

A Bachelor Degree Program in Surveying/Geomatics Offered to Place-bound Students: Measuring Success

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SUMMARY

Getting a college degree or finding continuing education courses in surveying/geomatics is still a problem in most parts of the world including the United States. There are only a handful of colleges or universities in the U.S. that offer baccalaureate or higher degrees in surveying even by traditional methods. An alternative to the traditional college education is distance learning. This method of education, although an old concept, has new meaning due to advanced delivery techniques. Continuing education has been the primary use of distance learning, but now, we have the means to deliver an entire college degree program to a student thousands of miles away from the campus.

Distance learning in surveying/geomatics is still in its infancy and most are not familiar with some of the delivery techniques. For this reason, it is essential that students, employers, and regulatory agencies are convinced that the quality of the education provided via distance learning can be comparable to what is being delivered on campus in a traditional setting. It is important that the structuring of the program, support it receives from the university administration and delivery technologies are all geared towards maintaining the quality of education the students receive in distance learning programs.

The distance learning program at Michigan Technological University in U.S.A. has been in existence since 1994. This paper presents a historical overview of the program and how it evolved as a unique, reputable, and successful program. It will also discuss the changes that had to be implemented in order to achieve the accreditation by the United State's Accreditation Board for Engineering and Technology and to be accepted by Michigan Board of Professional Surveyors. Statistical data related to student opinion and their satisfaction of the program, success it has achieved as measured by the graduate employment and achieving professional licensure to practice is also presented.

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1. DISTANCE EDUCATION

Distance education has become a significant component of delivery of education worldwide. Most developed countries in Europe and Asia have an Open University system in which students may be scattered all over the world and yet are pursuing degree programs, including graduate and professional degrees, at their own pace. Distance education is not limited to only liberal arts and business courses anymore. According to United States Distance Learning Association (USDLA) there are course offerings for baccalaureate, master and doctoral level degree programs as well as non-credit courses for adult learners and others who wish to pursue specific skills or interests. Distance Learning programs provide an education and training alternative in lieu of the traditional brick and mortar classroom.

The term "distance learning" generally implies that the students are not physically present with the instructor or even not in one location. USDLA (<http://www.usdla.org/>) describes distance learning as acquisition of knowledge and skills through mediated information and instruction, encompassing all technological and other forms of learning at a distance. Communication technologies used in distance learning create classrooms without walls and enable teachers to reach students without regard to their geographical locations. While communicating back and forth via e-mail certainly qualifies as distance learning, the term is usually applied to technology that broadcasts instruction from one central site to one or more remote sites. Satellite broadcast, one or two-way video, computer networks such as the Internet, and host of other audio and video technologies can be used for the delivery of instruction.

Even though distance education/learning is not a new concept, it is relatively new to science and engineering in the United States and certainly to the field of surveying. Currently there are only a very few courses in surveying/geomatics available to distance learning students. To the knowledge of this writer, Michigan Technological University is the only university in U.S.A. that enables one to earn a bachelor degree in surveying via distance learning. The International Federation of Surveyors (FIG) has been actively pursuing the delivery of surveying courses for professional development. The Commission on Professional Education (Commission 2) has published several papers on this subject and can be found on the FIG website (www.fig.net). FIG has been promoting the concept of Virtual Academy for some time.

1.1 Distance Learning Student

Distance learning is not for everyone. Best education is received when there is direct interaction with the instructor and peers. Only those who are place bound due to employment or family or both should consider this mode of education. Younger students without any work experience may find it difficult to be motivated to learn subject matter that is unfamiliar and often analytical in nature. Further, they may not see the importance of such material in a chosen career. They may also find it difficult to follow the fast-paced college level courses without some individual tutoring even when the course load is light.

Student who should be considering distance learning should be a mature, self-motivated one. Student plays an active role in the learning process as opposed to the passive learning style in the classroom. He or she must commit sufficient time to be devoted to studying course material, completing assignments on time as well as interacting with the course instructor when needed. One advantage that the distance learning student has over the traditional college student is that he or she generally takes one or two classes a semester. Further, the lessons in distance learning courses could be reviewed, as many times as needed, as they are available either on the web, on tape or any other medium. One disadvantage is that the student does not have access to the course instructor to answer any questions he or she may have at the time he or she is following the lesson. For this reason, the student must have at his or her disposal all modes of direct communication with the instructor. Telephone may be a good way of communication but, often, the instructor may not be available to answer the phone at the time the student has the question. Email may be the best way of communication followed by an occasional telephone call to have a personal conversation with the instructor. This writer encourages students to contact him by phone as often as they like.

Students planning to enroll in distance learning programs should have good high school preparation in mathematics, English, writing, and should possess good computer skills. Preferably, they should also have some experience in taking post secondary courses at a two year or four-year college. It is an advantage to have some work experience as well in the discipline they are pursuing.

2. DISTANCE LEARNING PROGRAM IN SURVEYING AT MICHIGAN TECHNOLOGICAL UNIVERSITY, U.S.A.

Bachelor degree in Surveying is one of handful of distance learning programs at Michigan Technological University in U.S.A. Distance learning program in Surveying is an extension of the on campus bachelor degree program.

The program began in the fall of 1994 as a result of a request made by the Michigan Society of Professional Surveyors. This is the culmination of agitation by paraprofessionals working under licensed surveyors and engineers to pave way for them to achieve professional status. A statute enacted and passed by the Michigan legislature in 1977 made it mandatory for anyone seeking professional licensure in surveying to have a baccalaureate degree with

required number of course credits in some key areas, the majority of which was in surveying. After the grandfathering period of ten years had passed, the individuals who had already been working in surveying companies as field and office technicians for several years had no prospects for career advancement. The main reason for this was that most of these individuals were older adults. They already had started families, had mortgage payments, and other family responsibilities. They could not quit their employment to become traditional, full time college students. This was the reason for Michigan Society of Professional Surveyors to seek an alternative way for these individuals to earn a college degree.

The discussions that Michigan Society of Professional Surveyors had with the surveying faculty and university administration lead to the distance learning extension of the already existing bachelor degree program in surveying. It was agreed that Michigan Technological University, or Michigan Tech as it's usually called, would deliver all the upper level surveying classes to several sites established within commuting distance of students. The classes in science, mathematics, engineering sciences, and general education were to be completed by the student at a local college close to student's hometown. The total credits required for the degree was 130 semester credits and the total upper level surveying classes amounted to 34. The university residency rule dictates that 30 of the last 36 credits applied to the degree should be earned from Michigan Tech. Our agreement was in compliance with the university residency rule.

There were also students who did not want to get a bachelor degree in surveying. These were the students who already had a bachelor degree in another discipline, mostly civil engineering, but needed the number of surveying credits to fulfill the statutory requirement for licensing. There was also a third category of students who merely wanted to take classes for professional development, especially to supplement their knowledge and skills in newly developed technologies such as GPS and GIS.

In few short years the number of students enrolled in the program grew to over one hundred. Students were interested in enrolling in the program not only from the state of Michigan but from several other states as well. There were inquiries from other countries too. The factors that limited the acceptance of students from other states and countries were the requirements of the accrediting agency, Accreditation Board for Engineering and Technology (ABET) in U.S.A. These and other restrictions placed by accrediting agencies and changes that had to be made to overcome them are discussed in a subsequent paragraph.

2.1 Course Delivery

As the students enrolled in the classes initially were employed full time, real time or interactive delivery of classes was not an option. It was decided to deliver classes videotape delayed. Classes were videotaped while the class was being taught on campus to regular students. A separate unit called Educational Technology Services (ETS) was already available at the university to handle videotaping. The required number of copies could be made simultaneously while recording the class. ETS also facilitated video conferencing and

teleconferencing as necessary. The classes that needed to be videotaped were taught in a room similar to a T.V. studio with cameras, microphones, and display monitors. This room can also accommodate regular, on campus students enrolled in the class as well. Another unit called Extended University Programs office handled delivery of videotapes and other class material to the sites.

The videotapes were delivered to the sites where a site coordinator facilitates viewing of videotapes. It should be noted here that, because all the students enrolled in these classes were working full time, they could not attend classes at regular hours. Sites for each class were selected based on geographic locations of students enrolled in the class. It was a location central to several students. The students would meet at the site after work, once a week on the assigned day, to view the videos. The site coordinator would distribute homework and other assignments and proctor any quizzes and exams as well. This person was also responsible for returning completed assignments, exams, etc. to EUP which in turn returned them to the respective instructors.

Delivering the laboratory component of a course was a problematic issue, especially those that involved field work using equipment. This certainly precluded delivering lower level surveying classes to distance learning students. The issue of lab practicals was handled by one of two ways. An adjunct would be designated to conduct lab practicals as necessary, as the course progresses. This person, usually a practicing surveyor, would conduct necessary lab exercises over a several weekends. This worked well for legal and boundary survey classes as the students could do the record search and necessary research at the local court house where the land related information was, and still is, kept. This method could not be used for labs that needed the use of licensed software such as least squares adjustments or GIS and those that required specific tools such as GPS or photogrammetry.

The use of licensed software issue was handled as follows. A site would be arranged for the students to meet for two consecutive days, usually Friday and Saturday. This site is usually a surveying/engineering firm or a photogrammetric firm. The instructor would travel to this site with media containing necessary software. The students would use their own portable computers or computers available at the site to conduct lab exercises. For labs in photogrammetry, the instructor would carry simple tools such as micro rules, pocket and mirror stereoscopes, parallax bars, etc. Photogrammetric company willing to host the class would allow the students to use their plotters for other labs.

2.2 Accreditation Issue

Since its inception in 1978, the bachelor degree program in surveying at Michigan Tech had been accepted by the State Board of Licensing of Professional Surveyors in Michigan as meeting statutory requirements for licensing. The degree also received accreditation by Accreditation Board for Engineering and Technology in U.S.A. in 1986. Now the question arose as to whether or not this accreditation extended to the distance learning degree which was an extension of the on campus degree. The State Board of Licensing questioned the standard of the degree earned via distance learning.

This question was addressed by ABET during their regular on site review of the program in 1998. They did not make a distinction between on campus program and distance learning program as long as any course applied to the degree, regardless of mode of delivery, was comparable in content, rigor, assessment, etc. to the one delivered on campus. The course content and assessment were the same as distance learning students viewed the same class and completed the same assignments and exams. The problem was in the delivery of lab practicals. ABET found the delivery of labs to be unsatisfactory as the facilities available may not be comparable with those available on campus but did not consider it a major violation of accreditation criteria. Still, they cited it as a cause for concern.

2.3. Present Status

Most distance learning classes, at least at present, are advanced courses that are upper division courses applied to the bachelor degree. Students are either professionals or paraprofessionals and are already employed in their respective fields. They have a basic understanding of the subject and have practical knowledge to follow the material without much difficulty. Almost all the students have prior college experience even if one does not have a complete college degree.

After a few short years, it became apparent that videotape delivery was too costly to sustain the program. An alternative mode of delivery had to be found. By this time on line course management software was available on campus. It was decided to stream the videos and place on a web page created for the class so the students can view the class at leisure. Currently, WebCT™ is being used for managing each class. All the course material such as course notes, reference material including links to relevant web sites, assignments, sample quizzes and exams are placed on the course web page in advance. Still, all quizzes and exams were given at a site monitored by a site coordinator. Answers to completed assignments, quizzes and exams are also posted but graded assignments are also returned to students.

Some practicals that involve only the use of software such as COGO calculations, least squares adjustment, geographic analysis, etc. can be done by remotely accessing the software available on campus. Such software programs are placed on the Citrix Metaframe Server on LAN maintained by the School of Technology that administers the Surveying Program. Students who have the Citrix client on their personal computers are able to run such software remotely and complete their assignments. Citrix client software can be downloaded from www.citrix.com free of charge. Instructions for completing assignments and samples are placed on the course web page. Special class sessions demonstrating the use of such software are video streamed and placed on the course web page. Labs that have field components such as GPS positioning are conducted on campus. The students have to travel to university campus, once during the term for each course, on a designated Friday/Saturday weekend.

3. BUILDING A SUCCESSFUL DISTANCE LEARNING PROGRAM

Spending a large sum of money on promotions or the use of the most advanced technology for course delivery does not guarantee the success of a distance learning program. Quality of the support services available to the students is as important as the quality of education they receive. These services are already available to students on campus. If distance education programs are run as extensions of on campus degree programs, these same services available on campus can be extended to distance learning students as well.

3.1 Program Management

School of Technology, as the host department, is only responsible for academic issues such as curricular changes, course content, web page management, and academic advising. Extended University Program Office (EUP) is responsible for all non academic issues of the distance learning program. They include the following in addition to the delivery of videotapes.

- Maintaining program information web page and making updates as necessary
- Answering written or telephone requests for information
- Processing admission applications and collecting application fees
- Working closely with the university admission office to ensure eligibility of students for admission
- Course enrollment and billing

Students who are pursuing degrees by distance education at Michigan Tech are admitted using the same admission criteria used for regular students. Due to the fact that the most distance learning students come with some work experience, EUP has to work with the academic advisor for granting any life experience credit. Further, applications from distance learning students are received throughout the year as opposed to the applications received from traditional students. This is the reason the admission applications from distance learning students are handled separately. Most distance learning students in surveying come as transfer students as they already had taken some college level classes previously.

Course enrollment and billing is another responsibility of the EUP. When a student applies for enrollment in a course, it is the responsibility of EUP to ensure that the student has met all requirements including the prerequisite courses to enroll in the course. It is very important for the degree seeking students to take classes in proper sequence.

3.2 Academic Advising

Distance learning students need help on planning their academic career more than on campus students. They are not familiar with issues such as degree planning, course scheduling, course prerequisites, etc. nor do they have peers to help them. The academic advisor of the program handles for the following.

- Awarding transfer credits for classes taken at other colleges
- Awarding advanced placement credits in lieu of work experience or by conducting tests to assess required knowledge
- Preparation of degree plans and scheduling of courses
- Advising/Mentoring
- Follow up and updates on progress

Academic advisor should make the students aware of the times he/she is available for consultation.

3.3 Course Development

Course instructors develop the courses to be offered by distance education. They are individually responsible for.

- Course content
- Preparation of course notes, guidebooks and other course related material

Course content depends on whether or not the course is part of a degree program or a course delivered for those seeking professional development. It is up to the instructor to choose the topics to be included in the course.

Unlike the course taught solely for on campus students, it is very helpful for distance learning students to have a course guidebook to help with each lesson. This may give the description or summary of the topic discussed in that lesson and some related reference material. This may include few questions as well. This is helpful regardless of whether or not a textbook is being used for the course.

3.4 Teaching/Presentation of Material

Teaching is the heart of any educational program. Teaching before a live student audience may improve the quality of presentation as opposed to teaching only in front of a camera. As there is no traditional chalkboard, a good portion of the course presentation such as graphics, figures, and mathematical formulas can be prepared prior to the class. These could be printed on paper to be used under the document camera or may be displayed from a computer or a web page. The classroom presentation should follow very closely the lessons shown on the course guidebook.

The instructor can also help the students by

- Making direct access to the instructor available
- Arranging occasional teleconferences or videoconferences for direct interaction
- Engaging students in intellectual discussions through chat rooms, etc.
- Making additional educational material available

As pointed out earlier, the students not being in one location pose problems for courses that have substantial hands-on lab components. This certainly excludes some lower level courses being taught as distance education classes. Even if a course does not have lab component, the distance education courses need to be structured and presented differently. Unless a course is delivered interactively students cannot clarify any difficult points as and when they arise. Instructor needs to be mindful of this and he or must anticipate type of questions the students may have. If the course is taught in the presence of a live audience, any questions raised by live audience will help the distance-learning students as well, and the instructor needs to encourage such questions. It is also helpful to repeat every question asked by a member of the live audience by the instructor in order to ensure that distance learning students know what the question was.

3.5 Student Assessment

Student assessment is an important part of the course and the most difficult part of distance education. Issues relating to student assessment are

- Ensure that assignments are done independently and submitted by the due date
- Maintaining integrity and honesty of quizzes and exams

Currently, above is accomplished by employing a site coordinator at each site to proctor quizzes and exams. This is not always practical due the cost involved or finding reliable persons. Web based assessment may be the ideal for economic reasons, but unless the accrediting agencies can be convinced that this method is fraud-proof, it may not be practical. The major hurdle is to ensure that the person answering the test or exam is the same person taking the class.

3.6 Course Evaluation

Student feedback is very important in order to make improvements to the course. There has to be some mechanism to have the students evaluate the course and making some suggestions for improvement. In addition to the feed back received by the instructor during teaching the course, course evaluation questionnaires are sent to students at the completion of the course before they receive their final grade. Student responses are made available to instructors after the grades have been finalized and posted.

4. MEASURING SUCCESS

The success of any endeavor is measured by how well it has achieved its goals or objectives. This is not different in education. The success of an education program can be measured by

- graduation rate
- placement rate
- employer satisfaction

By end of the academic year 2003 – 2004, a total of 154 students have completed at least one class in surveying by distance learning. There were 22 bachelor degrees conferred during this same period. It should be noted that some students already had a bachelor degree in a different discipline, and therefore, did not require a degree in surveying to be eligible to sit for the Fundamentals of Land Surveying (FLS) examination conducted by the National Council of Examiners for Engineering & Surveying. They only needed the appropriate courses and credits in surveying as stipulated by the state statutes. FLS examination is the first step of the licensing process in almost all states. In Michigan, the candidates are able to take the professional practice examination if they show 4 years of combined field and office experience.

Placement does not apply to the distance learning program at Michigan Tech as all the students in the program are full time employees. Employer surveys are sent out to the employers of all graduates of the surveying program. The survey does not make a distinction whether or not the employee earned the degree traditionally or via distance learning. The fact that the employers reimburse their employees the cost of taking classes is an indication that they are happy with the education their employees are receiving.

A small survey conducted to determine the students' satisfaction on the program was conducted in the fall of 2004 and the results are given below. The survey was posted on the web (http://www.admin.mtu.edu/eup/survey_id/survey_id.html) and a requests were sent to past and present students, by email, using all available and last known emails. A total of 27 responses were received. Some of the questions and statistical summary for some questions are tabulated below.

In addition to the personal information about each of the respondents, there were 14 other questions that are listed below. Personal information related to the year of enrollment in the program, year of graduation, whether or not the person has passes the FLS, how many attempts were needed the pass FLS, and whether or not the person is licensed to practice surveying.

Out of 27 responses received 10 have already graduated from the program, 9 have passed FLS in the first attempt. Out of the 9 who have passed the FLS exam, 5 are already licensed.

Questions 1 – 5, 13 and 14 are related to their satisfaction of the program, its support services and education they received. Questions 6 – 12 are related to usefulness of delivery and communication techniques. It can be noted that some respondents did not answer all the questions.

Questions 1 – 5, 13 and 14 were rated using 4 point scale as follows.

Strongly Agree	= 4	Somewhat Agree	= 3	Neutral	= 2
Somewhat Disagree	= 1	Strongly Disagree	= 0		

Question	Number of Responses	Mean	Std. Deviation
The education I received at Michigan Tech is valuable in my present employment.	27	3.6	0.6
I found the instructional material of the B.S.Surveying program useful.	27	3.6	0.6
The B.S. Surveying program provides a high quality of teaching.	26	3.8	0.4
The feedback I received about my performance in the individual classes was helpful/timely/useful	26	3.4	0.8
I received pertinent distance learning course information (such as course registration information) in a timely and helpful manner	26	3.5	0.9
In general, I found the distance-learning program at Michigan Tech a successful learning experience.	26	3.8	0.5
I would recommend the distance-learning program to a friend or another student.	26	3.8	0.4

Questions 6 – 13 were rated using a 3 point scale as follows

Very Useful = 3 Somewhat Useful = 2 Not Useful = 1

Question	Number of Responses	Mean	Std. Deviation
Email	26	2.7	0.5
Videoconferencing	16	2.5	0.5
WebCT	18	2.8	0.4
Portable Document Format (PDF)	18	2.9	0.2
Streamed audio or video	18	2.9	0.2
Fax	23	2.6	0.7
Phone conferences	17	2.4	0.5

5. CONCLUSIONS

It is clear that the student satisfaction of the education they received is very high. Most students are also able to pass the FLS exam in the first attempt showing that the education they received are relevant to their profession. They are also able to achieve professional licensure within few years of graduation. Most of the students surveyed hold responsible positions in the companies they are employed. Surveying Industrial Advisory Board that meets twice a year to advise us on the future direction of surveying program and curricular issues, is in favor of continuing the distance education extension of the surveying program at

Michigan Tech. Finally, the future of the program appears bright but its survival depends on the dedication of the personnel involved.

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BIOGRAPHICAL NOTES

Author, an Associate Professor in Surveying, has been teaching for more than 25 years in the U.S. as well as in Sri Lanka where he began his survey career as an Assistant Superintendent of Surveys in the Sri Lanka Government Survey Department. Author has a B.S. degree from University of Ceylon, Sri Lanka, a Post Graduate Diploma in Surveying from University College London, and an M.S. degree in Geodetic Science from the Ohio State University in U.S.A. The author also has been the advisor to the students enrolled in the distance learning program in surveying at Michigan Technological University since its inception.

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