Effects of Smart Classrooms on Learning and Teaching Effectiveness

The students' point of view

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Abstract
Student feedback on the relative advantages and disadvantages of traditional blackboard and technology-based instruction is presented. The two types of instruction are suited to different educational goals. Blackboard instruction is suited to presentation of problem solving. Smart classroom presentation is suited to transmission of basic facts and information. The classroom experience of students is very different for the two types of instruction. The relative benefits of the two types of instruction depend strongly on the students' learning preferences and personal circumstances.

1. Introduction

Recently, the College of Engineering and Engineering Technology at Northern Illinois University equipped four classrooms with audio-visual systems that allow display of videocassettes, paper documents, Internet pages, and interaction with commonly used software such as Microsoft Office. These classrooms are called "smart classrooms," multimedia lecture halls, or electronic classrooms. Their purpose is to create new opportunities in teaching and learning by integrating computer, multimedia, and network technologies. However, it is not clear that using this new technology will automatically result in more effective teaching and learning. After all, extravagant claims were made for the blackboard when it was introduced[1].

This paper focuses on students' comparisons of instruction that uses the smart classroom to the instructional style associated with traditional classrooms. The comparison is limited to the usage of the classroom for presentation of information, and does not address issues such as the relative advantages of the two types of classroom for active and cooperative learning.

2. Teaching styles for presenting information

Many instructors use smart classrooms to present information in the form of prewritten visual displays such as Powerpoint slides, PDF documents, graphics, and so forth. They may post handouts for these presentations on a web site, so that students may bring copies of them to class. Using this strategy, instructors do not need to spend any time writing on the blackboard.

Instructors who do not use the special equipment use the blackboard to support presenting information. They may write the bulk of the lecture on the board, write down only key concepts and overarching ideas, or use the board to map out class discussions.

3. The information available for analysis

Information was available from two sources:

1. A survey was conducted to collect students' comparisons of smart classroom teaching to blackboard teaching. The instructor of each course taught in a smart classroom was asked to distribute a questionnaire (Figure 1) to the students in the course. The questionnaire was also distributed to students in a course taught primarily through the Internet. No attempt was

made to determine whether the instructors actually used the smart classroom technology consistently.

2. One of the authors encouraged his students to write free-form essays on the advantages and disadvantages of smart classrooms. These essays were written as part of required journal assignments in one of the authors' courses[2]. Most of these responses came from seasoned industrial engineering majors who had experience with smart classrooms.

4. Response to the survey

Seventy-four questionnaires were returned --- only a small fraction of the total distributed. We believe that most of the questionnaires returned were from students enrolled in industrial engineering courses. Although the response cannot be called representative of all engineering and technology students, we believe it contains valuable information about students' perceptions of smart classrooms. It also contains valuable clues about the appropriate use of smart classroom technology.

Of the 74 respondents, 39 were industrial engineering majors, 20 were electrical engineering majors, 13 were mechanical engineering majors, 1 was a technology major, and 1 was an operations and management information systems major.   Thirty-four of the respondents reported their grade point average as above three (out of four), 30 reported a GPA below three, and the rest did not report their GPA. Seventeen were freshmen or sophomores; 56 were upperclassmen or above, and one did not specify their year in school.

The responses to the survey are summarized in the following table:

Question 1 Have you ever been in a smart classroom where the professor consistently used the ceiling projector to present information?	Responding Yes to question 1 (49)	Responding No to Question 1 (25)
Question 2 If your answer for the first question is YES, how often? a. One course b. Two or more courses	22 responding a 27 responding b	
Question 3 Do you believe that using the projector to present information is more effective than traditional presentation using a blackboard or whiteboard? a. Definitely b. Somewhat c. Definitely not	13 responding a 30 responding b 6 responding c	4 responding a 15 responding b 3 responding c 3 not responding

Question 4 Based on your experience with smart classrooms, which of the following do you prefer? a. Presentation of information using a projector. b. Presentation of information using a blackboard or whiteboard c. No preference	16 responding a	4 responding a
	16 responding b	8 responding b
	15 responding c	11 responding c
	2 responding both a and b	2 not responding

It is interesting that most of the students who responded No to the first question still had definite opinions. To test the hypothesis whether the preference of students who responded Yes is greater than the preference of those who responded No to the first question, we performed a Z-test. The z value was 1.008 and $Z_{0.05}$ is 1.64. This means that there is no statistically significant difference between the responses from those who said No and those who said Yes. There is also no statistically significant difference in response between those with low or high GPA or between those with shorter or longer experience with college courses. The z value for this hypothesis test was 0.35. There is also no strong preference for one presentation style over the other. Rather, as is evident from their written comments and the essays, the students have a much more sophisticated point of view than simply preferring one style over the other. They have identified situations where one style is more suitable than the other, and are more concerned with the effectiveness and deeper quality of the presentation than the medium in which it appears.

5. The written comments on the questionnaires and the free-form essays
Two strong themes appeared in the students' writing:
1. Instructors present two different kinds of information. Blackboard teaching works better for one and smart classroom teaching works better for the other.
2. The classroom experience of the students is strongly affected by the presentation style.

Many students feel that blackboard teaching is more suitable for presentation of solved examples and working through problems, where they feel it is important for them to keep pace with the instructor, and where they need to see thought processes actually worked out. They feel that smart classroom technology, on the other hand, is more suited to presentation of large volumes of information, such as definitions and facts, where real time comprehension is not so important.

This suggests that blackboards are more suited to the analytical and problem-solving end of Bloom's[3] taxonomy of cognitive skills, and that smart classrooms are more suited to comprehension and recall (the other end of Bloom's taxonomy). This also suggests that students like blackboard teaching more when it is more important for them to function as an interactive participant in the classroom rather than a spectator. It is certainly true that instructors using blackboards may, if they choose, create extemporaneous examples in response to students' comments, facial expressions, and listening styles. It should be remarked, however, that students

in another study[4], involving a sociology class, felt that the use of smart classroom technology increased student participation.

The classroom experience of the students is affected by their ability to download course notes that can be read before, during, or after class, or without going to class at all. Some students feel this is good because it allows them to think about the material as it is being presented and pay closer attention to details, instead of worrying about getting a good set of notes. It is also possible to restrict note taking to salient points. However, students noticed that smart classroom technology tempts instructors to present a large volume of information instead of selecting basic and salient concepts.

Other students feel that having prepared notes is good because it allows them to skip class without serious consequences. This may be a benefit for students who live off campus or have full time jobs. However, at least one student who succumbed to the temptation to try to teach himself from the prepared notes was unhappy with the results. Some students remarked that not taking notes tended to make them lazy and disinterested. One student said that it was even harder to pay attention during a smart classroom presentation than a blackboard presentation, because he knew exactly what was going to appear.

6. Summary and conclusions

From the above information, it can be concluded that a combination of blackboard and smart classroom technology should be used, and that instructors should always remember that students have widely heterogeneous needs and learning styles. Also, it should always be remembered that the instructor's goal should be deep learning and that excellent teaching skills are needed to reap benefits from technology and overcome its limitations. A direct quote from a student summarizes the situation very well:

> The combination of Smart Class Teaching and Black Board is the best way of teaching. Black Board Teaching allows for more interaction between the professor and the students, and the ability to more dynamically solve problems with the guidance of the professor. In a sense, really see the mental process that the professor goes through to solve a problem. Thus, the students are more involved in learning the material. Smart Class teaching is good for more specialized Industrial Engineering classes where computers or programming is involved. Inthis case, the professor may rely on the presentation to communicate information to the students. Engineering is really a mixture of art and science --- perhaps, teaching the "science" or more factual-oriented portion is better done using Smart Class Teaching, and the "art" or creative-oriented portion is better done using Black Board Teaching. However, it is critical that a professor be very comfortable with the material and periphery subjects if Black Board Teaching is used since the discussion may shift across multiple subject areas in order to reach the teaching objectives.

<div align="center">--- Milad Alhir</div>

REFERENCES

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Figure One

1. Have you ever been in a smart classroom where the professor consistently used the ceiling projector to present information?

      a. Yes   b. No

2. If your answer for the first question is YES, how often?

      a. One course   b. Two or more courses

3. Do you believe that using the projector to present information is more effective than traditional presentation using a blackboard or whiteboard?

      a. Definitely   b. Somewhat   c. Definitely not

      Please add any comments you have on advantages or disadvantages:

      _____

4. Based on your experience with smart classrooms, which of the following do you prefer?

      a. Presentation of information using a projector
      b. Presentation of information using a blackboard or whiteboard
      c. No preference

      Please add any comments on the reasons for your preference:

      _____

5. Please provide the following information:

      a.   Your major: _____.

      b.   Years in college: _____.

      c.   Your GPA: _____.