An Analysis of Student Satisfaction in Higher Education Courses Delivered Online and in the Live Classroom

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Abstract—*Regression analysis was used to compare degrees of student satisfaction with learning as affected by class size, technical content, interaction, feedback, and course duration. In online classes, having more students in a class enhances student satisfaction with the level of student interaction. In live classes, we find the opposite: larger class sizes have a negative effect on satisfaction with student-to-student interaction. Student satisfaction with instructor feedback in online classes declines with class size. Average levels of student satisfaction with technical courses taken over the Internet are significantly lower than with non-technical online courses. These findings are providing helpful insights to best practices research, especially in targeting the course activities, functions and format to achieve the best learning outcomes.*

Index Terms—*online, technical, education, student satisfaction, class size, learning, teaching*

1. INTRODUCTION

THIS paper addresses how class size, technical course content, and whether or not a course is accelerated affect student learning and satisfaction in college-level online courses compared to live courses. Previous research into student satisfaction with the delivery of higher education has primarily focused on the effect of class size.

The corresponding research questions are:

1. How does class size affect learning/student satisfaction in the live classroom compared to the online environment?
2. Do technical courses differ from non-technical courses in the levels of student satisfaction with the learning experience?
3. Do the levels of satisfaction differ for accelerated courses, compared to courses delivered over a fourteen-week semester?

While a majority of such studies over the past thirty years identifies a class size effect, the strength of this effect, in most instances, is small. Published research is most heavily concentrated in the undergraduate live classroom, where class sizes sometimes reach 600 students for introductory courses. The findings have been inconsistent, ranging from a small negative class size effect [1, 2, 3] to no significant class size effect [4, 5, 6]. Sugrue et al. [7] report on an experiment where an instructor taught the same MBA Managerial Finance course in two different environments (traditional live classroom and two-way video) and found that the class size effect on satisfaction was negative both for the classes taught using two-way video and for those taught in the traditional live format. An unpublished dissertation by Defusco [8] concludes that student satisfaction is maximized at a class size of 11-15 for adult students taking coursework over the Internet.

Scheck and Kinicki [9] surveyed 944 students taking live courses from a large southwestern university. Students were identified as attending a large (greater than 150 students) or small (38 students or less) class. When they analyzed the responses, they found that class size significantly and negatively affected teacher behavior (less satisfaction with teacher). In addition, large class size has a negative effect on student performance, defined as the grade earned by the student.

Hoffman, et al. [10] conducted telephone interviews with a random sample of 40 recent graduates from three college programs at a small liberal arts college. The graduates cited small class size as one of the major factors for their success in college and subsequently in the work place.

Hartman and Truman-Davis [11] administered a survey to 71 University of Central Florida faculty teaching in a variety of online and live formats and found from responses that optimal class size ranged from 25 for totally online classes to 42.5 for 100 percent live classes.

We were unable to find any published literature examining possible interrelated effects of technical/non-technical content and class size on measures of student satisfaction for courses delivered in a live format or over the Internet.

Examined in this study are several drivers of

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student satisfaction in live and online courses conducted in a large US accredited university, University of Maryland University College (UMUC), over six semesters, from the Fall 2001 semester to the Summer 2003 semester, using a large dataset consisting of student course evaluation data from 6,995 classes. Completing the course evaluation is mandatory for online students and is close to 100 percent in live classes. Class sizes in the study ranged from 15-55

2. METHODOLOGY, DATA, AND MODEL DESCRIPTION

The dependent/outcome variables in our models include the following:

1. Class drop/withdrawal rates
2. The degree to which the student feels the course stimulates interest for learning
3. The degree to which the student feels he/she is given adequate feedback to facilitate learning
4. The degree to which the student feels there is sufficient student-student interaction in the class
5. The degree to which the student feels there is adequate student-faculty interaction in the class
6. The degree to which the student is satisfied with the instructor as a facilitator of the learning activity
7. The degree to which the student is satisfied with the course and what has been learned
8. Student perception of the effectiveness of course pedagogy

Non-representative course data were deleted from the analysis (e.g., non-credit courses).

Linear regression analysis was employed to model the relationships between class size and the dependent variables described above. In addition to class size, other independent variables as described below were included as dummy variables. The model was tested for goodness of fit.

In this least squares model, the dependent variables (student satisfaction, class drop/ withdrawal rate) are regressed against class size, and the dummy variables defined for: technical/non-technical, undergraduate/graduate, regular/accelerated format, and live/online format courses.

We settled on this model after examining the residuals from the linear regressions. In performing various tests, we concluded the residuals exhibited a reasonably random pattern around the regression line and that the variances of the errors around the regressions were approximately normal and constant throughout the range of the dependent variables in the various versions of the model.

Model I:

The first phase of the analysis incorporates all the subpopulation categories as dummy variables into a comprehensive general model that includes graduate and undergraduate courses, accelerated and regular courses, live and online courses, and technical and non-technical courses. This yields one model X 8 dependent variables = 8 separate regressions.

The full model (Model I) is:

Dependent variable = a + b1*size + b2*tech + b3*school + b4*acc + b5*delivery + error term

where the expected value of the error term = 0 and size = beginning class size, the primary independent variable, and where the remaining dependent variables are defined as:

tech: non-technical (=0) or technical (=1) course
school: undergraduate (=0) or graduate (=1) course
acc: normal length (=0) or accelerated/summer (=1) semester
delivery: online (=0) or live (=1) course section

This regression is intended to show the average effect that class size and defined independent variables have on each dependent variable. The independent variables (other than class size) are coded as dummy variables for this form of the model. The coefficient of class size (b1) represents the magnitude of this effect for a one-student change in class size. We are particularly interested in the b2 coefficient, the effect of technical course content when controlling for the effects of other variables.

Model II

While there are numerous interesting findings possible from Model I, what it cannot tell us is also important. The coefficients do not show the effects of interaction between class size and other independent variables. We are interested in this interaction for class size and technical courses. In other words, we would like to be able to answer the question: What is the class size effect for technical courses in the categories undergraduate/graduate and online/live?

This deficiency in Model I is addressed by introducing an interaction term into the regression model, where class size*tech is entered into the model as a separate independent variable. We then derive the coefficient for the effect of class size on the value of the dependent variable (e.g., stim = stimulates interest) for technical courses by adding the coefficient of class size to the interaction coefficient.

We also introduce an interaction variable, size*acc, for the effect of class size on the value of the dependent variable for accelerated

courses. For this form of the model, we run separate regressions for graduate and undergraduate school courses and for online and live courses. Separate regressions for the more homogeneous populations (the four subcategories) facilitate interpretation of the results and improve the robustness of the statistical results by removing important sources of variability.

Model II results in four regressions (one for each subpopulation) for each of the eight dependent variables (4 subpopulations X 8 dependent variables = 32 regressions).

In summary, we perform separate regression analyses for the four subpopulations:

1. Undergraduate live classroom sections
2. Undergraduate online classroom sections
3. Graduate live classroom sections
4. Graduate online classroom sections

3. *Model Results*

When we model student satisfaction and class size variables in the full model (Model I), we find that technical courses have significantly higher average withdrawal rates (by about 2%) than non-technical courses.

Technical courses tend to score lower on the measures of satisfaction by .12 to .24 points on a 5-point Likert scale. Live courses, on average and when controlling for other dependent variables, have a withdrawal rate 5% below that of online courses and score from .15 to .38 points higher on the measures of student satisfaction.

The effects of accelerated courses on the measures of satisfaction are positive, with a withdrawal rate 4.7% below that of regular semester courses and with scores on the measures of satisfaction .05 to .11 points higher on the 5-point evaluation form scale.

The described results for Model I are significant at the .001 level, with R^2 ranging from .078 to .174.

We then broke the data down for Model II into the four population subsets (undergraduate online, undergraduate live, graduate online, and graduate live) and reran the regressions with technical and accelerated courses entered as dummy variables. Variables are also included to capture the effects of class size on both technical courses and accelerated courses. Our purpose in this approach is to determine if the relationships observed in the Model I are the same or different across data subsets and to identify any incremental class size effects due to the technical or accelerated nature of a course.

We find that the most consistent size effect is the positive effect that class size has on student satisfaction responses concerning student-student interaction in online classes (R^2 of .075 and .025 respectively). We also identified a significant negative effect of class size on student satisfaction with faculty feedback in undergraduate live courses (R^2 = .088). These results are significant at the .001 levels.

Though weak, a negative effect of class size on feedback is observed for undergraduate online (.08 level of significance) and graduate online (.10 level of significance) classes. This finding is not present in graduate live courses. A plausible explanation for this divergence in findings may be that graduate students attending live classes have lower expectations of personal feedback from faculty. Or perhaps they interpret the instructor's feedback in the live classroom as being directed at them personally, whereas the online students expect more focused personal feedback from their instructors via email or via clearly directed comments posted in the online classroom.

In general, class size appears to have the most consistent effects on the measures of satisfaction in undergraduate online courses. Interestingly, these effects are positive for student satisfaction measures, except for the negative faculty feedback effect discussed above. Also, the withdrawal rate in online undergraduate courses declines as class size increases. We conclude that the capability of the Internet and the online medium to enhance the learning experience accounts for this effect.

On the other hand, class size negatively affects satisfaction in undergraduate live classes. In addition to the negative effect on faculty feedback, class size negatively affects student-student interaction and faculty-student interaction scores.

An explanation for the generally positive effects of class size in undergraduate online courses and the negative effects of class size in live courses may be due to the self-selection by students who prefer one format to another. Students taking courses online are likely to be more comfortable with the technology of the virtual classroom and have learned how to leverage the properties of the Internet to make their experience more enjoyable. Thus, they may be able to realize the benefits of larger online classes more easily than students who are less technology savvy and choose the live classroom instead.

Undergraduate students taking live courses voice the expected negative effects of larger class sizes, consistent with what is heard anecdotally from students and gleaned from the literature.

The class size effects on graduate online courses appear to be limited to a few instances. In addition to the weak (statistically insignificant) negative effect of class size on faculty feedback in online courses, there are positive effects of class size in accelerated courses and negative effects of class size in technical courses.

In live graduate classes, no significant class size effects are identified based on the technical or non-technical nature of the course. However, there are significant negative class size effects in live accelerated courses for stimulating interest, faculty-student interaction, and overall course pedagogy scores.

The effect of technical content on course withdrawal rates is generally negative. Withdrawal rates are higher for undergraduate online technical courses by 5.17% and for graduate live courses by 6.56%. However, there is no significant difference between the technical and non-technical withdrawal rates for undergraduate live and graduate online classes. In undergraduate live and online classes, most measures of satisfaction score from .11 to .44 lower for technical courses. The only effect on the measures of satisfaction identified for graduate technical courses is the lower course overall satisfaction score (by .21) for live courses.

The effect of accelerated schedules on course withdrawal rates is positive for undergraduate live courses. Accelerated undergraduate live courses have lower withdrawal rates (by 5.7%) compared to regular courses. The withdrawal rates for all accelerated graduate courses and undergraduate online courses are not significantly different from those of regular courses.

As class size increases, student satisfaction, on average, appears to peak at around 25 students (this was visually confirmed by observing the results of a quadratic regression, satisfaction with interaction versus class size). This applies to both technical and non-technical courses.

4. CONCLUSION

The results of this study have several important strategy implications for the design and delivery of higher education in live classrooms and over the Internet.

Technical courses achieve lower satisfaction scores than non-technical courses, and this gap appeared in courses taught both online and in the live classroom. Thus, one strategy would be for course designers and faculty to collaborate in developing more effective approaches for the design and delivery of technical content in both environments, online and live classrooms.

Instructor feedback is important in both technical and non-technical courses. As class size increases, student satisfaction with feedback generally declines, slowly at first, then more rapidly as class size approaches 25. In light of this, online faculty should be trained to develop class management competencies that help facilitate classroom interaction and help them to efficiently provide substantive feedback to students. Our findings could help academic administrators when deciding on suitable class size for a technological environment. In order not to compromise student satisfaction, they should consider the amount of interaction and feedback that are required in a specific course and accordingly provide services and teaching support to that course instructor.

Opportunities for students to interact amongst themselves and with the instructor facilitate the learning process, as reflected in student evaluations. Thus, online courses should be designed with a significant interaction component to take advantage of the network property of the Internet.

Students in our study demonstrated significantly higher levels of satisfaction with both online and live classroom accelerated courses (e.g., an 8-week semester compared to a 14-week semester). This may be because the faster pace requires students to focus more on the content in a compressed timeframe and this enhances their learning experience. Accordingly, colleges and universities may wish to pilot and evaluate various accelerated course schemes as a means to improve the effectiveness of their curricula.

We did observe that higher withdrawal rates are present in the beginning courses of an online technical program (e.g., financial management, accounting). We believe a contributing factor to this situation is the difficulty beginning students have getting comfortable in the new medium and simultaneously mastering the fundamentals of the discipline. One recommended intervention is to populate these beginning online technical courses with tutors to work with students in solving problems, taking quizzes, and responding to questions regarding concepts and principles. A pilot tutoring project being conducted at the University of Maryland University College has yielded early positive results in significantly decreasing the withdrawal rates in these courses.

Best practices research has identified that teaching in a highly technical -and mainly online- environment is very challenging. In order to achieve successful student learning outcomes the research recommends restructuring the course delivery and design to engage the learners by stimulating their interests while promoting higher order learning skills. This research shows that, while pursuing the restructuring efforts, it is important to consider class size and its relationship with the levels of interaction and feedback in order to maintain high level of student satisfaction and learning.

It is important to note the limitations of this study. We only used student measures of satisfaction and learning. This is a first step toward a more systematic study with pre- and post-test instruments to measure the learning that occurs in classes of all types and sizes in the online environment. This would greatly facilitate

not only accreditation but provide a sound framework for future class size and best practices research. It is noted that while online education is new, the education literature confirmed the relationship between student ratings and satisfaction. Abrami, d'Apollonia, and Cohen [12] point out, "Student ratings are seldom criticized as measures of student satisfaction with instruction..."

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