Online Learning Preferences of Engineering Technology Management Graduate Students

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Abstract—As online graduate programs continue to grow, so does the availability of learning media and delivery tools. Faculty and students are increasingly using web-based means of communication such as blogs, wikis, threaded discussions, and collaborative tools in addition to assigning traditional readings, lecture notes, homework, writing exercises, and examinations. There have always been numerous choices available to instructors for the delivery of content and the assessment of learning, but now there are more varieties of instructional technologies from which to choose. Given the choice, are there certain online approaches that engineering technology management graduate students prefer? Qualitative and quantitative data was gathered from current students and alumni of an online master's program in engineering technology management. The questions assessed student preferences for instructional technology media, type of assignments, group work, assessment, and course resources. The results of the study indicated that students preferred threaded discussions, individual assignments, and authentic assessments. Students also slightly preferred web-based or electronic media and additional course resources of all types, if available.

Index Terms—online learning, student preferences, master's degree program, instructional technology.

I. INTRODUCTION

The continuing growth and acceptance of online distance education for graduate degree programs have resulted in faculty increasingly being asked to design and deliver courses using computer-mediated systems. These distance delivered degrees come in many forms with some faculty simply posting lecture notes while others make use of text, PowerPoint™ slides, hyperlinks, or video [1, 2]. The development of greater bandwidths and increasing familiarity with technology has enabled faculty to utilize more complex and interactive ways of delivering course material, both synchronous and asynchronous. However, asynchronous delivery of coursework still offers the greatest degree of flexibility for both the instructor and student.

The access, flexibility, and convenience benefits of distance learning, particularly for adult learners, are well documented. However, educational distance programs tend to suffer a higher dropout rate due to a variety of issues such as student feelings of isolation, lack of community within the program, cost of technology, and lack of student support services [3, 4, 5, 6]. It is imperative that distance-learning faculty know the learning preferences of their students and become familiar with various instructional methods so that curricula can be designed effectively. Successful online courses are those that engage the learner while reflecting the instructor's personality through the content [7]. The intent being to utilize the appropriate method and format for instruction provided the instructional goal facilitates its use.

II. RELATED STUDIES

Drexel's online asynchronous graduate professional degree program emphasized extensive interaction between students through group work, team projects, and collaborative learning within a cohort structure. Students were encouraged to interact both informally and ad hoc as well as formally in a pre-scheduled manner. Forty-four percent of the students indicated they were more motivated since they knew other students would see their assignments, but 21% felt more inhibited (n = 82). However, 51% indicated they missed face-to-face lectures and 40% felt they had to work harder in the online course. Fifteen percent felt the online class was more boring than a traditional class [8].

Queensland University of Technology built an online Master of Engineering using PDF chapter files, discussion boards, blogs, and web-conferencing tools that were fully accessible to students at the beginning of the semester. Program content was a mix of interactive synchronous and asynchronous activities. Assessments consisted primarily of written reports on case studies, spreadsheet analysis, plans, or self and peer assessments. Students rated the program courses with mean scores of 4.3 out of a maximum of five [9].

Using a mixed methods approach at the Athabasca University Nursing and Health Studies graduate program, student's scores on a learning style inventory were compared to students' perceptions of value using a wiki in their online course. Due to technical difficulties with the wiki software, no relationship was demonstrated. However, the study did reinforce the value of having a reliable learning management system and explicit instructions on how to use a wiki [10].

Reference [11] found that students ranked community-centered approaches, constructivist learning environments, instructor interaction, peer interaction, and critical discourse highly for building online learning communities. The methodologies used included discussion boards, application activities, research papers, self-assessments, projects, portfolios, group learning, and assessment rubrics. Online practices that encouraged social interaction and positive feedback were perceived as contributing strongly to effective learning, but the practices did not correlate with actual academic achievement.

Reference [12] discovered that students valued the opportunity to interact with one another as part of their course activities and that the threaded discussion was useful and engaging. Students also appreciated courses that had clear expectations, were well organized, and easy to navigate. Also useful were text and article resources.

Online learners tend to be non-traditional students who are more self-directed and motivated to learn. They prefer courses that promote problem solving, application, critical reflection, and experiential learning [13]. Reference [14] found that the most common Myers-Briggs type personality of a technology graduate student at a NAIT accredited Mid-Western university was ESTJ while the dominant group personality was ENTJ. These personalities both exhibit extraverted thinking and a preference for preplanning. The primary difference between the two is that ENTJs are abstract perceivers of information whereas the ESTJs are concrete. Both types of learners would prefer the structured sequence of online courses and working interactively with others in the class. Reference [15] identified four distinct learning modes of graduate students at the University of West Indies Open Campus: independent learning, instrumental learning, interactive learning, and collaborative learning. The most dominant mode was collaborative learning, but instrumental learning also emerged as a strong factor where students demonstrate competencies through instructor-guided activities.

All these studies reinforced the value of interactive elements for asynchronous online courses and suggested the addition of synchronous activities if possible. In addition, a variety of delivery methods seems to be appreciated as long as they are accessible, reliable, and organized. Use of these methods indicates some positive effect on student motivation and satisfaction. However, none of the studies was able to relate the use of these approaches to greater academic achievement.

III. COURSE DESIGN

The design of an online course greatly affects its quality. In addition, the role of an online faculty member changes from lecturer to facilitator. Proper media selection for the content of an online course can either help or hinder the facilitation process, particularly the critical student-to-content, student-to-student and student-to-instructor interactions [16, 17, 18, 19]. For distance courses, these interactions take place predominantly through threaded discussion, chat rooms, or e-mail. Most researchers recommend a high degree of interactivity in an online course and use of asynchronous material, which promotes

flexibility and a self-directed pace. Reference [20] found that the time students spend reading and responding to threaded discussions in online courses is comparable to traditional, face-to-face class participation. Furthermore, publishers are now offering customized e-books and tailored course cartridges, providing a cheaper alternative to hard copy books that may have unassigned chapters. Reading and writing cater best to visual learners, but other activities may benefit kinesthetic and tactile learners [21]. Instructors who are particularly good at facilitating interactions in classes using a variety of technologies are satisfying for students [4].

With regard to exams, reference [22] determined that student satisfaction for open-book, open Web exams was high, even though they create a number of administrative issues due to the technology. A material advantage of open-book, open Web exams is that they provide a more authentic type of assessment, examining students using the types of questions they would be asked on the job. It also prevents the use of simple recall-type questions. Another advantage is the ease of reading typewritten rather than handwritten student responses. Conversely, online exams cannot automatically distinguish between minor answer variations, but they can automatically grade other types, such as multiple choice and true-false. Online exams can be created using text banks and questions can be randomized. However, academic integrity remains an issue even though students cannot cheat using unauthorized materials because all materials are authorized. If this is an issue, then the best defense is to proctor the exam.

At the graduate level, a number of educational studies have investigated the use of various learning media and delivery tools. The rest of this paragraph provides an overview. At Athabasca University's Master of Nursing and Master of Health Studies, the primary medium for communication, instruction, and assessment was asynchronous, text-based, threaded discussions, both formal and informal. In addition, synchronous chat rooms were available. The facilitation strategies used to promote engagement included awarding marks for discussion participation, encouraging and modeling thoughtful introductions, the creation an online coffee lounge, use of private email, and small group forums within the course. In addition, the instructors identified and engaged non-contributing students [23]. The online graduate nursing course at the University of Saskatchewan used threaded discussion and peer review of assignments to promote authentic and experiential learning [24]. Reference [25] at Capella University blended synchronous instruction using Adobe Connect into an online asynchronous graduate course. They concluded that strategic use of synchronous approaches may provide students in asynchronous courses with the connection they need to each other, the teacher, and the institution provided the sessions are well planned and effectively facilitated. Northern Arizona University's Graduate Mathematics Education program designed their courses to include group-based discussions and activities, structured group experiences, screen casting recordings, wikis, blogs, shared documents. All are used to maximize

student participation and promote active construction of knowledge [20].

Commonly, the literature recommended course designs that are interactive and provide students some flexibility. There is a preference for authentic and experiential learning, including the method chosen for examinations. As the majority of online students are adult learners, courses should emphasize concrete problem solving and application using structured sequences. Collaborative learning seems most favored by students followed closely by learning that is competency-based. The most dominant instructional media tool was the threaded discussion followed by other text-based tools such as email, blogs, and wikis. A variety of synchronous and asynchronous mediums was frequently mentioned for group sharing and promoting student participation.

IV. METHOD

The purpose of the study was to assess student preferences regarding instructional technology media for delivery of course content and the means of communication. The scope of the study was limited to an online graduate program in Engineering Technology Management at a comprehensive pubic university with asynchronous online instructional technologies. Students were asked their preferences and perceptions regarding online course content and the various communication modes within the degree coursework. Using 10 questions, both qualitative and quantitative data was gathered. Forty-five students and alumni were sent e-mail and invited to participate in a survey using Easy Survey Package (ESP), an institutionally supported on-line software package. Twenty-five responded for a response rate of 55%.

V. FINDINGS

The quantitative findings were compiled and are shown following. In the first question, subjects were asked to check the online or web-based items where they had the most experience. Of the responses, 100% had or have experience with online discussion boards or forums and 76% used social media such as Facebook or My Space. A majority utilized online presentations, YouTube videos, and Google docs. Almost half of the respondents had experience with blogs and online projects. See Table I.

TABLE I.
Question 1: Of the following, check the items that you have used or with which you have the most experience.

Item	Percent checked	Number of respondents
Discussion Board/Forums	100%	25
Facebook/My Space	76%	19
Online Presentations	64%	16
YouTube Videos	52%	13
Google Docs	52%	13
Blogs	48%	12
Online Projects	48%	12
Web Page Creation	40%	10
Tegrity/Captivate	36%	9
Wikis	28%	7
Podcasts	28%	7
Twitter	20%	5
RSS	20%	5
Online Collaboration Tools	20%	5
Other: gotomeeting.com	4%	1
Other: research papers	4%	1
Other: webinars	4%	1

For the second question, subjects were asked for their preferences regarding online assignments. The respondents were instructed to check between 1 and 5 with 1 being the most preferred and 5 the least preferred. The results are shown in Table II. The most preferred type of assignment was the discussion board/forum followed by research papers. Web pages and homework assignments were also slightly preferred with the rest being preferred about the same. Least preferred items for assignments were wikis, blogs, and Tegrity/Captivate video-audio, but these were not strong. Question 3 asked the following: Do you have other preferences for assigned work that are not listed above? If yes, please describe. The stated preferences listed by respondents included assignments using AutoCad, Adobe, Java, TopCat, Visio, and Visual Basic.

TABLE II.
Question 2: From the following, select your preferences for online assignments. On the Likert scale, indicate your preferences using 1 as the most preferred to 5 representing your least preferred.

Item	Average rank
Discussion Board/Forums	1.6
Research Paper	2.3
Homework	2.5
External Web Page	2.5
Google Doc	2.7
Project	2.7
Presentations	2.8
Podcast or YouTube	2.9
Blog	3
Tegrity/Captivate	3
Wiki	3.1
Portfolio	3.1

Question 4 asked subjects their preferences regarding group or individual assignments. See Table III. The majority strongly or moderately preferred individual work with approximately one-quarter neutral on the question. Question 5 asked subjects if they preferred sharing their completed assignments with the rest of the class or just submitting the work directly to the instructor. See Table IV. The responses to this question were mixed with a slight majority preferring to submit directly to the instructor. Again, approximately one-quarter of the respondents were neutral on the question.

For question 6, subjects were asked their preferences regarding online exams on a scale of between 1 and 5 using 1 as the most preferred to 5 representing the least preferred. See Table V. The least preferred online exam was a timed exam with forced completion. The most preferred exam type was one that allows multiple attempts. The other types of exams were similar in terms of a slight preference. Question 7 asked: Are there other types of examination methods that you would prefer? If so, please describe. Other suggested examination methods included research papers, essay questions, oral, and practice exams. One comment was that exams are not appropriate for graduate classes.

TABLE III.
Question 4: In general, do you prefer to work on assignments in a small group or individually? Select the one answer that best represents your preference.

Assignment preference	Percent	Number of respondents
Strongly prefer individual work	56%	14
Moderately prefer individual work	15%	4
Neutral	24%	24
Moderately prefer group work	4%	1
Strongly prefer group work		0
Total	*100%*	*25*

TABLE IV.
Question 5: In general, do you prefer to share your completed assignments with the rest of the class or just submit the work directly to the instructor? Select the one answer that best describes your preference.

Assignment sharing	Percent	Number of respondents
Strongly prefer submit to instructor	20%	5
Moderately prefer submit to instructor	32%	8
Neutral	24%	6
Moderately prefer share with class	16%	4
Strongly prefer share with class	8%	2
Total	*100%*	*25*

TABLE V.
Question 6: From the following, select your preferences for online exams. On the Likert scale, indicate your preferences using 1 as the most preferred to 5 representing your least preferred.

Online exam preferences	Average rank
Exams that allow multiple attempts	2
Essay exams (open-ended questions)	2.3
Multiple choice/true-false exams (closed-ended questions)	2.4
Short answer or single sentence response exams	2.6
Timed exams (forced completion)	3.7

On question 8, subjects were asked to select their preferences for viewing course content in an online class using 1 as the most preferred to 5 representing the least preferred. Most preferred a web-based or electronic form of a textbook followed closely by pictures/graphics, and video. A hard copy textbook or podcast was least preferred, but not strongly. See Table VI. Question 9 asked: Are there other course content delivery methods that you would prefer? If yes, please describe. Other course content delivery methods suggested were audio clips, Kindle, Adobe PDF, and video teleconferencing. In addition, respondents provided a few interesting comments.

- "I really do not like materials that must be printed in order to get an online class completed."
- "Video, graphics, and podcasts are helpful sometimes, but also require heavy Internet connections."
- "If there were enough interest, classroom."

For question 10, subjects were asked: From the following, select your preferred online resource. On the Likert scale, indicate your preferences using 1 as the most preferred to 5 representing your least preferred. In terms of preferred assignment resources, responses were all very similar with a slight preference for assignment checklists. See Table VII. Other assignment resources suggested were online textbooks in PDF format.

TABLE VI.
Question 8: From the following, select your preferences for viewing course content in an online class. On the Likert scale, indicate your preferences using 1 as the most preferred to 5 representing your least preferred.

Course content delivery preference	Average rank
Textbook (soft copy, e.g., web)	2.2
Picture/graphics	2.4
Video	2.4
Textbook (hard copy, e.g., book)	2.5
Podcast or YouTube	2.7

TABLE VII.

Question 10: From the following, select your preferred online resource. On the Likert scale, indicate your preferences using 1 as the most preferred to 5 representing your least preferred.

Online resource preference	Average rank
Assignment checklists	1.7
Posted grading rubrics/criteria	1.8
Assignment templates provided	1.8
Examples of student work (both good and bad)	1.9

VI. SUMMARY AND CONCLUSIONS

The students surveyed have used and are familiar with online media such as blogs, projects, presentations, YouTube, or Google Docs. There was heavy use of social media. Students preferred and frequently used online discussions or forums. Most preferred individual work submitted solely to the instructor. Students liked exams that allow multiple attempts, but disliked timed exams with forced completion. These results are not surprising given the nature of adult learning and the current generation of graduate students. It also supports the use of authentic assessment for graduate school. There was a slight preference for the use of electronic or web-based textbooks, if available. Students indicated a slight preference for checklists as an assignment resource, but all resources seemed to be appreciated. It is interesting to note that only 4% of students had experience in research papers, but ranked them highly in assignment preference. This may indicate confusion regarding the question as they are used extensively in this program as an assessment method.

In the study, the continued use of discussion boards and forums in the delivery of distance courses was supported and would be preferred by this group of students. Group-based discussion boards are supported in the literature as the *primary* method to engage students. The majority of students in this study preferred individual assignments. Online instructors will want to consider assigning individual versus group work, but only if it is congruent with the goals of the course. However, this finding is also in conflict with some of the literature regarding student-to-student interaction. The case cited by reference [19] received similar responses regarding group work and interaction. Conversely, the study by reference [15] did verify groups of independent learners. An alternative explanation might be that it is more characteristic of the self-directed, self-motivated adult learner whose time is precious and must be managed well [26]. It is debatable whether extensive use exams at the graduate level are valuable, but the type of exam, other than a timed one, does not appear to be of great concern to students. As the survey was regarding online exams rather than paper exams, this finding is congruent with the literature [22]. These students appreciated additional resources, which if incorporated astutely, can potentially enhance course design and interactivity.

In terms of future opportunities, the use of social media may have potential, but at present seems to be geared more towards the marketing of degree programs rather than instruction. While blogs, podcasts and YouTube videos were not highly preferred as a means of submitting assignments or viewing course content, they do have validity as an additional way to engage students. Instructors should certainly explore and be encouraged to adopt electronic versions of textbooks or customizable course cartridges as they become available.

In terms of effectiveness, it appears the discussion board or threaded discussion forum is a preferred instructional media for engaging students by providing a degree of instructor-student interaction when the instructor is actively moderating the discussion. The amount and frequency of online group work and exams continue to generate the most controversy due to conflicting research findings. This may be alleviated in the future as the technology improves. The majority of the effectiveness of online programs is still highly dependent on the instructor and the design of the course content.

REFERENCES

[1] Dunn, L.S., Poirot, J. L., & Rice, J.W. (2005). Instituting a distance-delivered doctorate in educational computing: PHDifferences, not just a higher-lever masters degree. Proceedings of Society for Information Technology and Teacher Education International Conference. (pp. 385-390).

[2] Kongrith, K., Aberasturi, S., & Maddux, C. (2004). Are online master's degree programs replacing the traditional master's degree programs? Proceedings of Society for Information Technology and Teacher Education International Conference. (pp. 523-528).

[3] Aversa, E., & MacCall, S. (2013). Profiles in retention part 1: Design characteristics of a graduate synchronous online program. *Journal of Education for Library Science, 54*(2), 147-161.

[4] Exter, M. E., Korkmaz, N., Harlin, N. M., & Bichelmeyer, B. A. (2009). Sense of community within a fully online program. *The Quarterly Review of Distance Education, 10*(2), 177-194.

[5] Keengwe, J., Whittaker, S., Anyanwu, L. O., Arome, G. A., & Tate-Blake, C. (2004). Distance education: Design considerations for effective and successful distance learning. Proceedings of World Conference on Elearning in Corporate, Government, Health Care and Higher Education. (pp. 1290-1296).

[6] Yang, Y. C. & Newby, T. J. (2001). Does distance education resolve the current problems of education? Proceedings of Society for Information Technology and Teacher Education International Conference. (pp. 304-309).

[7] Wolf, L. G. (2004). The other side of the web page: Attempting to be an online professor. Proceedings of World Conference on Elearning in Corporate, Government, Health Care and Higher Education. (pp. 1557-1564).

[8] Hislop, G. W. (1999). Anytime, anyplace learning in an online graduate professional degree program. *Group Decision and Negotiation, 8*(5), 385-390.

[9] Murray, M. H. (2011). Creating global networks through an online engineering graduate programme. *European Journal of Engineering Education, 36*(1), 97-106.

[10] Park, C. L., Crocker, C., Nussey, J., Springate, J., & Hutchings, D. (2010). Evaluation of a teaching tool -wiki- in online graduate education. *Journal of Information Systems Education, 21*(3), 313-321.

[11] Lee, J., Carter-Wells, J., Glaeser, B., Ivers, K., & Street, C. (2006). Facilitating the development of a learning community in an online graduate program. *The Quarterly Review of Distance Education, 7*(1), 13-33.

[12] Rao, K., & Giuli, C. (2010). Reaching REMOTE learners: Successes and challenges for students in an online graduate degree program in the Pacific Islands. *International Review of Research in Open and Distance Learning, 11*(1), 141-160.

[13] Guerrero, S., & Crites, T. (2013). Technology in an online graduate mathematics education program. *Computers in the Schools, 30*(1-2), 191-206.

[14] Hogan, R, L. (2009). Assessment of technology graduate students' learning preference styles utilizing the Myers-Briggs Type Indicator. *Journal of Industrial Technology, 25*(1), www.atmae.org.

[15] Kuboni, O. (2013). The preferred learning modes of online graduate students. *The International Review of Research in Open and Distance Learning, 14*(3), 228-249.

[16] Cesarini, P., Sinn, J. W, & Armentano, T. (2006). Distance education at Bowling Green State University: Challenges, opportunities and promise. *Journal of Industrial Technology, 22*(4), www.atmae.org.

[17] Sadeghi, R., & Moslehpour, S., (2007). Comparison of classical method of education and modern web-based distance learning system (WBDLS). *International Journal of Modern Engineering, 8*(1), 128-142.

[18] Schmidt, E. K., & Gallegos, A. (2001). Distance learning: Key issues and concerns of distance learners. *Journal of Industrial Technology, 17*(3), www.atmae.org.

[19] Woolsey, R., & Rodchua, S. (2004). Quality measurement and good practices in web-based distance learning: A case study of the Industrial Management Program at Central Missouri State University. *Journal of Industrial Technology, 20*(4), www.atmae.org.

[20] Brown, A. H., & Green, T. (2009). Time students spend reading threaded discussions in online graduate courses requiring asynchronous participation. *The International Review of Research in Open and Distance Learning, 10*(6), 51-64.

[21] Burgess, L. A., & Strong, S. D. (2003). Trends in online education: Case study at Southwest Missouri State University. *Journal of Industrial Technology, 19*(3), www.atmae.org.

[22] Gehringer, E. (2010). Online vs. on-paper exams. Proceedings of the 2010 American Society for Engineering Education Annual Conference and Exposition. (pp.1-18).

[23] Melrose, S. (2006). Facilitating help seeking through student interactions in a WebCT online graduate study program. *Nursing and Health Sciences, 8*(3), 175-178.

[24] Holtslander, L. F., Racine, L., Furniss, S., Burles, M., & Turner, H. (2012). Developing and piloting an online graduate nursing course focused on experiential learning of qualitative research methods. *Journal of Nursing Education, 51*(6), 345-348.

[25] Armstrong, A, & Thornton, N. (2012). Incorporating Brookfield's discussion techniques synchronously into asynchronous online courses. *The Quarterly Review of Distance Education, 13*(1), 1–9.

[26] Leavitt, L. & Amber, V. (2005). Adult learners and online education. Proceedings of World Conference on Educational Multimedia, Hypermedia, and Telecommunications. (pp. 2754-2756).

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