Abstract - This study constitutes a starting point for gathering better evidence for the effectiveness and appropriate uses of various online learning tools. The research question investigated – How valuable are threaded discussion forums as a pedagogical tool in a course delivered via an online modality? – was addressed by a longitudinal study in which the performance of graduate students (N=103) on a series of discussion forum assignments was compared to their ultimate success in their program of study. This study lends credence to the belief that discussion forums can indeed play an important role in an online course. A significant correlation was demonstrated between success in an academic program as measured by progress toward completion of degree requirements and GPA and performance in discussion forum assignments as measured by the timeliness of the contributions to the forum and the content of those contributions. Even if the discussion forum assignments do no more than predict success, however, their value is evident, if as nothing more than an evaluative tool.

Index Terms – asynchronous discussion forums, distance education, online learning environments, online pedagogy.

INTRODUCTION

College courses are being offered via an online modality by an ever-increasing number of institutions. This learning option is available for all levels of the higher education spectrum, from undergraduate to doctoral level studies. Although online education is becoming more widely accepted, there is still a paucity of research literature that demonstrates clearly and statistically the effectiveness and best uses of the various pedagogical tools available in the environment.

In classroom-based education, we have a history of over hundreds if not thousands of years of experience. Although there have been changes and refinements to the educational pedagogy over the years, we are still basically working with the Socratic method of teaching. The tools have become modernized, but they basically remain the same and teachers are quite familiar with them based upon previous experience as both a student and an instructor. In online education, on the other hand, although certain tools are becoming standard choices – course management systems, web pages, email, and electronic discussion forums, to name a few – little has been proven regarding when and how to use the tool.

This study constitutes a starting point for gathering better evidence for the effectiveness and appropriate uses of various online learning tools by investigating the following research question: how valuable are threaded discussion forums as a pedagogical tool in an online course. A “snapshot” approach to evaluating an online pedagogical tool offers little meaningful data; effectiveness of a learning system has meaning only when viewed from the perspective of time. This study incorporates a longitudinal approach to reflect student progress over a three-year period.

The organization of this paper is as follows. First, there will be a brief discussion of online education including issues and some solutions and a discussion of the present state of the art. Then we will move into a detailed discussion of the methodology including the educational environment, assumptions and limitations of the study. There will be a presentation of the hypotheses and then the testing protocols will be explained. The article will conclude with some thoughts for future research directions.

Online Education

There are a number of studies that have investigated various aspects of online learning environments. Some studies concentrate on the teacher perspective [1], other studies examine education from the vantage point of the student [2]. Research efforts are underway trying to get deeper understanding of learning and the learner [3]. Additional research is looking into quantitative content analysis of forum discussions. [4] The purpose of computer conferencing from a social communication perspective is also being studied. [5] Regardless of study or perspective the online discussion forum seems to be a standard tool in almost all online teaching environments.

Many faculty discussions center on barriers to online learning. It seems for some disciplines the transition to online education is easier than in other disciplines. For example, how does one teach a course with a clinical component online? Yet, in online environments, simulations and experiments can abound. Videos, PowerPoint slides, audio files, animation can be integrated and cause some disciplines to really come alive. Using the Internet "virtual visits" can be taken to places near and far (i.e. famous museums or landmarks). Dangerous simulations can be run...
in a "safe" environment and repeated at no real additional cost. Administrative and teaching load issues are additional topics, but outside of this research focus.

Asynchronous pedagogical tools are currently the preferred approaches in online learning environments. These tools have been shown to be flexible and provide the timing most students seem to desire in online learning environments – the freedom from time and place. [6] They are an integral component of most every course management system and are available in stand-alone formats as well.

The discussion forum can provide a deep level of interaction. The forum provides a self-documenting record of the discussion that can be subject to further analysis. It provides information that is not available in a traditional classroom format. Efforts are underway to better understand the patterns of interaction that occur in the discussion forums. [7]

Although the discussion forum is a widely accepted tool used in most every professor’s repertoire, there is still controversy over the use. What does a faculty member do with the non-participating student or the lurker? [8]. How can participation in the forum be evaluated? What type of learning outcomes can be effectively facilitated through the use of this tool?

The literature does provide some insight into the potential of the threaded discussion forum as a pedagogical tool. The asynchronous nature of the participation requirement usually provides sufficient flexibility for students, affording a student the opportunity to compose her or his postings off line and then “cut and paste” the contributions when she or he is satisfied with it. This latency gives a student a chance to reflect, spell check, and think about her or his posting. Participating in a discussion forum still can subject the student to vulnerability, including risking rejection. [9] Because of the asynchronous nature of the forums this risk is less than in a classroom setting.

The learning that occurs in the forum can be reviewed repeatedly by a student since the forums provide a written record of the contributions. Forums also provide a significant peer-based environment, allowing not only the traditional transfer of knowledge from faculty to student, but also providing information that can be shared student to student.

The concept of a learning community [9] in most online learning environments is typically established via use of the online discussion forums. It replaces the outside the classroom discussion, but is open 24 hours a day, 7 days a week. Current research [5] seems to show that a balance must be created between social communication and the challenging and more productive types of discussion. We are still exploring and trying to better understand the nature of the interaction.

As technology continues to change and mature there may be other alternatives [10] to provide this component of the educational infrastructure, but before we move into these new technologies, we need to know do online forums make a difference.

Online Students

Much of the spontaneity and intimacy both instructors and students enjoy in the classroom is either lost or severely curtailed in an online setting. Since one of the major attractions of the online environment is the freedom from constraints of both time and place, and the students comprising an online course offering might live across several time zones, the attractiveness of real-time (synchronous) interaction is often muted. Feelings of isolation from instructional staff, administration, and other students are not uncommon [11].

Online students often present a wide range in age and ability level. These abilities are impacted by the student’s previous experiences, both with the technology supporting the online environment and with the college environment. Many of the students enrolled in online classes are non-traditional students and working adults. As such, they bring identifiable strengths and weaknesses to the learning task. Online students in general are considered self-motivated and independent learners. Richardson [12] found them to have superior time management skills. Kubala [2] found online students to be daring and confrontational regarding their expression of ideas.

METHODOLOGY

The research question – How valuable are threaded discussion forums as a pedagogical tool in a course delivered via an online modality? – was addressed by a longitudinal study in which the performance of graduate students on a series of discussion forum assignments was compared to their ultimate success in their program of study. All subjects of the study were doctoral students studying computer information systems, information systems, or computing technology in education. All subjects were enrolled in one in five sections of a multimedia systems course offered during the January through December 2000 time period. Each student’s participation in one of those five sections was compared with her or his success in the program as a whole, as measured in December 2002.

An understanding of the institution in which this study was conducted is essential. As mentioned above, the subjects of the study were doctoral students pursuing degrees in a computer-technology related field. The institution in which the study was conducted offered a hybrid, classroom-online program that combined 16-hours of classroom activity offered in either six consecutive days or two segments each of three days in duration both with five-months of Web-based interactivity. Online assignments including participation in threaded discussion forums comprised the bulk of the learning activities.

The participation requirements for the multimedia systems courses that served as the data sources for this study
included a series of six discussion forum assignments that constituted 25% of the course grade. The forum topics were offered sequentially in three-week blocks and each student was responsible for making three contributions to each forum during the period in which it was open. Contributions could be made to present a position statement or to dispute or reinforce the contribution of another student. Regardless of the intent, all contributions were to be supported with citations from the literature.

Assumptions, Limitations, and Delimitations

This study must be reviewed in the context of two assumptions. The data collected and analyzed in the study is assumed to be accurate and representative of the student’s performance. Secondly, success in the program is assumed to be comprised of progress toward completion of degree requirements, coupled with grade point average. The validity of the results of this study may be impacted by the limitation that much of the data analyzed, although quantitative, were based upon subjective assessments. The generalizability of these results is impacted by the delimitation that the study focused only on doctoral students engaged in computer-technology related studies.

Hypotheses

This study addressed the research question by testing four hypotheses:

$H(0)$ – Success in the academic program as measured by cumulative grade point average (GPA) will not be related to discussion forum participation as measured by content of the forum contributions.

$H(1)$ – Success in the academic program as measured by progress towards degree completion will not be related to discussion forum participation as measured by content of the forum contributions.

$H(2)$ – Success in the academic program as measured by progress towards degree completion will not be related to discussion forum participation as measured by the timeliness of the forum contributions.

$H(3)$ – Success in the academic program as measured by progress towards degree completion will not be related to discussion forum participation as measured by the timeliness of the forum contributions.

Variables

Four variables were necessary to test these hypotheses:

$V(0)$ – GPA, defined as the cumulative grade point average, on a four-point scale, that the student had earned for all courses taken as a part of the academic program in which she or he was enrolled, as of December 2002.

$V(1)$ – Progress toward degree completion, based upon a nine-point scale that rated a student’s actual progress toward degree completion with the target rate of progress established by students who had successfully completed the program of study. School historical data indicated that over 80% of the students who successfully complete a dissertation and earn a Ph.D do so within five years of their date of first enrollment. Based upon the target of completing degree requirements within five years, the optimal schedule for success detailed in Table 1 was developed. Table 2 presents the progress rating scale derived from the optimal schedule for success. As an illustration, a student in her eighth term should have an approved preliminary proposal.

$V(2)$ – Content of forum contributions, defined as the grade received on the forum assignment. A student could earn up to eight points for each discussion topic, based upon the content and the support from the literature of her or his contribution. Since there were six discussion topics for the course, a student could earn up to 48 points for the forum assignment.

$V(3)$ – Timeliness of forum contributions, defined as how early the contributions were made in the period that a discussion forum was open. Since each topic was open for a three-week period, the simple, five-point scale illustrated in Table 3 was used to rate the

contributions in each topic. Since three contributions were required for each of six topics, a student could earn up to 12 points per topic or 72 points for the assignment as a whole.

Data Collection and Analysis

The data necessary for this study were collected from a number of sources. The GPAs of the students involved in the study were derived from the official transcripts, as stored by the university Registrar. The data necessary to assess each student’s progress toward degree completion was available in departmental records that track each step in the dissertation process. The rating for content of forum contributions was derived from the records of the two instructors that taught the five courses comprising the data source for this study. Finally, the timeliness rating was derived from SQL queries to the database underlying the ColdFusion forums system used for the courses.

The data were analyzed using two statistical tests. Initially, a test for correlation among all four variables was accomplished using the Pearson Product-Moment Correlation Coefficient. The correlations indicated by the Pearson test were then examined for statistical significance using an analysis of variance (ANOVA). Two separate ANOVAs were run. In the first test, timeliness of contributions was categorized into three sections based on percentiles and differences in the means of progress toward degree completion and GPA, based upon timeliness category, were evaluated. For the second ANOVA, content of contributions was likewise categorized into three sections based on percentiles and differences in progress toward degree completion and GPA based upon those categories was evaluated.

RESULTS

As can be seen in Table 4, the Pearson Product-Moment analysis produced statistically significant correlations among all four variables included in the study. The strongest correlation was between GPA – V(0) and the rating on the content of the forum contributions – V(2) which is hardly surprising since the two factors are marginally self-referential.

Table 5 details the results of the ANOVAs used to test for significant differences in both progress toward degree completion – V(1) and GPA – V(0) based upon percentile category for both timeliness of contribution – V(3) and content of contributions – V(2). As can be seen in Table 5 there is a statistically significant difference in progress toward degree completion based upon the percentile category of the timeliness of contributions – V(3) but not on the percentile category of the content of the contributions – V(2). There are statistically significant differences in GPA – V(0) based upon the percentile categories for both V(2) and V(3).

<table>
<thead>
<tr>
<th>TABLE 5</th>
<th>COMPARISON OF MEANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Type III Sum of Squares</td>
</tr>
<tr>
<td>Corrected Model</td>
<td>50.393</td>
</tr>
<tr>
<td>Intercept</td>
<td>448.706</td>
</tr>
<tr>
<td>Timeliness – V(3)</td>
<td>24.229</td>
</tr>
<tr>
<td>Content – V(2)</td>
<td>2.305</td>
</tr>
<tr>
<td>Timeliness by Content</td>
<td>2.765</td>
</tr>
<tr>
<td>Error</td>
<td>128.287</td>
</tr>
<tr>
<td>Total</td>
<td>178.680</td>
</tr>
</tbody>
</table>

R Squared = .282 (Adjusted R Squared = .221)

<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>CORRELATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V(0)</td>
</tr>
<tr>
<td>GPA – V(0)</td>
<td>Correlation</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Timeliness – V(3)</td>
<td>Correlation</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Content – V(2)</td>
<td>Correlation</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Progress – V(1)</td>
<td>Correlation</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>
Hypotheses Tests

Based upon the results of both the Pearson Product-Moment Correlation Coefficient and the ANOVAs detailed above, hypotheses H(0), H(2), and H(3) can be clearly rejected. The test for hypothesis H(1) produced somewhat mixed results. Although a statistically significant correlation was noted between the rating for the content of the forum contributions – V(2) and the students progress toward graduation – V(1) this correlation (.268) was the weakest of all the correlations among variables. Furthermore, the ANOVA did not reveal a statistically significant difference in progress toward degree completion – V(1) based upon the percentile grouping of the content rating – V(2).

CONCLUSIONS

How valuable are discussion forums as a pedagogical tool in a course delivered via an online modality? This study lends credence to the belief that discussion forums can indeed play an important role in an online course. A significant correlation was demonstrated between success in an academic program as measured by progress toward completion of degree requirements and GPA and performance in discussion forum assignments as measured by the timeliness of the contributions to the forum and the content of those contributions.

It is important to note that a direction of causality was not in any way included in this study. There is no indication if the forums caused improved learning and performance in the program or if they merely predicted success that was based upon totally unrelated factors. Even if the discussion forum assignments do no more than predict success, however, their value is evident, if as nothing more than an evaluative tool.

FUTURE RESEARCH

This question of the value of any pedagogical tool can only be completely answered in terms of how well that tool performed the planned functions in the context of the course. Studies offering finer granularity based upon how well threaded discussion forums function as pedagogical tools to facilitate specific learning outcomes for specific types of courses offered to identified student populations would be of value.

Discussion forums are, further, only one of many pedagogical tools available in online learning environments. Similar research on the value of other pedagogical tools would likewise be quite interesting.

REFERENCES