IMPLEMENTATION OF A MULTIMEDIA CURRICULUM AT VITERBO UNIVERSITY

By

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ABSTRACT

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Due to the widespread use of multimedia and hypermedia educational and training materials in both education and industry, it has been suggested that a multimedia specialization/minor be implemented and offered at Viterbo University. This study is part of a larger needs assessment to help determine the requirements and lay the groundwork for such a program. A survey will be developed to assess student interest in such a program, overall computer literacy, and satisfaction with current computer courses offered at Viterbo University. Issues related to implementation in higher education such as cost, time, and evaluation procedures will be investigated. Analysis of the findings and recommendations will be made available to the Academic Vice President and the curriculum committee.

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CHAPTER 1

INTRODUCTION

"The potential significance of multimedia applications in the educational environment cannot be overstated, and it would appear that the multimedia revolution has finally arrived" (Mathisen, 1991, p. 93).

Multimedia has become the most used and misused term in education in the 1990s. The multimedia/hypermedia blitz has taken business, industry, and education alike by storm. The proliferation of educational and training materials incorporating digitized sound, speech, images, and full motion video, with high speed computers and videodisc players that break the paradigm of linear, teacher-driven instruction promises to revolutionize the way we learn. Preliminary studies show that multimedia instruction increases learning content and retention, and reduces the amount of time it takes to learn material (Walton, 1993). However, the technology does not drive itself. Multimedia without sound instructional design is no more than an electronic book, or a very expensive overhead projector. "It is not the system itself necessarily but the way the system is used that determines its effectiveness" (Trotter, 1993, p. 19). However reluctantly, traditional instructional and educational

media must move to incorporate the concepts of multimedia. This will include the training of educators in the use of the latest technology. But effective utilization is the key to maximizing the potential of multimedia instruction. This requires education not only in the available technology, but also the concepts governing effective production and usage, with a comprehensive curriculum providing both. It is in order to insure that graduates of Viterbo University are adequately prepared to effectively utilize interactive multimedia in both educational settings, business, and industry that this study is undertaken.

STATEMENT OF THE PROBLEM

Due to the widespread use of multimedia and hypermedia training materials in both education and industry, it has been suggested that a multimedia specialization/minor be implemented and offered at Viterbo University. This study is part of a larger needs assessment to help determine the requirements and lay the groundwork for such a program.

PURPOSE OF THE STUDY

Multimedia and hypermedia have garnered much attention and gained widespread use in both education and industry in the past few years. In order for Viterbo University to successfully implement an effective

curriculum in multimedia, it must be determined whether or not there is sufficient student interest in such a program. These results will be compiled and analyzed to determine current and future trends in the area of multimedia/hypermedia instruction, and provide a basis for meeting the needs of students preparing for careers in either education or training in business and industry.

RESEARCH QUESTIONS

This study seeks to answer the following questions:

1. Do the students at Viterbo University view multimedia skill as an important part of their future jobs?
2. Is there sufficient student interest in an Intro to Multimedia course offered as General Education credit?
3. Is there sufficient interest in a Specialization in Multimedia Studies at Viterbo University?
4. Is there sufficient student interest in a Minor in Multimedia Studies at Viterbo University?

SIGNIFICANCE OF THE STUDY

This study is significant because it is taking place in an area that is undergoing rapid growth and almost daily change. Interactive multimedia will likely change the way we think, the way we learn, and probably

the way we live. This revolution in education presents unique opportunities and problems. In order to understand this phenomenon, overcome the inherent problems, and utilize it to its maximum potential, it is imperative research be done to insure that all aspects of multimedia are given adequate attention. This study will attempt to aid the body of research that is being done and help shape the future of interactive multimedia use in education.

LIMITATIONS OF THE STUDY

This study is limited by the fact that curricula in interactive multimedia/hypermedia have only recently been implemented in post-secondary institutions, thus making information regarding course work and curricula sparse. Another significant barrier is the rather nebulous definition of multimedia and/or hypermedia.

Multimedia is a buzzword in education and training, and everyone is touting their ideas of what a multimedia platform consists of. Until a uniform, standardized definition of multimedia is accepted, gathering information regarding multimedia is rather a subjective process. In order to insure uniformity in this study, multimedia is defined at the end of this chapter.

ASSUMPTIONS

The following assumptions are made in order to

assist in providing a framework for the study:

1. The full-time enrollment at Viterbo will remain steady at c.1100.
2. There will be a time lag between the inception of a new technology and its widespread implementation in higher education.
3. Education will be slower to implement the new technologies than business and industry.
4. The cost of the new technologies will continue to increase.
5. The capabilities of the new technologies will make them easier for educators to use.

DEFINITION OF TERMS

Analog - A continuous electrical signal that can vary in frequency and amplitude. In video, frequency responds to resolution and amplitude to brightness. In sound, frequency is a measure of pitch and amplitude represents volume. Analog data must be converted to digital for input into computers (Shelton, 1993, p. 700).

Authoring System - A software application that allows the producer to incorporate multimedia elements such as text, video, audio, and animation. It allows the designer to utilize the non-linear nature of the computer to design

instruction with built-in interactivity and evaluation. (i.e. Authorware, Director, Toolbook, Hyperstudio)

CD-ROM - An acronym for Compact Disc - Read Only Memory. An optical digital storage device read by a laser capable of storing large amounts of information(currently up to 800mb).

Computer Assisted Instruction - Also known as computer aided instruction, computer based instruction (CBI), computer mediated instruction (CMI).

Digital - Data expressed in discrete numerical units according to a predetermined code. In computing, data are expressed in binary code--an electronic pulse, either "on or off" (Shelton, 1993, p. 701).

Educational Technology - a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems and devising, implementing, evaluating, and managing solutions to those problems, involved in all aspects of human learning

Hypermedia - For purposes of this study, Hypermedia and Interactive Multimedia will be used synonymously. See below.

Instructional Technology - See "Educational Technology."

Interactive Multimedia - The incorporation of

text, digitized graphics, speech, sound, video and optical technologies such as videodisc and CD-ROM technologies integrated through a computer that makes the entire package non-linear and learner driven.

Multimedia Specialist - The Multimedia Specialist designs and/or produces communications media (still, motion, audio, graphic and text images) in a computer-based environment for use in a presentation or interactive mode.

Specialization - A specialization is a program of study, with carefully constructed learning goals and experiences, and evaluation procedures. While course work may be included in the specialization, students may also work to meet the learning goals through internships, working with a mentor, successfully completing a proficiency examination, or other non-classroom experiences. Courses may come from several departments and involve faculty from several disciplines. Courses taken to complete a specialization may also fit elsewhere in a student's program of study.

In some cases, an all-university specialization may not increase the length of time required to complete a degree, in other cases, additional time may be needed. Students who complete a specialization will have the specialization recorded on their transcript and will

receive a certificate of completion.

Videodisc - An optical storage medium for analog signals that are mastered from videotape, film, and etched into a polymer disc that is read by a laser. The two main types are Constant Angular Velocity (CAV) and Constant Linear Velocity (CLV).

METHODOLOGY

Information and data for this study will be derived from students currently enrolled at Viterbo University. A survey will be developed and delivered to students in all the schools at Viterbo University. The following chapter will lay the background for the study, acquaint the reader with the potential and concerns of educational and instructional media and specifically interactive multimedia in education.

CHAPTER 2

REVIEW OF LITERATURE

This chapter will attempt to define multimedia/hypermedia, introduce the terminology germane to the field of multimedia/hypermedia, present past and current research in the field, and outline the potential advantages and drawbacks to the use of multimedia in education.

Interactive multimedia is a natural outgrowth of educational and instructional technology. As such, it will be necessary to understand exactly what educational technology is, and what its purpose is. Educational technology seeks to improve education through the systematic application of technology:

> "Over the past fifty years educational technology has evolved from its early emphasis on the production and use of the media and instruments of communication to its current concern with the systematic approach to solving educational problems based on the theories of learning and instruction. The time has been marked by the arrival of new technological developments, each one of which has been heralded as a major breakthrough with a potential for revolutionizing education" (Ely & Plomp, 1991, p. 5).

Such is the case with interactive multimedia, also known has hypermedia.

The characteristics of non-linearity and random access promise to personalize instruction, allowing learners to work at their own rate, free from the traditional classroom

pressures and constraints, and according to some studies, maximize each student's learning potential.

MULTIMEDIA DEFINED

At present, a standardized and universally accepted definition of multimedia has not yet emerged. As a result, multimedia means many different things to different people. In the course of doing research, the definitions encountered were many and varied, and ranged from simply combining at least two media, to exclusively interactive video. Some are more conceptual, describing what multimedia does, and some are very specific, identifying the components required to qualify as multimedia. In his article “The Educational Buzzword of the 1990s: Multimedia, or Is It Hypermedia, or Interactive Multimedia, or..." Jeremy Galbreath recounts many definitions of multimedia. Here are just a few:

"The term 'multimedia' describes a new application-oriented technology that is based on the multisensory nature of humans and the evolving ability of computers to convey diverse types of information" (Galbreath, 1992, p. 15).

"Today multimedia generally means using an authoring system such as HyperCard or Macromind Director to create and playback a production"(Galbreath, 1992, p. 15).

> The term Multi-media is redundant; media is already plural in character. Moreover, Multimedia has previously been widely applied as describing a far different entertainment industry...Using Hypermedia instead in microcomputer discussions today is a better choice. It correctly connotes its interactive desktop computer driven character. This properly distinguishes Hypermedia from those song-and-dance, Multimedia concerts and shows of the 1960s that gave the latter its earlier and still predominant meaning. (Galbreath, 1992, p. 16).

"...to qualify as multimedia, an application needs to only incorporate two or more of the following: still or animated graphics, still or motion video, audio, or text and numerical data" (Galbreath, 1992, p. 15).

In an article by Liedtke, multimedia is defined as: "a revolution in communication that combines the audiovisual power of television, the publishing power of the printing press and the interactive power of the computer" (Liedtke, 1993, p.21).

Ludwig Issing says that

> “Multimedia is a technology which enables the operator to use computer-supported interaction with a multiple media system including a variety of presentation forms such as data, text, sound, graphics, animation, still frame, moving picture and real time simulation in cyberspace” (Issing, 1994, p. 171).

Tim Hudson writes in an article called "Teaching with Interactive Multimedia":

> "Multimedia is a nifty, new-age catch-phrase for what audio/visual presentation professionals have been doing for decades. If you make a presentation using two or more of the following: video, slides, graphics, computer graphics, printed text, computer text, recorded audio, or digitized sound, then you are using multimedia." (Hudson, 1992, p. 2).

To be complete in within an educational framework, the definition for multimedia must also include the concept of non-linearity, and learner interactivity. For the purposes of this study, multimedia will be defined in the following manner: The incorporation of text, digitized graphics, speech, sound, video and optical technologies such as videodisc and CD-ROM, integrated through a high-speed computer that makes the entire platform non-linear (allowing for random access), and learner driven. This definition includes the most key elements and requirements of modern multimedia: the fact that it is dependent on the computer, it incorporates *digital* media, and that it is non-linear. This is multimedia in its simplest form.

The non-linear capability offered by today's high-speed computers allows us to design interactive multimedia to address diverse learning styles. By offering other alternatives besides the traditional face-to-face, lecture-

note taking format, we allow students to utilize their preferred learning style. By allowing them to pursue a different path through learning material, we offer them a chance to learn at their own pace, following a learning progression that is most logical to them, that may also be a better match with their meta-cognitive skills.

Farmer writes:

"Although ideas may be arranged sequentially, along one dimension, links between ideas may be non-linear so students can explore the multimedia products according to their interests and capabilities" (Farmer, 1995, p.30).

Hudson (1992) agrees:

"I'm more interested in the other half of the equation—interactivity. Interactive multimedia means people can individually control, manipulate, learn from, and change the outcome of complex multimedia 'programs.'"(p. 2).

Nelson and Palumbo describe the potential of multimedia/hypermedia best in an article entitled "Learning, Instruction, and Hypermedia:"

"Hypermedia-based learning environments allow the knowledge base to accommodate the learner rather than the learner accommodating the knowledge base"(Nelson & Palumbo, 1992, p. 288).

And that:

"Hypermedia systems eliminate the linear, arbitrary sequencing of traditional text, allowing users to freely browse through a knowledge base"(Nelson & Palumbo, 1992, p. 287).

The next step, then is to take a look at the promises, potential, problems, and drawbacks associated with multimedia.

ADVANTAGES OF MULTIMEDIA

Many studies show that multimedia has great potential. Early adopters say that it greatly improves education and learning. In an article entitled "Why Students should use Multimedia," Bucher (1995) believes that

> "students are able to combine traditional library/information skills (i.e., selecting and narrowing a topic, preparing an outline) with the higher level thinking skills, (i.e., critical thinking, problem solving, and decision making) when they are actively involved in authoring their own multimedia presentations. If they work in groups, they are developing cooperative learning skills. Giving students this opportunity also takes advantage of the students' various learning styles. Often, we forget that many high school students are tactile-kinesthetic and learn best by actually doing things" (p. 21).

It remains to be seen, then, just how effective interactive multimedia is. Liedtke (1993) reported that: "multimedia used in education and training assists audiences in retaining 20 percent of information they hear,

40 percent of what they see, and 60-70 percent with which they interact" (p. 9).

Shelton (1993) reported that:

"Users learn more and learn more quickly with multimedia. A 1987 study indicates that students using interactive programs learn and retain 25% more of the information presented and learn it 50% faster than those who use traditional learning methods" (p. 696);

And that:

> six studies conducted from 1990 to 1992 show that multimedia students have a 55% learning gain over students receiving traditional classroom teaching. They learn the material 60% faster, and their long term (30) day retention ranges from 25% to 50% higher (p. 696).

Lamb cites a 1990 article by R.L. Miller which identified ten beneficial areas regarding interactive multimedia technologies:

"More than thirty studies have found that interactive technologies reduce learning time" (Lamb, 1992, p .37).

In an article entitled "Multimedia Learning: Today and Tomorrow," Bill Walton says:

> Estimates are that learning occurs 38-70% faster than with classroom instruction, and course content is mastered 60% faster. Perhaps equally important is that when compared to with classroom instruction, interactive multimedia learning also results in better training. Studies show that participants increase understanding by more than 50%, resulting in greater learning gains. Participants also demonstrate 25 to

> 50% higher content retention, and 50 to 60% greater consistency in content understanding (Walton, 1994, p. 1).

Additionally, in a study involving high school students: "The IVD (Interactive Video Disc) student-learners earned more credits and had a higher GPA than students not in the program and the learned the material and average of 66% faster than students using traditional methods" (Walton, 1994, p. 2).

Nelson and Palumbo (1992) report:

"For example, an experiment comparing traditional, linear presentation of information with a hypermedia document of identical content resulted in significantly better recall of ideas by learners who viewed the information in a linear configuration" (p. 292).

RESEARCH AND EVALUATION ISSUES

Much of the literature in the field of multimedia is rife with speculation and opinion. The research techniques are often criticized, and thus their conclusions are suspect.

Although we find many positive studies and statistics in support of the use of new technology in higher education, there are many, for one reason or another, are not willing to blindly embrace multimedia. Some see the technology having little effect on the teaching/learning process:

"There is no evidence that computers and multimedia improve learning. Research to date has never established that using a computer or any other technology improves learning" (Lookatch, 1997, p. 110).

And that:

"There are no unique benefits from media or its attributes. Once the information content and instructional strategies are controlled for, the differences will disappear." (p. 111).

Yildiz & Atkins agree with Lookatch:

> Many of these studies have shown no significant advantages or gains from the use of new technologies. The expectations of the media designers appear not to have been realized in practice. To make matters worse, the way in which these evaluation studies have been designed and carried out has also been severely criticized. (Yildiz & Atkins, 1993, p. 133).

Richard Lookatch also takes issue with the experimental design of multimedia effectiveness studies:

> The point of this discussion on experimental design is to point out the flaw in the research on multimedia's impact on learning—flawed as much as the 'IQ' research of the 1950s. Just as those mislead souls failed to control for environmental differences, many multimedia researchers to date have also failed to control for a host of conditions that may account for the observed impact on learning. (Lookatch, 1997, p. 110)

While a good deal of research in the areas of distance learning and computer assisted instruction has been done, information regarding interactive multimedia is at present

scarce. This fact is lamented by Liedtke in her 1993 article “Multimedia Technologies for Higher Education:” "How such advanced software systems and multimedia technologies can be effectively utilized within the technology education instructional environment including high school and college/university level course work has yet to be fully researched" (Liedtke, 1993, p. 9).

> In the 1990s we seem to have learned little from the evaluation studies of the past. For example, we do not know very much about the effectiveness of different kinds of courseware design on acquisition of conceptual understanding of development of higher-order cognitive skills. Transfer of learning from multimedia simulations to the equivalent real-world referents has been explored in procedural training but not much in relation to education. (Yildiz & Atkins, 1993, p. 135).

Not only is the information scarce, there are many issues with its usefulness and accuracy. New types of evaluation must be devised to really determine effectiveness of multimedia as an instructional tool. With a completely new and untested technological infrastructure, old methods of evaluation were no longer relevant. This phenomenon began to be noticed in the late 1970s:

> …during this period there were already critics of the dominant approach to evaluation. The findings were variously described as uninterpretable, meaningless, and fruitless. Commentators began to argue for a more sophisticated approach to the design of evaluation studies and one that did justice to the uniqueness of the new media instead of reducing it to the common denominators it shared with conventional instruction. (Yildiz & Atkins, 1993, p. 134)

An article by Todd Oppenheimer (1997) entitled “The Computer Delusion” blasts the conclusions of a major study on multimedia’s effectiveness as a learning tool:

> Unfortunately, many of these studies are more anecdotal than conclusive. Some, including a giant, oft-cited meta-analysis of 254 studies, lack the necessary scientific controls to make solid conclusions possible. The circumstances are artificial and not easily repeated, results aren't statistically reliable, or, most frequently, the studies did not control for other influences, such as differences between teaching methods. (p. 47)

And also the design of the study itself:

“To be fair, educators on both sides of the computer debate acknowledge that today's tests of student achievement are shockingly crude.” (p. 48)

And that:

> The research is set up in a way to find benefits that aren't really there, Edward Miller, a former editor of the Harvard Education Letter, says: "Most knowledgeable people agree that most of the research isn't valid. It's so flawed it shouldn't even be called research. Essentially, it's just worthless.” (p. 47)

Nelson and Palumbo paraphrase an article by Raskin (1987) noting that:

“hypermedia has been heralded with mostly uncritical attention. While he does state that current implementation of hypermedia are worth pursuing, he strongly cautions that

they may fail to realize the expectations currently promised." (Nelson and Palumbo, 1992, p. 295)

There appear to be two sharply divided camps regarding multimedia use, development, and implementation in higher education.

COST/BENEFIT DEBATE

Developing multimedia for classroom use is both time-consuming and expensive. A debate exists as to whether or not multimedia is worth the investment:

> Higher education is suffering from a cost disease today, with costs increasing for the last 25 years (along with those of pharmaceuticals) at rates of 3 to 5 percent higher than inflation. Only through intelligent utilization of interactive multimedia technology can we make higher education simultaneously more productive and more efficient (Gifford, 1994, p. 36).

> …educators and decision makers at all levels need to see convincing evidence of the claimed instructional effectiveness of multimedia applications before they will make the considerable investment in hardware, courseware and teacher training that successful integration requires. (Yildiz & Atkins, 1993, p. 133).

The ivory tower of education is now subject to the same bottom line as the private sector. Solomon (1994) puts it in layman's terms:

"Unless and until multimedia can reduce the cost of higher education, I do not believe it will receive the needed investments"(p. 82).

Although there are many who agree with Gifford, not all embrace the rampant popularity of multimedia as a panacea for all of higher education's ills. There are critics who see many problems associated with its use in higher education.

The fact that multimedia is technology intensive, and therefore complex is an issue for implementation:

"Interactive multimedia is set to become one of the major business and social phenomena of the 1990s. The only factors holding back multimedia are its cost and complexity." (Wing, 1994, p. 40)

Farmer (1995) notes:

> So why isn't everyone jumping on the bandwagon? Money is one obstacle, but there are others. Systems can be incompatible, authoring programs can be confusing, cable hook-ups can seem like so much spaghetti, and memory demands can crash the computer. Much time is needed to get the pieces together (p. 30).

A prevalent idea is that multimedia development is not a legitimate "academic" activity, but rather a sideline for those who have proven that they can already do quality academic research.

"The Center for Innovative Technology at North Carolina University, for example, discourages assistant of associate professors from becoming too involved in developing multimedia materials. They suggest that only full

professors can afford to spend time in this manner" (Solomon, 1994, p. 83), and "it is a fact that in some places faculty have failed to receive tenure or a promotion because they devoted too much time to developing instructional materials and not enough time to producing quality research" (Solomon, 1994, p. 83).

TIME FACTOR

Not only is the development of multimedia expensive, it is also time consuming:

"In virtually all research institutions and large universities, faculty do not feel they have the time to devote to serious innovation in the classroom"(Solomon, 1994, p. 82).

> Even with the availability of Stackmaker (a multimedia authoring system) however, one of the greatest hurdles faced during the project was that of finding subject specialists with sufficient time and inclination to become involved in the authoring of applications. Typically academic staff may initially be enthusiastic about additional facilities available to them, it is only realistic to recognize that they may be deterred by the extra time involved. (Hutchings, 1994, p. 40)

"Professors report spending, on average, 20 hours per week to develop multimedia lectures, or 150-200 hours converting one course to multimedia"(Sammons, 1994, p. 89).

Until an atmosphere of support and reward is put in place for faculty who want to develop more complex multimedia,

the widespread use and hence evaluation may not be realized.

> Now, as more and more faculty become involved in this new delivery method, compensation strategies are needed for the amount of time and effort put into such projects. Is multimedia 'worth' as much as writing a new curriculum? How does the college negotiate fair compensation for this development when the final design is not identifiable at the projects inception? How can cost/benefit be established for a product? Where will the dollars move from for multimedia development projects? (Whitaker, 1992, 30).

TECHNOLOGICAL CHANGE

Another problem faced by anyone attempting to implement multimedia into their curricula is that of the rate of technological change. The central component to multimedia as stated before is the computer. It is this technology that allows us to build in the audio, video, 3D animation, and non-linearity that is crucial to the success of any multimedia application. Since cost is central to higher education, there is certainly concern over buying technology that will be obsolete within a few years, if not sooner. Here is an example of the change that is taking place:

> Fifteen years ago, the cornerstone of Intel's x86 CPU line, the 4.77MHz 8088, executed some 300,000 native instructions per second with 29,000 transistors. Today's Pentium does better than 100 million instructions per second with 3.3 million transistors. That's a performance leap exceeding 30,000 percent, with the transistor count climbing 11,000 percent! (Blackford, 1994, p. 182).

CONCLUSION

The complexity of the implementation of multimedia in education is daunting. The major issues that affect the implementation and use of multimedia in higher education are poor research techniques regarding effectiveness, high cost, complexity, rapid technological change, and time constraints. These serve only to further confuse the issue. These problems must be addressed as implementation of multimedia in higher education becomes more widespread, whether though perceived or real need, or economic impetus.

Chapter 3 will outline the design for the study related to determining student interest in developing a program in multimedia studies at Viterbo University.

CHAPTER 3

METHODOLOGY

The purpose of this study was to obtain information regarding student interest in a curriculum (Intro Class/Specialization/Minor) in Multimedia Studies. The methods and procedures used in this study are described in this chapter under the headings of (1) Method of Study, (2) Sample Selection,(3) Procedures Followed, and (4) Method of Analysis.

METHOD OF STUDY

The first stage of the study involved developing an instrument to measure both student knowledge of, and interest in a program in Multimedia Studies. The survey was developed with a total of eleven questions. The preliminary survey was reviewed by an expert in quantitative research and appropriately revised.

SAMPLE SELECTION

For purposes of this study, a structured random sampling technique was utilized. The survey was administered to two randomly selected classes within each of the schools at Viterbo College. They are the: School of Business, School of Fine Arts, School of Letters and Sciences, School of Education, and School of Nursing. The

surveys were distributed and collected in class, yielding a 100% return. There were a total of 167 participants.

PROCEDURES FOLLOWED

As stated above, this study consisted of a survey of eleven questions (See Appendix A). The first three questions asked the student to list their Major, Minor (if applicable), and class. The remaining eight questions were quantifiable. The following questions were asked of the selected students at Viterbo College:

1. Rate your computer skill on a scale of 1-10 with 10 being the highest.

2. Do you feel that your current level of computer skill will make you competitive with others in your field?

3. Does Viterbo College provide adequate courses for you to improve your computer skills?

4. How important will it be in your job for you to be able to utilize or produce multimedia materials for education, training, presentations, or information distribution (i.e. marketing, advertising, kiosks)?

5. Would an introductory course dealing with aspects of multimedia (such as multimedia presentation programs, video, graphics) be valuable to you?

6. Would you take in Introduction to Multimedia course if it were offered?

7. Would it be valuable for you to possess a Specialization/Minor in Multimedia Studies?

8. Would you elect for a Specialization (15cr.)/Minor (20-25cr.)in Multimedia Studies if it were offered?

There were a total of 167 students surveyed. The information was then compiled and broken down according to all the students polled and by school.

METHOD OF ANALYSIS

Once all of the information had been obtained, the information was compiled and analyzed. Mean and standard deviation were derived from this data. Questions 4,5, and 7 were to be answered on a five point Likert scale, ranging from 1 (Not Important) to 5 (Extremely Important). Question 3 asked the student select from a range from 1-10. Questions 5,6, and 9 were “yes” or “no” questions. The final question asked the student to select a program option of “Specialization,” “Minor,” or “Neither.” The results of this survey will be reported in the succeeding chapter.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter will report the results of the multimedia questionnaire distributed Viterbo University undergraduate students as outlined in Chapter 3: Methodology.

RESULTS OF THE SURVEY

As stated in Chapter 3 (Method of Study) a survey related to various aspects of multimedia was developed and distributed to Viterbo University undergraduate students. Two classes from each school were chosen at random. The survey addressed eight questions designed to assess various needs and competencies (see Appendix A). The results are categorized by total, and by school. As stated above all surveys were returned for a response rate of 100%.

Question 1

Question 1 is a self-assessment of each student's computer skill on a scale of 1-10, with 10 being most proficient.

1. Rate your computer skill on a scale of 1-10 with 10 being the highest.

School	Mean	STDEV
School of Business	5.88	2.28
School of Education	5.81	1.51
School of Fine Art	5.53	2.11
School of Letters and Sciences	6.18	2.12
School of Nursing	5.50	1.51
Total	5.85	1.88

Figure 4-1

The mean response for all of the respondents (n=167) was 5.85, with a standard deviation of 1.88. The students in the School of Letters and Science (n=44) reported the highest level of computer skill with a mean of 6.18, but with the second highest standard deviation of 2.12. The School of Business (n=17) was the second highest at 5.88, but with the highest standard deviation at 2.28. The School of Fine Arts (n=29), School of Nursing (n=19), and School of Education (n=50) come in last at 5.53, 5.50, and 5.81 respectively, all very close to the university-wide average. The School of Nursing and School of Education come with the lowest standard deviation, both at 1.51.

Question 2

Question 2 asks the students to evaluate their own computer skill in comparison to their peers.

2. Do you feel that your current level of computer skill will make you competitive with others in your field?

School	Yes	No
School of Business	10	7
School of Education	26	24
School of Fine Art	12	17
School of Letters and Sciences	23	21
School of Nursing	8	11
Total	80	81

Figure 4-2

University-wide, only 49.7% (80 out of 161) of the students believe they will be competitive with others in their field with their current level of computer skill. The breakdown by school is very similar. The students most confident int their abilities came from the School of Business at 58% (10 of 17), followed by the Schools of Education (26 of 50) and Letters and Science (23 of 44) each at 52%, the School of Nursing at 42% (8 of 19), and the School of Fine Arts at 41% (12 of 29).

The reason the School of Business and the School of Education may be at the top, is that both require basic computer courses as part of their curricula. Students in the School of Business are required to take MCIS 102 - Computer Literacy, and Education students are required to take EDU 250 - Microcomputers in Education, and EDU 334 – Educational Media. Although students in the other schools

have the option to take classes in computer-related or computer-intensive fields, they are not required.

Question 3

Question 3 asked the students if they felt that Viterbo University's current curricula offered sufficient computer courses to aid students in acquiring computer skills:

3. Does Viterbo provide adequate courses to help you improve your computer skills?

School	Yes	No
School of Business	6	8
School of Education	22	21
School of Fine Art	31	16
School of Letters and Sciences	30	17
School of Nursing	4	10
Total	75	72

Figure 4-3

The results of this question were the most varied. The school as a whole reported that 48.9% of all students do not believe that there are sufficient computer courses in the curricula.

The School of Fine Arts students were most satisfied with the current offerings, with 34.0% reporting dissatisfaction. The next lowest was the School of Letters and Science with 36.1% unsatisfied. Then the rating

increases quite a bit. The School of Education students report a 48.8% dissatisfaction rate. The School of Business comes in next at 57.1%, and the School of Nursing students are most dissatisfied with 71.4% of students believing that the current course offerings are inadequate.

Question 4

Question 4 asks the student to make a prediction based on their field of study, as to how important it would be for them to use and develop multimedia materials in their careers after college. The question was on a five point Likert scale from "Not Important" through "Extremely Important." It reads:

4. How important will it be for you to be able to utilize or produce multimedia materials for education, training, presentations, or information distribution (i.e. marketing, advertising, kiosks)?

School	**Mean**	**STDEV**
School of Business	4.13	0.81
School of Education	3.54	0.97
School of Fine Art	3.68	0.94
School of Letters and Sciences	3.69	1.01
School of Nursing	3	1.21
Total	3.61	1.01

Figure 4-4

The mean response for this question for all students polled was 3.61, with a standard deviation of 1.01. This response

falls between “Important” and “Very Important” on the scale provided. This means that the students believe that it will indeed be important to have these skills.

The School of Business indicated a mean score of 4.13 with the smallest deviation of the schools at 0.81. This is the only group that ranks the ability to utilize or produce multimedia materials between “Very Important” and “Extremely Important.”

The School of Letters and Sciences mean score was 3.69, with a standard deviation of 1.01. The School of Fine Arts was similar at 3.67 with a slightly smaller standard deviation at 0.94. The School of Education’s mean score was 3.54 with a standard deviation of 0.97. The students who feel that the ability to utilize or produce multimedia materials were from the School of Nursing, whose mean score was 3.00, with the highest standard deviation of 1.21. That result puts them in the “Important” category on the scale provided.

Question 5

Question 5 assesses student interest in a basic course in multimedia:

5. Would an introductory course dealing with aspects of multimedia (such as multimedia presentation programs, video, graphics) be valuable to you?

School	Mean	STDEV
School of Business	3.56	1.09
School of Education	3.21	1.17
School of Fine Art	3.52	1.08
School of Letters and Sciences	3.04	1.15
School of Nursing	2.57	1.12
Total	3.17	1.16

Figure 4-5

As a whole, all respondents felt that an Intro to Multimedia course would be beneficial. The mean result was 3.17 with a standard deviation of 1.16. This result falls into the category just above "Valuable" on the five point Likert scale provided. The students most interested were the School of Business, with a score of 3.56 with a standard deviation of 1.09, and the School of Fine Arts, with a mean score of 3.52 and a standard deviation of 1.08. This puts those respondents in the category between "Valuable" and "Very Valuable." Three respondents answered "Unsure."

The School of Education mean score was 3.21 with a standard deviation of 1.17, followed by the School of Letters and Sciences whose score was 3.04 with a standard deviation of 1.15, ranking the class as just above "Valuable." The School of Nursing students were least interested in the class, scoring 2.57 with a standard deviation of 1.12. There is a slight discrepancy here between the number of

students who believe that it will be important for them to be able to utilize multimedia (3.00, see Question 4), and the number of students who think such a class would be valuable.

Question 6

Question 6 asks if the student would opt to take an introductory course in multimedia if it were available.

6. Would you take an Introduction to Multimedia course if it were offered?

School	**YES**	**NO**
School of Business	11	5
School of Education	29	17
School of Fine Art	34	14
School of Letters and Science	5	23
School of Nursing	7	10
Total	107	49

Figure 4-6

Of Viterbo University students polled, 107 of 167 (64%) would opt to take an Intro to Multimedia course if it were available. The School of Fine Arts had the highest percentage of students interested, 23 out of 28 for 80.1%. The next highest was the School of Letters and Sciences with 34 out of 48 (70.8%) willing to take the class. Next was the School of Business at 68% (11 of 16), the School of

Education at 63% (29 of 56), and finally the School of Nursing at 58.8% (7 of 17).

Question 7

Question 7 asked the students if they thought it would be valuable for them to possess a specialization or minor in Multimedia. Their responses were available from a five point Likert scale from "Not Valuable" to "Extremely Valuable."

7. Would it be valuable for you to possess a Specialization/Minor in Multimedia Studies.

School	Mean	STDEV
School of Business	2.85	1.16
School of Education	2.06	1.14
School of Fine Art	2.39	1.24
School of Letters and Science	2.30	1.15
School of Nursing	1.66	0.68
Total	2.22	1.11

Figure 4-7

According to all respondents, the value to them of taking either a specialization or minor in multimedia studies was 2.22, placing the value between "Somewhat Valuable" and "Valuable." The standard deviation was 1.11 for all respondents.

The students most interested in a minor/specialization are the School of Business students, whose mean score was 2.85 with a standard deviation of 1.16. This puts them in just

below “Valuable” on the scale. The School of Fine Arts’ score was 2.39 with a standard deviation of 1.20, with a standard deviation of 1.24, the School of Letters and Sciences comes next with 2.30 and a standard deviation of 1.15. The School of Education is second to last in interest with a mean score of 2.06 and a standard deviation of 1.14. The students with the least interest, as in Question 6, are the Nursing students, whose mean score was 2.57, and the lowest standard deviation of .068.

A possible explanation for this is that Education and Nursing students have the fullest curricula and the least flexibility in scheduling electives. Education students expressed interest in the program, but a minor in multimedia studies would not be certifiable from the Department of Public Instruction who have strict guidelines for what minors they will allow their students to have. Comments such as: “I have no room in my schedule.” “Is this certified by DPI?” “I would take this but I can’t” occurred frequently. This would certainly discourage students from taking an additional 12-18 credits for a specialization or minor that is strictly elective. As mentioned above, a minor is not required at Viterbo. As a result, many programs use these normally available credits to fill out their majors.

Question 8

Question 8 asks the student if they would pursue a specialization/minor in multimedia studies if it were available:

8. Would you elect for a Specialization (15 cr.)/Minor (20-25 cr.) in Multimedia Studies if it were offered?

School	Specialization	Minor	Neither
School of Business	4	8	5
School of Education	14	8	28
School of Fine Art	9	6	14
School of Letters and Science	12	12	25
School of Nursing	1	2	15
Total	40	36	89

Figure 4-8

Although the perceived value of a program in multimedia studies was only 2.22, just above "Somewhat Important," of 167 total students polled, over 46% of students would take either a specialization or minor in that area.

The School of Business results showed that 70.6% of students would take the program--4 specializations and 8 minors. Despite the program not being certified by the Department of Public Instruction, 44% of the students surveyed in the School of Education would take one program or the other. 14 students would take a specialization and 8 would minor. In the School of Letters and Sciences, 54% of the students (24 of 44) would take the

specialization/minor, 12 in each category. In the School of Fine Arts, 31% would take a specialization (9), and 20% (6) would minor. Again the School of Nursing comes in last with 1 specialization and 2 minors out of 19.

SUMMARY

There appears to be some student interest in moving forward in the development of a multimedia curriculum at Viterbo University. Certainly if only 50% of students believe there are adequate computer course offerings, that number could be increased. Most students believe that it would be important to be able to utilize or produce multimedia materials in their future jobs. Most felt that it would be valuable for them to take an introductory class in multimedia, and 64% would do so if it were available. And although students reported that it would be only "somewhat valuable" to "valuable" for them to possess a minor or specialization in multimedia, 46% reported that they would do one or the other if a program was available.

The final chapter will analyze the data from the above chapters and make some recommendations based on that data.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine if there was sufficient interest and justification to start a program in multimedia studies at Viterbo University. Through the course of this study, many issues regarding multimedia's use, implementation, and especially evaluation presented themselves.

First, what is multimedia? More than one media? A slide show with music? Those definitions are really quite superficial. Specifically, it must include the computer as its central component. The computer gives multimedia it's most important attribute—non-linearity. Not just non-linearity, but nearly seamless non-linearity. In reality, a book is non-linear, you can turn to any chapter at any time. A VCR tape is non-linear. You can fast-forward or rewind to any spot at any time. Even a CAV videodisc is non-linear. But accessing these different areas takes a long time compared to the nearly instantaneous access of the computer. Second, multimedia must be all digital. Interfacing with clunky devices such as VCRs and laserdisc players (both analog devices) is a thing of the past. Digital video and audio now pervade the industry, and within a few years, analog will be gone for good. The

increasing bandwidth of the internet allows for more and more types of media to be delivered, all in digital format. Students of multimedia must be familiar with the specialized issues of digital media as they move into the fields of web design, graphic design, video and audio production. Multimedia is here to stay. While education may be slow to adopt the technology of multimedia, private industry is not. Students unprepared for a digital workplace are going to be significantly behind their peers.

Secondly, does multimedia really improve education? At this point, that seems undetermined. Shelton and Walton say "yes," Lookatch and Oppenheimer say "no." To date, studies have been poorly designed, the evaluation techniques, and thus their conclusions have come under great scrutiny and criticism. Clearly more studies must be done with more variables accounted for than just the technology factor. The potential of multimedia is great. At the very least, for the present, multimedia does not seem to hurt the teaching/learning process.

IMPLEMENTATION IN HIGHER EDUCATION

This study sought to answer the following questions:

1. Do the students at Viterbo University view multimedia skills as an important part of their future jobs?

2. Is there sufficient student interest in an Intro to Multimedia course offered as General Education credit?

3. Is there sufficient interest in a Specialization in Multimedia Studies at Viterbo University?

4. Is there sufficient student interest in a Minor in Multimedia Studies at Viterbo University?

The results of the survey conducted for this study indicate some student interest in going ahead with the development of a program related to multimedia. Students responded that multimedia skills would rank between "important" and "very important" in their future careers. 51% indicated that more computer-related courses could be provided and 46% of students were interested in taking some sort of program whether a minor or specialization.

Offering a course for General Education credit proves to be a more complicated issue. To qualify as a general education course, a General Education Course Approval Form must be filled out and signed by the department chair followed by the school dean. If approved by these parties, the proposal must be taken before the Faculty Assembly and ratified by that body. Students must take 45 credits limited to the following subject areas:

Composition (ENG 103 & 104) ..... 6 semester hours
Religious Studies ..... 6 semester hours
Philosophy ..... 3 semester hours
History ..... 3 semester hours

Fine Arts (Two areas)	4 semester hours
Literature	3 semester hours
Natural Science	4 semester hours
Social Science	3 semester hours
Liberal Studies Electives	13 semester hours
Total General Studies	**45 semester hours**

Note that there is no technology area or requirement. Multimedia clearly falls under that category. There is currently a limit to the number of total credits that can comprise General Education of 143. Until the curriculum committee agrees to expand the number of categories of General Education courses, multimedia will be excluded from this opportunity.

However student interest cannot be the only factor in determining whether or not to proceed. Before implementing any program in multimedia, an institution should undergo a thorough study of what technology and how to use it. In an era when processing power doubles every year and hard drive density doubles every six months, the cost of getting and maintaining the technology alone is an expensive proposition. Throwing money at a perceived problem is dangerous, and potentially disastrous. Multimedia costs money, time, and resources. While a cost benefit analysis is important, there exists a great deal of technological determinism and peer pressure between institutions to draw students. Lap top colleges, more computer lab access, and

better facilities are all selling points in today's race to attract students. As a curriculum is designed, a periodic replacement strategy will have to be adopted to make sure that facilities exist that are sufficiently up to date to allow for state-of-the-art multimedia development.

CURRICULUM DEVELOPMENT

As a curriculum is developed, considerable emphasis must be on the proper implementation of the technology. While technical skills are important, learning ways to utilize the positive aspects of multimedia are equally, if not more important. So called "Talking heads" and "electronic page turners" are not effective uses of multimedia. Only by taking advantage of random access and the digital component of multimedia can instruction be improved. Trotter (1993), in "Planning for Multimedia" notes that "educational multimedia programs, like textbooks, are valuable if done well. But most things in this medium are not done well"(p. 18). By emphasizing instructional design and appropriate evaluation techniques, students will be better prepared to produce materials that can be proven to have a positive effect on the teaching/learning process.

The DACUM (Developing A CurriculUM) Task/Required Skill Set Definition develops a list of skills that

students should have in order to be classified as a multimedia specialist/producer. Any program should keep these qualifications in mind as a program is developed, to insure that students are adequately trained to do their job according to industry standards. (See Appendix B) This DACUM Task/Required Skill Set Definition was obtained from the Association for Applied Interactive Multimedia (www.aaim.org).

The DACUM process was developed and refined in the 1970s as a quick, low cost way to develop task lists using a structured interview process with a committee of incumbent workers. The DACUM process is the first step in designing an academic curriculum or training program that is based on the reality of the workplace. It enables a team of curriculum designers and program developers to design a new program quickly and cost-effectively, resulting in a program that is responsive to changing technology and job restructuring.

Note that much of the emphasis under Part A: Design Programs is on the instructional design process, task analysis, and evaluation to make sure that the end product meets its educational goals. To this end, it would be prudent to include courses that focus on instructional design and the special considerations that present

themselves when working in this new non-linear digital medium.

In summation, multimedia has great potential. While the debate rages over implementation, effectiveness, and evaluation, the problems inherent to the medium will be exposed, and through this interchange, ultimately solved.

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Appendix A:
Multimedia Interest Survey

Multimedia Interest Survey

This survey is designed to assess student interest in a **Multimedia Studies** program at Viterbo University. This will help to assess how important it is that you as Viterbo graduates be able to understand, evaluate, manipulate, and produce multimedia. As you fill out this survey, keep in mind the definition of multimedia below:

Multimedia: The integration of text, video and audio, animation and graphics, through a computer for education, training, or presentation.

What is your Major? _____ Minor (if applicable) _____

What year are you in school? (circle one)
Freshman Sophomore Junior Senior Graduate

Rate your computer skill on a scale of 1-10 with 10 being the highest. _____

Do you feel that your current level of computer skill will make you competitive with others in your field? ____ Yes ____ No

Does Viterbo provide adequate courses to help you improve your computer skills?
____ Yes ____ No

How important will it be in your job for you to be able to ***utilize or produce*** multimedia materials for education, training, presentations, or information distribution (i.e. marketing, advertising, kiosks)?

____ Not Important ____ Somewhat Important ____ Important
____ Very Important ____ Extremely Important ____ Unsure

Would an introductory course dealing with aspects of multimedia (such as multimedia presentation programs, video, graphics) be valuable to you?

____ Not Valuable ____ Somewhat Valuable ____ Valuable
____ Very Valuable ____ Extremely Valuable ____ Unsure

Would you take an Introduction to Multimedia Course if it were offered? ____ Yes ____ No

Would it be valuable for you to possess Specialization/Minor in Multimedia Studies?

____ Not Valuable ____ Somewhat Valuable ____ Valuable
____ Very Valuable ____ Extremely Valuable

Would you elect for a Specialization (15 cr.)/Minor (20-25 cr.) in Multimedia Studies if it were offered?

____ Specialization ____ Minor _____ Neither

Please see the reverse side for information regarding your participation in this survey and include any comments on the back of this form.

Appendix B:
DACUM Task Required Skill Set

The Multimedia Specialist
Task/Required Skill Set Definition

Revised July 28,1993

Sponsored by:

AAIM

The Association for Applied Interactive Multimedia

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NOTE: The tasks/skill set definition presented in this array have been judged to be most appropriate for either or both Technicians or Professionals. Technician-level tasks/skills are indicated by (I), and the Professional-level tasks/skills are indicated by (II). Those judged appropriate for both are identified by (I and II).

No specific sequencing of tasks or events is intended by this presentation, and none should be inferred.

Multimedia Specialist: The multimedia specialist designs and/or produces communications media(still, motion, audio, graphic, and text images) in a computer-based environment for use in a presentation or interactive mode.

Competencies **Supporting Skills**

A. Design Programs

A-1 Incorporate communication and design theory (II)
A-2 Use communication/instructional design principles (II)
A-3 Identify target audience (II)
A-4 Identify with content specialist to determine instructional objectives and content (II)
A-5 Determine how to achieve instructional and production goals and objectives (II)
A-6 Adapt program design to intended audience (II)
A-7 Develop script and storyboard from content (II)
A-8 Develop graphic design (I)

B. Produce Media Elements

B-1 Produce audio (I and II)
B-2 Produce still images (I,II)
B-3 Produce motion sequences (I,II)
B-4 Produce animation (I,II)
B-5 Produce text images (I,II)
B-6 Produce database (I,II)

C. Author Programs

C-1 Develop flowchart (I,II)
C-2 Select (II) and/or use (I) authoring software
C-3 Integrate media elements (I,II)
C-4 Conduct user evaluation of content and design (II)
C-5 Conduct systems assurance/ beta testing (I,II)
C-6 Prepare technical documentation (I,II)

D. Implement and Utilize Programs

D-1 prepare delivery/ distribution options (II)
D-2 Design presentation facility (II)
D-3 Develop user manual/ tutorial (II)
D-4 Develop user training (II)
D-5 Provide user support (I,II)
D-6 Provide manager support (I,II)

E. Conduct Evaluation

E-1 Conduct formative evaluation (II)
E-2 Conduct summative evaluation (II)
E-3 Make revisions as necessary (II)

F. Configure and Operate Systems

F-1 Select (II), operate (I,II), adapt (I,II) operating systems
F-2 Select (II), install (I,II) and use (I,II) operating systems
F-3 Integrate peripherals and cards (I,II)
F-4 Troubleshoot problems (I,II)

G. Utilize Networks

G-1 Integrate multimedia into networks (II)
G-2 Communicate with networks (terrestrial, microwave, satellite) (I,II)
G-3 Work cooperatively with network manager (I,II)
G-4 Integrate e-mail, listserv and other communications options as appropriate (II)

H. Posses Appropriate Personal Attributes

H-1 Practice good problem-solving techniques (I,II)
H-2 Give and receive constructive criticism (I,II)
H-3 Practice time management (I,II)
H-4 Demonstrate organization skills (I,II)
H-5 Display originality and creativity (I,II)
H-6 Work effectively in a team setting (I,II)
H-7 Demonstrate self-motivation (I,II)

I. Communicate Effectively

I-1 Practice good listening skills (I,II)
I-2 Communicate clearly (I,II)
I-3 use technical writing skills (I,II)
I-4 Communicate on appropriate level (I,II)
I-5 Negotiate effectively with other team members (I,II)

J. Related Knowledge

J-1 Applications software (I,II)
J-2 Educational uses of networks (II)
J-3 Keep abreast of emerging technologies (I,II)
J-4 Project planning/ grant writing (II)
J-5 Budget development/ management (II)

K. Continuing Responsibilities

K-1 Maintain professional memberships (I,II)
K-2 Participate in professional development activities (I,II)
K-3 Share information through presentations/ publications (II)
K-4 develop multimedia products (I,II)

The competencies and supporting skills for Multimedia Specialist were identified by **DACUM** panel through a Structured Group Interview process on April 19, 1993 and validated at the AAIM Conference on July 28, 1993. This **DACUM** panel (or committee) was comprised of individuals who develop multimedia presentations and interactive multimedia presentations and interactive multimedia training programs.

This **DACUM** was sponsored by the Association for Applied Interactive Multimedia, AAIM and Co-sponsored by IBM Corporation and Apple computers.

The DACUM Process

Background:
In the 1970's **DACUM** (D_eveloping_A_C_urricul_UM) was researched and refined as a quick, low cost way to develop task lists using structured interview process with a committee of incumbent workers.

DACUM is based on the philosophy that:

1. Expert workers are better able to describe/ define their occupations than anyone else;
2. Any job can be effectively and sufficiently described in terms of the tasks successful workers in that occupation perform; and

3. All tasks have direct implications for the knowledge and attitudes that workers must have in order to perform the tasks correctly.

The **DACUM** process is the first step in designing an academic curriculum or training program that is based on the reality of the workplace. It enables a team of curriculum designers and program developers to design a new program quickly and cost-effectively, resulting in a program that is responsive to changing technology and job restructuring.

What is the DACUM Process?

DACUM is a structured Group Interview which is highly refined to accomplish occupational analysis resulting in a validated task list. The principles used in the Structured Group Interview technique are also successfully used to verify task lists.

A trained facilitator guides the process. This facilitator is skilled in competency based curriculum development and in group processing. The facilitator works with a **DACUM** Committee to develop the **DACUM Chart**.

Specific group processing techniques are used to ensure the participation of each of the carefully selected committee members. Duty areas, also called general areas of competence are identified first. Tasks are then identified for each duty area. Duty areas and tasks may include only psychomotor skills, or may include identification of cognitive and affective skills, depending on the occupation being described.

DACUM committees of 6-10 incumbent workers are carefully screened and selected to participate in the **DACUM** process which could take from 2-3 days.

The result of identifying and sequencing the tasks is a completed **DACUM** chart which becomes the basis of the training program. Annual reviews are recommended and revisions should take place at least every three years.