (i.e., content) is being sacrificed for the "how" of the presentation, it is likely that not all learning objectives are being met.

Related to these concerns and likely a much bigger issue for most educators is the lack of concrete evidence that technology based presentations enhances the academic performance of students. Results have been decidedly mixed, an outcome that may be tied to the methodologies employed to assess the phenomenon. As noted by Susskind, some prior studies have compared the performance of recent cohorts of students taught by using technology with students taught using traditional lectures in earlier semesters (2005). Other research projects have involved different presentation formats as well as different content, making comparisons of performance difficult at best. These and other methodology variances may indeed be responsible for the lack of definitive findings. But in these cases, keeping all other variables constant can be easier said than done.

Concerns over faculty workload and effort must, out of necessity, also play a part in the discussion on the merits of technology. Teaching is typically only one component of the academician's job, albeit usually a dominant one. To the extent a proportionately large amount of the professor's time is being devoted to mastering the technology without any obvious beneficial returns, such an improved student learning or better student course evaluations, one may need to question the extent to which technology should be embraced for classroom use. If such effort substantially detracts from time spent on research or service commitments, then the costs of incorporating technology into one's classes may clearly outweigh any associated benefits.

Thus, it appears that similar to the chicken and egg conundrum, there may be no easy answer to the question of the importance of the medium to the learning process. At a minimum, it appears that technology is not a cure-all to end all ills of academia. Technology enhanced presentations, like whiteboard, blackboard or overhead based presentations, can be very good or very bad, depending on the skills of the presenter. If technology is used as a means to provoke critical thought on the part of students, then the learning process wins. However, if technology is used in such a way that it widens the chasm between student and teacher, or as a way to entertain rather than educate, then the tool will fail to make a meaningful contribution to academia. At the very least, the issue of how much value technology adds to academia is deserving of continued investigation.

Present Study

Students taking selected business classes in a mid-sized Midwestern university were invited to participate in research study, the purpose of which was to assess the effectiveness of classroom technology on student learning and effort. The authors explicitly acknowledged that different instructors use technology in varying degrees in their classes, and that the extent of usage could be dependent upon a number of factors including the proficiency of the professor, the nature of the particular class (e.g., quantitative versus qualitative), and time demands of a course.

Students in the chosen classes were asked their opinion of how the use of technology (such as PowerPoint) would generally impact the overall quality of a "hypothetical course with the same features and characteristics of the course" in which they received the survey as well as how they might evaluate the instructor of such a course. Students were informed that the study was not meant to be an evaluation of the particular course or particular instructor, but rather the investigators only wanted to gain an understanding of their general perceptions regarding how the use of technology might impact classes. In each case, students were asked to assume that the class did "make extensive or moderate use of technology (PowerPoint slides or similar technology)," irrespective of how much technology was actually being used in the particular course. Survey questions were patterned after three different student evaluation forms previously or currently being used at the authors' institution, including a form created and used by all regental public institutions within the state, the student instructional report II (i.e., SIR II), and the IDEA Diagnostic Form Report.

The survey instrument consisted of three parts. In Part I, students were asked how the extensive or moderate use of technology would influence their perceptions of the instructor, including his or her level of preparation for class, enthusiasm for teaching, knowledge of the subject matter, ability to clearly present information in a understandable way, ability to summarize and emphasize important points, ability to use illustrative examples, ability to introduce stimulating ideas and student intellectual effort, concern for student learning and willingness to answer questions. In addition, Part I asked students how the use of technology would impact the total amount of material being covered, the complexity of the material, and the effective use of class time. Each item was based on a 5 point scale, with "1" being significantly positive, "2" being somewhat positive, "3" being no difference, "4" being somewhat negative, and "5" being significantly negative.

Part II asked students how they believed the extensive or moderate use of technology would impact their own actions or behavior, using a similar 5 point scale. Specifically, students were asked the effect technology would have on their own level of preparation for each class, the amount of time they would study for each class and for exams and quizzes, their attentiveness, participation and attendance in class, and the amount of their interaction with the instructor during and outside of class. Students were also asked how technology would impact their appreciation of the instructor's effort and of the importance of the course material, as well as their desire to take additional classes from the instructor or in the subject matter. Finally, students were asked how extensive or moderate use of technology would impact their overall evaluation of a course and of an instructor.

Part III of the survey included demographic questions. Students were asked whether they were graduate or undergraduate students, their program of study or major, and their year in school (e.g., freshman, sophomore, etc.), as well as their grade point average, gender, age, race, and personality type.

Twelve faculty, including two of the authors, administered the survey in their classes. Faculty were selected on the basis of their rank, varying degrees of technological proficiency and usage, discipline, and gender in order to provide a cross-section of courses being evaluated. Classes chosen included those at the 100 (first year), 200 (second year), 300 (junior level), 400 (senior level) and graduate (700) level. In addition, courses were selected from almost all majors offered by the school including accounting, economics, finance, health services, human resources and management/organizational behavior at the undergraduate level as well as from the MBA and MPA (Master of Professional Accountancy) programs. In total, the survey was administered in seventeen different classes, including multiple sections of several of the courses.

As part of the study, faculty who participated were asked to identify whether the class in question would be best described as quantitative (problem solving) or qualitative, whether or not it made extensive or moderate use of technology (defined to mean significant use of PowerPoint slides or similar technology in a majority of the classroom sessions), and whether the course was primarily taught through lecture or by other means such as cases or seminar.

The survey was administered near the end of the spring 2007 term, approximately two weeks prior to the time the regular student course evaluations were given. Enrollment in the sections evaluated totaled 676 students, including some students who were enrolled in more than one of the classes included in the sample. Faculty were given the option of devoting class time to the completion of the survey, or allowing the students to complete the questionnaire outside of class and return it later via an anonymous collection box. In total, approximately 500 usable surveys were completed and returned.

Results

As mentioned, Part I of the survey queried students as to how the use of technology might influence their perception of the instructor, and as Table 1 shows below, students generally responded positively. This section of the questionnaire included a total of fifteen questions that were further divided into two groups through the application of factor analysis: those relating to the impact of technology on a faculty member's presentation style and skills (Construct 1) and those relating to the faculty member's general teaching prowess (Construct 2). In other words, Construct 2 included questions that measure, to a certain extent, an instructor's teaching ability and how technology might impact the students' impressions of an instructor's abilities. So, while technology does not necessarily impact the instructor's behavior with respect to the questions in Construct 2, the use of technology in the classroom might conceivably impact a student's perception of the instructors teaching ability with respect to the questions in Construct 2. Recall that each item was based on the following 5 point scale: "1" - significantly positive, "2" - somewhat positive, "3" - no difference, "4" - somewhat negative, and "5" - significantly negative. The mean and standard deviation is provided for each question, as well as the percentage of students who gave a particular response.

Overall, student perceptions of the impact of technology on the effectiveness of the instructor's presentations (Construct 1) were more positive than their view of the impact of technology on the instructor's teaching ability (Construct 2). Over forty percent of the students believed that moderate or extensive of technology would have a significantly positive impact on their perception of the instructor's ability to emphasize important points, present information in a clear and understandable fashion, and use helpful examples. Technology was also viewed as helping the instructor to summarize important points and to make effective use of class time. In other words, students appear to perceive that technology helps instructors to be more organized in their presentations and to more clearly present and summarize material. Most students also believed that the use of technology would enable the instructor to cover more material. Further, more than half of the students thought more complex material could be covered with the help of technology, although there were more neutral responses to this particular question when compared to the others comprising Table 1.

Table 1

Basic descriptive statistics Instructor			Positive		Neutral	Negative	
	Mean	Std Dev	1	2	3	4	5
Construct 1: Presentation Skills and Style							
The instructor's ability to *emphasize* important points.	1.8644	1.0114	.45	.35	.11	.06	.03
The instructor's ability to present information in a clear and understandable manner.	1.8804	1.0085	.43	.37	.12	.05	.03
The instructor's ability to *summarize* important points.	1.8902	0.9464	.39	.42	.12	.05	.02
The instructor's use of examples or illustrations to clarify important material.	1.9234	1.0118	.42	.34	.16	.05	.03
The effective use of class time.	1.9765	1.0066	.38	.38	.15	.06	.03
The total amount of material that is covered, assuming more coverage is preferable to less coverage.	2.1000	0.9567	.28	.44	.19	.07	.02
The complexity of the material covered.	2.3084	0.9625	.22	.36	.33	.07	.02
Construct 2: Teaching Prowess							
The instructor's level of preparation for class.	1.8585	0.9637	.43	.38	.12	.05	.02
The instructor's knowledge of the subject matter.	1.9096	1.0517	.48	.23	.22	.05	.02
The instructor's overall enthusiasm for teaching.	1.9705	1.0103	.40	.32	.20	.06	.02
The instructor's ability to relate course material to real life situations.	2.0549	1.0266	.38	.30	.24	.06	.02
The instructor's willingness to answer questions from students and listen to student opinions.	2.1906	1.0181	.32	.25	.36	.04	.03
The instructor's ability to introduce stimulating ideas about the subject matter.	2.2627	0.9556	.25	.34	.34	.05	.02
The instructor's concern for student learning.	2.2652	1.0148	.28	.29	.35	.05	.03
The instructor's ability to stimulate students to intellectual effort beyond what is required in most courses.	2.2941	0.9588	.23	.34	.35	.06	.02

Student perceptions of the impact of technology on the instructor's teaching ability (knowledge, enthusiasm, level of preparation, etc.) as measured in Construct 2, were positive but, in general, less so than the responses to questions found in Construct 1 as evidenced by the larger percentage of neutral responses and higher means. Instructors using presentation technology were perceived as being more prepared for class, having greater knowledge of the material, and demonstrating greater overall enthusiasm for the material. However, there were more neutral responses to the questions concerning faculty interaction with the students. The instructor's willingness to answer questions and to listen to student opinions, his/her ability to introduce stimulating ideas about the subject matter, his/her perceived concern for student learning, and his/her ability to engage students each received a more neutral, but still positive, response. These responses suggest that technology may be less effective in helping to create a culture of student engagement, class discussion, and student-faculty interaction.

As mentioned earlier, students were asked to respond for a hypothetical class with the same characteristics as the one in which they received the survey (i.e., same level of course, similar nature of the course – quantitative vs. non-quantitative, etc.), assuming the hypothetical course made extensive or moderate use of presentation technology (PowerPoint slides or similar technology). This raised the issue of whether student responses may have been biased by the extent to which presentation technology was being used in the actual class in which they completed the survey. To address this issue, student responses were divided between those courses which made extensive or moderate use of presentation technology (roughly 350) and those courses which reported minimal use of the technology (roughly 150). The results of this analysis are shown in the appendix; only one question (i.e., the instructor's ability to introduce stimulating ideas, where the respective means were 2.2197 and 2.3907) reflected a statistically significant difference in the responses given by students in the two contrasting environments, suggesting that the student responses were not materially biased by the extent of the actual amount technology was being used.

Recall that Part II of the survey asked students to indicate how the extensive or moderate use of presentation technology might influence their own behavior and learning. This part of the survey included sixteen questions, fourteen of which were broken into three groups: those relating to how technology might affect their own learning and subsequent behavior (Construct 4), their engagement in the classroom (Construct 5) and their engagement outside of class (Construct 6). Responses to these questions are shown in Table 2 below; the mean and standard deviation is once again provided for each question, as well as the percentage of students who gave the specific response.

Student responses suggest that students believe technology enhances their learning, per the results shown for Construct 4. Likely related, students also seem to better appreciate the effort of the instructor and the importance of the material when moderate or extensive technology is utilized, although a larger percentage of students are neutral. Technology appears to have less of an impact on the students' desire to take additional classes from a particular instructor or in the particular discipline, although there is still a positive overall effect.

Student perceptions of their engagement in the classroom (Construct 5) also tended to be more neutral. A majority of students indicated they were more likely to attend class when technology was being used, and they thought that technology made them more attentive in class. However, results were more mixed when it came to the quantity and quality of note-taking by the student. While not reflecting the lowest overall response (i.e., highest mean), almost a fifth of the students thought technology had a negative effect on their notes. Students were also more neutral with respect to technology's effect on their participation in classroom discussions.

The use of presentation technology in the classroom did not have as much of a positive effect on students' out of classroom activities (Construct 6). The overall responses still reflected positive perceptions as indicated by the means slightly below 3.0, but for each of the questions in this group, the neutral responses were the dominant response. The presence of technology in the classroom did not appear to positively alter the study habits of the students or student-instructor interactions in or out of the classroom.

Table 2
Basic descriptive statistics
Student

	Mean	Std Dev	Positive 1	2	Neutral 3	Negative 4	5
Construct 4: An Overall Appreciation							
The amount you learn from class.	2.2294	0.9193	.22	.42	.28	.06	.02
Your appreciation for the instructor's effort.	2.2466	0.9670	.25	.34	.33	.06	.02
Your appreciation for the importance of the material.	2.3523	0.8706	.18	.36	.41	.04	.01
Your desire to take additional classes from the instructor.	2.3875	1.0565	.25	.26	.41	.03	.05
Your desire to take additional classes in the subject matter.	2.5569	0.9168	.15	.26	.52	.03	.04
Construct 5: Personal Engagement in the Classroom							
Your attentiveness in class.	2.3425	1.0600	.22	.41	.21	.13	.03
Your overall attendance for the class.	2.4384	0.9639	.22	.22	.47	.07	.02
The quantity and quality of notes you take.	2.5362	1.1956	.23	.31	.22	.19	.05
Your level of participation in class discussions.	2.6712	0.8708	.09	.30	.47	.12	.02
Construct 6: Out of Class Engagement							
The amount of time you study for exams and quizzes.	2.4462	0.9417	.19	.28	.43	.09	.01
The level of your preparation for each class session.	2.4932	0.9997	.16	.33	.40	.10	.01
The amount of time you study for class each day.	2.6614	0.8499	.10	.29	.48	.12	.01
The amount of your interaction with the instructor during class.	2.7495	0.9031	.10	.24	.49	.15	.02
The amount of interaction with the instructor outside of class.	2.8337	0.8821	.09	.17	.59	.10	.05

Part II of the survey also included two questions on how technology would impact the student's overall evaluation of the course and the instructor. Consistent with previously discussed findings, a majority of students indicated that the use of "more" technology would positively impact both their course and instructor evaluations, although roughly a third of the student population was neutral.

Table 3
Basic descriptive statistics
Course and instructor evaluation

	Mean	Std Dev	Positive 1	2	Neutral 3	Negative 4	5
Your overall evaluation of a course.	2.2231	0.8570	.21	.43	.31	.04	.01
Your overall evaluation of an instructor.	2.2697	0.9295	.23	.35	.36	.04	.02

Summary and Conclusion

The results of this data analysis suggest that the extensive or moderate use of technology in the classroom has the largest positive impact on the factors measured in Construct 1. In the opinion of students, the biggest benefit of technology appears to be in assisting faculty in creating more organized classroom presentations, utilizing class time better, and emphasizing important points more effectively. Technology appears to have a more neutral, though still positive, impact on creating an engaging classroom situation and encouraging student-faculty interaction.

When students were asked how technology impacted their behavior with respect to a course, they indicated that technology increases their attentiveness, improved the quality and quantity of their note taking, and positively impacted the amount they learned from the class. The use of technology also increases the student appreciation of the instructor's effort expended in teaching a course. These findings suggest that technology may create a more student-centered learning environment. On the other hand, the use of technology had a less positive effect on student attendance, participation, and the amount of time students spend preparing for class.

In today's performance culture at many academic teaching institutions, faculty are focused on obtaining good teaching evaluations and/or improving their evaluations. The results of this study show that using technology in the classroom does appear to have a positive impact on the student's overall evaluation of both the course and the instructor. Thus, increasing technology usage in the classroom may help to improve certain aspects of the classroom experience. However, depending on the instructor's knowledge of and comfort level with technology, the instructor effort required to learn to effectively use technology may not be worth the cost. In fact, considering the total educational experience that students receive while in college, there are benefits to individual students associated with learning how to learn in multiple environments from diverse instructors who use a variety of teaching methods. If technology were to become prevalent in absolutely every classroom, creating a homogenous learning experience, overall student learning might suffer given the various learning styles exhibited by students.

These results suggest that, on the margin, technology use in the classroom has a positive impact. While technological enhancement may not necessarily be appropriate for all classroom situations and all subject matter, instructors who are comfortable using technology and find that it enhances their teaching experience should continue to incorporate it in their classes. Those who do, however, must remember technology for what it is – a tool, when used appropriately, which can aid the learning process.

Further analysis is presently underway that considers whether certain demographic traits of the students, selected courses and participating faculty have any impact on the how the usage of technology is perceived in the business curriculum. For instance, do students with a higher GPA, different majors (e.g., quantitative) or other differences (gender, personality type, etc.) perceive technology use differently? Do differences in class type (quantitative, lecture oriented, etc.,) or faculty qualifications influence the perceived strengths or weaknesses of technology? It is hoped that as more information is made available to academicians, the debate over whether technology benefits student learning and educator effectiveness can become more enlightened.

Appendix

Potential Bias Defense Instructor	PowerPoint	N	Mean	Std Dev	Test	Prob
The instructor's level of preparation for class.	Minimal	151	1.9735	0.9015	1.7105	0.0872
	Extensive	354	1.8192	0.9878		
The instructor's overall enthusiasm for teaching.	Minimal	151	2.0993	0.9220	1.8521	0.0640
	Extensive	354	1.9266	1.0431		
The instructor's knowledge of the subject matter.	Minimal	151	2.0265	0.9794	1.5924	0.1113
	Extensive	354	1.8701	1.0804		
The total amount of material that is covered, assuming more coverage is preferable to less coverage.	Minimal	151	2.1192	0.8788	0.2006	0.8410
	Extensive	355	2.1014	0.9891		
The instructor's ability to present information in a clear and understandable manner.	Minimal	151	1.9139	0.9447	0.4003	0.6889
	Extensive	355	1.8761	1.0368		
The instructor's ability to *summarize* important points.	Minimal	151	1.8874	0.8449	-0.1618	0.8715
	Extensive	355	1.9014	0.9880		
The instructor's ability to *emphasize* important points.	Minimal	150	1.8600	0.9051	-0.1731	0.8625
	Extensive	355	1.8761	1.0557		
The instructor's use of examples or illustrations to clarify important material.	Minimal	151	1.8808	0.9446	-0.7215	0.4706
	Extensive	354	1.9492	1.0417		
The instructor's ability to relate course material to real life situations.	Minimal	151	2.1788	0.9244	1.7802	0.0750
	Extensive	355	2.0113	1.0656		
The instructor's ability to introduce stimulating ideas about the subject matter.	**Minimal**	**151**	**2.3907**	**0.8483**	**1.9692**	**0.0489**
	Extensive	**355**	**2.2197**	**0.9927**		
The instructor's ability to stimulate students to intellectual effort beyond what is required in most courses.	Minimal	151	2.3510	0.8422	0.8314	0.4058
	Extensive	355	2.2789	1.0020		
The complexity of the material covered.	Minimal	151	2.2848	0.8823	-0.4811	0.6304
	Extensive	354	2.3277	0.9957		
The effective use of class time.	Minimal	151	1.9934	0.9695	0.1660	0.8681
	Extensive	355	1.9775	1.0249		
The instructor's concern for student learning.	Minimal	152	2.2632	0.9260	-0.0939	0.9252
	Extensive	353	2.2720	1.0524		
The instructor's willingness to answer questions from students and listen to student opinions.	Minimal	152	2.2237	0.9434	0.4172	0.6765
	Extensive	353	2.1841	1.0513		

Appendix (continued)

Potential Bias Defense
Student

	PowerPoint	N	Mean	Std Dev	Test	Prob
The level of your preparation for each class session.	Minimal	152	2.5855	1.1762	1.1542	0.2484
	Extensive	355	2.4620	0.9148		
The amount of time you study for class each day.	Minimal	152	2.6579	0.8773	-0.0486	0.9612
	Extensive	355	2.6620	0.8360		
The amount of time you study for exams and quizzes.	Minimal	152	2.4013	0.9154	-0.8010	0.4231
	Extensive	355	2.4732	0.9515		
Your attentiveness in class.	Minimal	152	2.4342	1.0837	1.1677	0.2429
	Extensive	355	2.3127	1.0500		
The quantity and quality of notes you take.	Minimal	152	2.6250	1.1838	0.9751	0.3295
	Extensive	355	2.5127	1.1987		
Your level of participation in class discussions.	Minimal	152	2.7697	0.8257	1.6304	0.1030
	Extensive	355	2.6366	0.8800		
Your overall attendance for the class.	Minimal	152	2.5263	0.8985	1.2509	0.2110
	Extensive	355	2.4141	0.9860		
The amount of your interaction with the instructor during class.	Minimal	152	2.8224	0.8697	1.1188	0.2632
	Extensive	355	2.7268	0.9090		
The amount of interaction with the instructor outside of class.	Minimal	152	2.8750	0.8559	0.6598	0.5094
	Extensive	355	2.8197	0.8837		
The amount you learn from class.	Minimal	151	2.1987	0.8328	-0.5811	0.5612
	Extensive	355	2.2479	0.9570		
Your appreciation for the instructor's effort.	Minimal	152	2.3421	0.9070	1.4471	0.1479
	Extensive	355	2.2113	0.9903		
Your appreciation for the importance of the material.	Minimal	152	2.4211	0.8729	1.1503	0.2500
	Extensive	355	2.3239	0.8664		
Your desire to take additional classes from the particular instructor.	Minimal	152	2.3947	0.9708	0.1190	0.9052
	Extensive	355	2.3831	1.0917		
Your desire to take additional classes in the subject matter.	Minimal	152	2.5000	0.8915	-0.9273	0.3538
	Extensive	354	2.5810	0.9276		

Potential Bias Defense
Course and instructor evaluation

	PowerPoint	N	Mean	Std Dev	Test	Prob
Your overall evaluation of a course.	Minimal	152	2.2697	0.7887	0.8073	0.4195
	Extensive	355	2.2056	0.8862		
Your overall evaluation of a course.	Minimal	151	2.3179	0.8514	0.7306	0.4650
	Extensive	353	2.2550	0.9610		

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