Instructional Delivery Rationale for an On and Off-Campus Graduate Education Program Using Distance Education Technology

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Purdue University's School of Technology (SOT) began offering its M.S. in Technology degree program for off-campus professionals in an on-campus weekend plus distance education format in the fall of 1998. Creating the new program required a reexamination of what was most important in teaching technological content at the graduate level. Of particular concern was the instructional delivery strategy for implementing the program. The strategy provides students with a 30-credit-hour program completed in four, 15-week semesters and one summer session. Each semester, students attend three extended weekend sessions, featuring face-to-face instruction and live peer interaction. This is complemented throughout the semester with distance education in a variety of forms including WebCT, listserve announcements, e-mail, audio files, facsimile, and telephone. The summer semester requires one extended weekend on campus.

Graduate Education at a Distance

With the capability and affordability of today's personal computers and related peripherals, distance education is becoming more popular across the country. "Formally defined, distance education is a form of education characterized by: physical separation of learners from the teacher, with limited access to the teacher and other learners; an organized instructional program; technological media, and two-way communication" [1]. Many universities are modifying existing on-campus courses that use the Internet as an instructional delivery tool. More and more universities are offering courses (undergraduate and graduate, alike) that students can take completely via the Internet with no live, face-to-face component.

Is a completely distant approach appropriate for a graduate degree in technology? We assert that in order to maintain the quality and integrity of a Master of Science degree in technology, it cannot be based completely on distance education; it must include a significant portion of on-campus meetings with professors and peers. Our assertion evolved based on the preferences and experience of our faculty relating to the needs of the students, our experience with traditional graduate students, and the graduate curriculum and specific course content. In addition, we conducted a more formal analysis of learner characteristics, the program's learning context, and the learners' tasks within the program.

Rationale for Distance plus On-Campus Format

The M.S. program for off-campus professionals was developed in response to industry demand for graduate distance education in technology that would meet the needs of full-time industry and business professionals. The typical students for this program are working professionals who are about 40 years old. On average approximately 10 years have passed since their last formal education experience. Indeed, our students fit Johnstone's and Rivera's profile of the adult learner: "The adult participant is…typically under forty, enjoys an above-average income, works full-time usually in a white-collar occupation, is married and has children, lives in an urbanized area but more likely a suburb than a large city…" [3]. The lack of recent experience with formal education means that these students may have a higher need for interaction with professors. In addition, these students have many other responsibilities competing for their time and may need the support that interaction with faculty and peers can provide.

The SOT graduate faculty's experience with traditional graduate students is the second point that leads to our assertion. Faculty members, like students, have their own comfort zones. Purdue's SOT graduate faculty experience in delivering graduate education had been totally based on traditional face-to-face instruction without the use of distance delivery. Faculty recognized the importance of student-instructor interaction in the traditional graduate school environment and did not believe that students would get the same educational experience without the interaction. In addition, faculty willingly admitted their own lack of preparedness to deliver distance education. In essence, they "didn't know what they didn't know" about managing graduate education at a distance and were concerned that this shortcoming would be a detriment to the quality of the program in the short term.

The third point that leads to our assertion focuses on specific course content and the existing graduate curriculum. Purdue's curriculum is a combination of manufacturing technology, information technology, and industrial distribution courses. The applied nature of these courses requires that students receive instruction in a manner that includes demonstration, modeling, and guided practice. The program's focus is to blend advanced technological content, critical-thinking skills, and face-to-face interaction/feedback to provide practical relevance in their respective professions.

An Instructional Design Approach

Is our assertion supported by concepts found in the literature? We believe it is. In modifying the existing curriculum to include a distance-education delivery strategy, we utilized the analysis phase of Smith and Ragan's [4] instructional design model (Fig 1) to determine the appropriate delivery and management strategies for the new version of the M.S. in Technology. Delivery strategy characteristics "deal with what instructional medium will be used and how learners will be grouped" and management strategies "include the scheduling and allocation of resources to implement the instruction that is organized and delivered as planned." The organizational strategy – "how instruction will be sequenced, what particular content will be presented, and how this content will be presented" – were relatively fixed in place based on the parameters of the existing traditional M.S. in Technology, as well as input from industrial representatives [4].

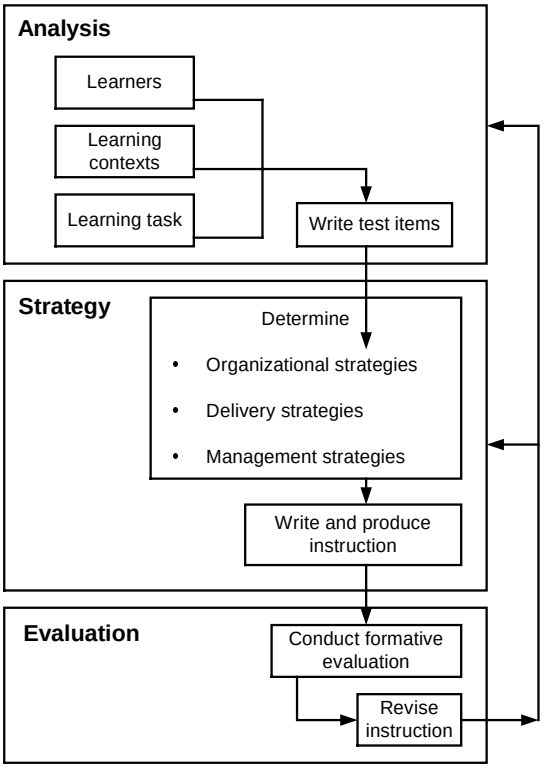

Fig 1. Instructional Design Model [4]

Instructional design models typically involve three major activities: analysis, strategy development and evaluation [4]. When done well, instructional goals, instructional strategy, and the evaluation of instruction are congruent; thus the strategy that is used (instructional method) is appropriate for the learning task (goals), and the tests measure how well the learners have achieved the learning task (assessment). In developing a distance-based graduate education program, we used an innovation-based analysis to examine the exact nature of changes needed in the instructional delivery system. Although Purdue University has offered a graduate M.S. in Technology for many years, we recognized that incorporating a distance education component would require many instructional design changes. The likely change in the learner population, as well as the presumed inefficiency and ineffectiveness of the traditional materials that had been used in the a traditional lecture, all pointed to the need for an instructional analysis to better deliver and manage the new graduate program. The Smith and Ragan's [4] instructional design model provides a good framework for conducting an instructional analysis that includes an examination of the learner characteristics, the learning context, and the learning tasks.

Learner Characteristics

We believe students enrolled in the program and those for whom it is targeted possess many characteristics that will ensure their success in their graduate education endeavor. For example, students are assumed to possess an appropriate degree of readiness for graduate-level work based on their acceptance into the program. In addition, they are likely to have higher interest in their education and motivation to learn because they have been in the workforce and are more likely to see the relevance of their education to their work and, perhaps, their future success. It is also

more likely that they will have a positive attitude toward learning and subject matter because they chose to participate in the program. The age and experience of the students suggest that they have more general world knowledge than their counterparts in the traditional M.S. program, and may be more used to working with their peers in team activities. All of these characteristics may well act to support the graduate students in this program.

However, further examination suggests that many of the learners in this program may need an extra degree of support from faculty. It has been shown that learners do not typically employ cognitive strategies spontaneously, and that several factors may serve to inhibit their use: low skill, learners' low feelings of self-efficacy, learners' lack of awareness of their own memory and processing characteristics, lack of knowledge of task characteristics, insufficient content knowledge, and insufficient allocation of time [4]. We believe many of the learners in the program are more likely to fit this description because approximately 10 years have lapsed since their last formal educational experience. Finally, one of the common barriers to participation in adult education is a dispositional barrier. Dispositional barriers refer to "attitudes and self-perceptions about oneself as a learner" [2]. Dispositional barriers include low confidence, negative past experience, and fear of being "too old" to participate. Combining a significant on-campus component to the required distance component gives students the opportunity to interact with their peers, share experiences, and breakdown dispositional barriers.

Instructional Context

The learning context analysis revealed some important factors that support the mix of face-to-face instruction combined with distance education.

- The target students are geographically removed and have responsibilities that prevent them from attending graduate school in residence full time.
- The students' graduate program is most often financially supported and highly encouraged by their employers. Employers are highly interested in the practical application of the their students' education to their respective jobs.
- The faculty have a clear preference for face-to-face interaction with their graduate students in order to better assess their progress and to ensure a rich dialogue with and among the students and to better direct the capstone research project.
- The faculty have mixed feelings about using web-based instructional tools. Many are interested and willing to learn how to use web-based tools, while others are hesitant about the time required to develop and use them.
- Most of the faculty have experience teaching at the graduate level..
- Technological options for distance education include the Internet, e-mail, simulations, chat rooms, instructional software, facsimile, telephone, and audio files. Bandwidth limitations prevent the use of synchronous (real-time) video conferencing or asynchronous video files in any substantive way (teaching at a distance).
- There is good availability and variety of appropriate classrooms and computer labs needed for graduate instruction during weekends on campus, although there are some scheduling limitations.

- Purdue University is supportive of distance education and/or non-traditional formats for graduate instruction.

The implications of this analysis of the learner context are four-fold. Extended time away from work for extensive classes on campus are not feasible for the learners, thus making a distance component an important requirement. Secondly, distance education is certainly feasible and some faculty are willing to use the technology to teach graduate education, however, there is a lack of experience with using and managing distance education. The third point is that professors have a clear preference for face-to-face instruction, particularly at the graduate level. The last implication is the availability of classrooms at Purdue University that could accommodate the program in a weekend format.

Learner Task

The second phase of the analysis is to analyze the learner task. The curriculum for this new offering of the M.S. in Technology is a fixed combination of courses that includes three core courses (applied statistics, research methodology and a quality and productivity course), plus a combination of information technology, manufacturing technology and industrial distribution courses. The learning outcomes are quite varied, ranging from basic declarative and conceptual knowledge that students may not be familiar with, to more advanced problem-solving and cognitive strategies. In addition, students will be exposed to new psychomotor skills. Our conclusion, based on the variety of learning outcomes, is that the program's instructional delivery options must be flexible. In particular, a complete use of distance education may limit students from engaging in complex problem-solving and cognitive strategies.

We noticed a direct relationship between the information processing requirements and the need for face-to-face instruction. For example, teaching higher ordered thinking skills is more effective using live demonstration and interaction than depending solely on distance education delivery. The most complex task within the program is the capstone experience. This is a formal process that leads students to the completion of an applied directed project (usually within their companies). The project format is much like a traditional master's thesis because it follows a traditional proposal format and is negotiated and approved by a faculty committee. The directed project is an educationally rigorous exercise. It requires students to develop a traditional proposal. Students formulate a problem statement supported by a literature review, collect and analyze data, and draw conclusions. The culmination of the project is preparing a written report, and effectively presenting and defending those results and conclusions to their faculty committee and their peers. The success of the directed project depends heavily on faculty mentoring and modeling, plus interaction with their peers.

We developed the M.S. in Technology in a weekend format because we believed it was in the best interests of our faculty and students. Our analysis using the Smith and Ragan model, reinforced our assertion that graduate education is not best served by a total distance education approach. Now that we have a year's worth of experience and know first-hand what the opportunities and challenges are in a program that mixes on-campus with distance education, we are firm in our belief that this is the best model for both the student and the faculty involved.

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