Using Technology to Foster a Student-Centered Classroom

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Walk into any traditional classroom and you will see that the physical arrangement of the room is designed such that the focus of the classroom experience is directed toward the instructor. The chairs all face the lectern, where the instructor stands, often in front of a black or whiteboard. In this article, we propose that this traditional model of education, which has served us well since the time of the Greek philosophers, is no longer the most appropriate model for effective learning.

One way to quickly assess whether any class is instructor-centered or student-centered is to observe student behavior when the instructor is late. In the instructor-centered class, the class passively sits and waits for the instructor. On the other hand, in the student-centered class students come into the room and start working and although they may check to see if the instructor is available to answer questions, the class work starts with or without the presence of the instructor.

In the days before the invention of the printing press, it was necessary for an instructor to be the primary source of information for students and the instructor centered model of education worked well. Later, as democratic ideas fostered the belief that education should be freely available to everyone; the instructor-centered approach provided a means for instructors to work with large numbers of students who came together in the classroom to be 'taught.' Again, since this allowed much greater access to education this was a reasonable approach. Today, however, the advent of modern computer technology makes it possible to restructure the learning environment and work with large numbers of people, but shifts the focus away from teaching and directs attention to helping students learn. Accordingly, education can be delivered to a large number of students without sacrificing the one-on-one qualities afforded by a Socratic approach.

One does not have to look far to find evidence that there is a need for change. The instructor-centered nature of the traditional classroom has fostered an environment in which responsibility for learning has been shifted from the student to the instructor. Therefore, if a student is not performing well it is not because he or she needs more effective study time. A review of comments made by students enrolled in the undergraduate behavioral statistics course at Wichita State University suggests that there is a fairly general attitude that if one attends class, takes notes as the instructor lectures and attends exams they will succeed. Moreover, if or when they do not succeed it is somehow the fault of the instructor. At a recent graduation exercise, a member of the Kansas Board of Regents speaking to the graduates noted that with graduation they would see many changes in their lives. In jest, he noted that, "among these changes, they would find that there would now be an extra 15 to 30 minutes more each week for other activities, since this time would no longer by needed for study." Unfortunately, this is far too close to the truth. In a recent study Taraban, Maki, and Rynearson (2000) state that students self-report spending approximately 15 minutes per day in course-related study behavior. The authors note that when students were asked to contrast their study behavior with that of other students, they responded that they thought other students study about the same amount of time that they do, while they believed that the 'ideal' student probably would spend somewhere closer to 20 minutes per day in study

outside of class. This is disturbing not only because these results suggest that students see this as the norm, but also because they maintain the belief that this is an adequate commitment of time for learning college level material. Moreover, when asked to record time spent learning course-related material, actual study time was clustered in the 24 hours preceding examinations.

The numbers reported by Taraban, et. al. (2000), do not seem inconsistent with our observations, nor with the informal self-report of our students. A review of student evaluations taken over the past ten years reveals that almost without exception students rate the behavioral statistics course as one of the most demanding courses they have experienced. Yet our work is designed to allow for successful completion if students follow the age old formula of spending two hours in study for each hour that they spend in class. We carefully tell students that for a three hour course like statistics this translates to around one hour per day. Clearly any student who spends anything close to that amount of time in active learning activities relevant to the course content will be successful. An article appearing in The Wichita Eagle (June, 2002) in which a new policy of reducing the privileges students receive after their fourth year as a student, University of Georgia Provost Karen Holbrook was quoted as saying, ". . . a recent survey found students average 13 hours a week in class and six more hours studying." Therefore, the average University of Georgia student reports spending approximately 4.5 minutes each day outside of class studying. Given the similarity of these findings with those of Taraban, et. al. (2000), there can be little doubt that whatever we are doing, we need to do much more to motivate the student to become actively engaged in their own education.

Technology gives us the potential to embrace a student-centered model of education which clearly focuses on the student, but which would not limit a student's access to the didactic process or pull the cost of education so high as to make it inaccessible. Since learning is both a personal and active process, the individual student must become the primary agent responsible for implementing this process. Making education more student and learning centered is going to require a redefinition of the role for both the student and the instructor.

Student-Centered Classroom Using Technology

As students become the center of classroom activity, the role of the instructor changes as he or she becomes a resource for students, a catalyst to help the student find the right combination of activities to promote his or her individual learning. The work that students do in the classroom becomes very similar to the study to that they might do outside of the classroom. The time spent in class becomes more directly aimed at the individual needs of each student and thus more likely to serve to motivate them to work outside of the classroom. As the process becomes more student-centric, the role of the instructor becomes that of facilitator. These new roles for both student and faculty help both parties understand that the instructor can lend a hand as the student learns, but is not responsible for their learning or failure to learn.

During class the instructor is present to answer questions, help the individual student, and to guide the students as they become engaged in the learning process. Technology enables the instructor to extend this role beyond the classroom. Using e-mail, discussion forums, and even virtual classrooms[1]. which allow mediated Q&A sessions, students are encouraged to engage in collaborative learning. Thus technology gives the student access to the faculty virtually 24 hours a day.

Even though the lecture no longer is the focus of the student-centered classroom, we have seen that there are some students who need a formal didactic presentation of the material to help them master complex concepts. Again, technology makes it possible for the student to access lectures, demonstrations or discussions when needed rather than when dictated by a single schedule. These materials can be digitally stored and delivered on-demand via the internet, CD-ROM or DVD. The lecture may be the same as the one that they would have heard in the traditional classroom setting, but can now be delivered when he or she wants it. Furthermore, it allows the student to tailor the presentation to meet their own individual needs. Using the pause control and the rewind control they can back up or stop the lecture while they take notes or look up reference material. This is something we just can't do when we are lecturing live in the classroom. Technology facilitates this student-centered delivery of even the formal lecture and provides the student the opportunity via e-mail or discussion forums to ask questions and/or collaborate with other students in developing an understanding of the course content. For many students, the ability to ask and receive answers to their questions without having to speak in front of a large group of people is much easier.

Exploring Student-centered vs. Instructor-centered

To test these ideas and confirm that the change to a more student-centered classroom environment would produce the positive results we expected, we initiated a series of case studies examining the attitude, behavior, and achievement of students given the opportunity to learn in this very different class environment. An environment in which each student worked on his or her own with access to a personal computer located on the table at which he or she was seated. We also ran a parallel traditional class to help provide a reference by which to evaluate our outcomes. The traditional class met in a classroom with desks lined up facing the front from which the instructor lectured. It would have been our preference to design true experiments to evaluate these questions, but the realities of the academic environment and the needs of the students precluded the level of control required for formal experimental evaluation. The case study approach provided a format for examining some of the potential consequences which might be expected to accompany the shift from an instructor to a student-centered classroom.

METHOD

The Course

An undergraduate statistics course required of all psychology majors served as the focal point for this study. We chose this course because the content is perceived by students to be difficult, abstract, and generally unfamiliar. In addition, since statistics is a required course but very unlike most other courses in the psychology curriculum, we thought it was reasonable to assume that for the majority of students the strongest motivation for enrolling was probably the need to meet the curricular requirement. This is also a course that many students struggle with and we thought it might be more sensitive to changes in the course format. But most of all, we chose the course because it is one we teach.

The Students

A total of 81 students during the fall semester 2001 and the spring semester 2002 enrolled in one of two sections of undergraduate statistics. Table 1 displays the distribution of students among the four sections and details the number of those who received grades in the course. Table 2 displays the number (percent) of students who dropped the course by class format.

Table 1. Final Enrollment by Semester and Class Format

	Traditional	Student-Directed
Spring 2001	10	8
Fall 2001	19	12

Table 2. Class Withdrawal (%) by Semester and Class Format

	Traditional	Student-Directed
Spring 2001	9 (47%)	5 (38%)
Fall 2001	12 (38%)	6 (33%)

Results

Using the data, for students who actually completed the course, a Chi Square was performed to determine whether there were any differences in the number of drops among the students in the two class formats ($?2 (1) = .34$, $p = .56$). This non-significant finding was somewhat surprising as we had formed the impression that the student's were more likely to drop the traditional-format class than the student-centered format. We were particularly interested in this outcome because of the high rate of drops among students enrolling in the statistics course. Looking at these data clearly suggests that dropping the class is a fairly common method of dealing with poor performance.

A final Chi Square took the form of Fisher's Exact Test of Probability because of the large number of cells which contained small numbers. This test was designed to determine if there was a relationship between the class format and the grades assigned (see Table 3). For this analysis, we counted the number of students in each class formats who earned each of the grade categories. The test did not provide any indication that such a relationship existed (X^2 (4) = 1.0, p = .95).

Table 3. Frequency of Grades Earned by Class Format

	A	B	C	D	F
Traditional	9	13	5	1	1
Student-Centered	7	7	4	1	1

The mean total points earned by students in the class with the traditional format was 231.86. The lower and upper .05 confidence limits were 197.71 and 266.02 respectively. The standard deviation for these students was 89.787. For the students in the student-centered group the mean was 228.7 with a lower boundary of 182.22 and an upper boundary of 275.18. A look at these numbers suggests that the null hypothesis cannot be rejected. The difference between these means was 3.1521 with a lower and upper 5% confidence boundary of -51.66 and +57.985. The only logical inference to be made is that there were no differences found.

Looking at these two standard deviations the thought occurred to us that we might have a reliable difference between the variances for these two groups. An F ratio was computed, but once again it failed to reach a level even close to significance at the .05 level.

DISCUSSION

The purpose of this study was to demonstrate the role that technology could play in facilitating a more student-centered model for the university level classroom. When this model is followed, each student works at his or her own pace with the instructor along side them as they work to master the sometimes complicated and abstract course concepts. The instructor is no longer the source of information and the purveyor of wisdom, but rather an ally in the war against ignorance. Using technology, we developed two distinct models of classroom instruction. One, was a technology enhanced version of the traditional lecture format, the other model was one where each student moved through the material at his or her own pace, guided and helped by an instructor and teaching assistant who responded to the students, helping in whatever ways possible, but not serving as the center of attention for all of the students in the classroom. The traditional class, met in a traditional room with desks facing the front with the instructor as the center of attention. In the other class, the students worked at tables with each student having an PC with appropriate software on the table and available for them to use. The instructor and teaching assistant randomly moved about responding to student interaction or providing encouragement and feedback as appropriate. On some days, the teaching assistant was present in the room, while the instructor interacted with the students electronically by being available for a private or public chat session in which the student could ask questions or request an explanation of some difficult or troubling concept. What we have reported here are the results of our effort to investigate the consequences of using technology to move the class focus from the instructor to the student. While the same technology was available for both formats, the way in which students interacted with the content and the instructors was different.

It is important to note that with the exception of what happened in the classroom, students in these two classes were treated alike. Technology can enhance learning regardless of the way it is used in the classroom. What technology does for the student-centered classroom format is to allow the instructor to interact with each student individually without the need to reduce enrollment. By providing students with their own computer, a schedule of activity, and lots of encouragement and support, students are able to use the class time to become more actively engaged in learning.

The results reported here suggest that however one wishes to look at these students' performance, there was no discernable performance difference between these two classes (at least not in terms of the objective measures we used). While we refer in this paper to the lecture format as the traditional

format, in reality neither of these classes were traditional, since both were facilitated by using the internet and other computer tools. Both of the classes described in this paper made extensive use of technology. In fact, every effort was made to insure that these two classes were as similar as possible with the exception of what happened during the scheduled class period. Both classes:

- had access to recorded lectures synchronized with the PowerPoint presentations used in the lecture class. The recorded lectures were actually recorded during class the previous semester.
- used the Blackboard online education support system (www.blackboard.com) to access a large quantity of outside reference material and to receive instructor feedback on their performance. This important instructional management tool was important as it facilitated the use of e-mail, discussion groups, computer testing, etc for both classroom formats.
- were provided with 'practice quizzes', administered via Blackboard, which the students could take, ad lib, as often as desired. Items on the practice quizzes were selected randomly from the same pool of items as were the chapter quizzes and the three major in-class exam questions. While students earned no points by taking these practice quizzes, students had the opportunity to see the questions which they ultimately would be asked on the real exams.
- used the internet to receive assignments and chapter quizzes. All assignments and chapter quizzes were self-paced, with the exception that there were deadlines for each assignment. These deadlines were the same for both classes and were used to synchronize the two classes. Chapter quizzes were also self-paced, but unlike the 'practice quizzes' they could only be taken once and did contribute points toward the final grade.
- were encouraged to use e-mail to communicate with the instructor. Every effort was made to respond to the e-mail as quickly as possible. The students were also urged to communicate with one another via e-mail although this rarely happened.
- were invited to participate in 'out-of-class' virtual study sessions conducted with a chat facility embedded in the Blackboard system. It was explained that the teaching assistant worked late most evenings and would monitor the class chat facility and be available to answer any questions which might come up. This also was used far less than expected.
- took their major exams via computers located in the classroom where the student-centered classes met.

Both classes were computer facilitated. What differentiated them was what occurred in the classroom. Since there were no differences in any of the objective measures, we are left with the inevitable conclusion that student performance is not determined by what the instructor does or does not do in the classroom. It is what the students do that makes the difference. We now believe that the format of classroom activity is less important as a determinate of student performance than we originally thought. We expected the students in the student-centered class format to perform better than the students in the traditional class setting. This didn't happen, but we hasten to add that the opposite also did not happen. With or without the formal lecture, even in a class with abstract concepts which students often have difficulty with, we could not find any objective differences. We did have the impression, although it can be considered nothing more than an impression that the students in the student-centered classes were less disgruntled and more positive than those in the traditional classes, but we have no objective data to support this notion.

One bit of good news is that since class format doesn't seem to make a difference, it should be possible to offer the off-campus or distance education classes even for important upper division classes such as statistics, with confidence that the student will get the same opportunity to learn as does the resident student. Although this was not the focus of our study, we think that this is an important implication which should not be overlooked. Given economic and other pressures to provide more opportunities for students to obtain off-campus coursework, this could have important ramifications.

Perhaps also, there is room for some commentary at this point on the fact that many of the schemes used to evaluate teaching focus on how students react to what the instructor does in the classroom. If what the instructor does makes little if any difference, it might be time to include a greater emphasis on student/faculty interaction and the ability of the professor to motivate students in teaching evaluation schemes. Understandably, this is difficult to measure, but the ability to get the students to invest time in learning may be the single most important attribute of effective teaching. The ability to communicate to the students that they are important and that they can learn. It is our experience that in student-centered classes, the most time consuming part of teaching is the investment of time to make oneself available to students, both in and outside of the classroom. It is easy to deliver a well-prepared

lecture. It is much more difficult to be ready to respond to whatever questions or concerns the students, both collectively and/or individually, but we think that in this environment, knowledge of the content and a genuine concern with whether or not the student learns are the major ingredients to effective teaching.

Finally, as a result of our experience during these case studies of different classroom models, we have come to believe even more strongly than before that it is the student and not the instructor who determines whether or not learning occurs. We think the most important thing we learned was that students can learn in a self-paced, student-centered classroom environment without the need for a formal lecture. We suspect, that a major advantage of the student-centered model is that it actually adds a full 90 minutes to the time that students spend working on course material. We also believe that without the aid of the computer technology, the task of administering a class in this way is just too great. We also think that beyond the basics of providing the student with the tools with which to learn, the most important thing that the instructor does is to somehow serve as a catalyst to facilitate a change in attitude and provide the student with incentive to actively participate in the learning process. It has been our experience that any student who will take up the gauntlet and accept responsibility for his or her own learning will be successful. It is in meeting this challenge that we believe the student-centered approach will eventually prove most effective, if for no other reason than it affords the student with fewer scapegoats to which blame for his or her failures. Therefore, tilting the playing field such that it favors students for whom learning is more important than merely obtaining a degree. Technology and computer mediated interaction with students, used in the right way can serve not to make the class more impersonal, but rather to move us back to a basic one student working with a professor or instructor to learn.

[1]. The virtual classroom can take several different forms including informal electronic chat to more formal question and answer sessions which can be conducted in synchronous (real-time) or in an asynchronous (bulletin board) format.

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