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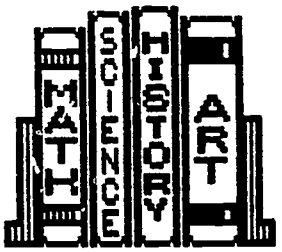
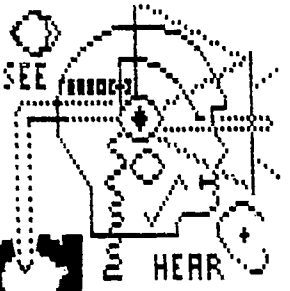
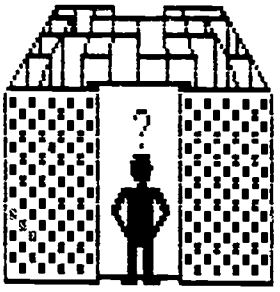
ABSTRACT

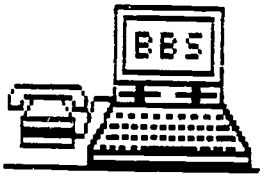
This paper builds a case for the use of multimedia to meet students' varied learning needs instead of relying solely on the traditional lecture/textbook/workbook approach. Piaget's theory of intellectual development is used as background for a discussion of developing teaching strategies based on individual learning styles, and various theories of learning and learning preferences are considered. The use of a learning preference survey with three mathematics classes is described to demonstrate how the survey can be used to plan teaching approaches. Increasing uses of various types of multimedia technologies in K-12 classrooms are briefly reviewed and laserdisc technology is described as one option for meeting varied learning needs. A review of some of the literature on the advantages of multimedia in teaching and learning concludes the case for multimedia as a means of systematically incorporating individual learning approaches into the classroom. An example of a student learning style inventory and a guide to interactive instructional technology programs at colleges and universities are appended. (Contains 30 references.) (KRN)

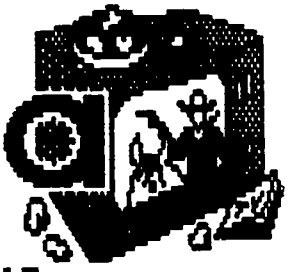




Meeting Learning Needs Through Multimedia







Meeting Learning Needs Through Multimedia:

A Look at the Way Modern Technology Can Help Classroom Teachers Meet the Varied Instructional Needs of Students.

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May 25, 1992

MEETING LEARNING NEEDS THROUGH MULTIMEDIA

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Introduction

Imagine having a classroom of students watch the bombing of London or actually being able to see the first moon landing. These two teaching opportunities and many more are all possible with the technology available to teachers today. We do not have to wait to share these events in our classes. It is possible now, not just anticipated for some time in the future. By incorporating computer authoring programs and various other forms of multimedia technology, such as laser discs, CD-ROM, or video tape, topics come alive for students, either as the audiences for them or as their creators.

This paper asserts that students' varied learning needs can be more successfully met when using a multimedia approach to teaching than when relying solely on traditional lecture/ textbook/ workbook approaches to teaching. The scenarios described above are just two examples of the many ways that multimedia can be incorporated into regular class presentations.

This modern technology enables students to capture photographs, from stills or from video tapes, taken by the student or obtained from other sources, digitize these images, and then incorporate them into a report they have researched and created using a computer authoring package. Students as young as first grade have successfully created multimedia reports to share with their friends (McMillian, 1991-92, p.17). While researching these projects, the students must use all of the learning modes to gather the needed information, and then they

must engage in higher level thinking and decision-making to create their project. With these types of learning activities, the teacher becomes a facilitator of education and learning rather than a presenter. The students and the teachers both become actively engaged in the learning process.

Different People Make Use of Different Approaches to Learning

Piaget's Theory of Intellectual Development

Jean Piaget (Wadsworth,1971), the Swiss researcher, spent most of his life refining his research into the physical and intellectual developmental levels in children. The primary contribution that this research has made to education has been the formation of the theory of the stages of development each individual goes through on their way to intellectual maturity. These stages can be summarized in the following manner:

1. Sensorimotor - birth to 2 years
2. Preoperational - 2 years to 7 years
3. Concrete operational - 7 years to 11 years
4. Formal operational (or abstract) - 11 years and up

The ages at which these stages occur are merely averages, giving some indication of the general progression in which these developments occur. While the actual age of occurrence may vary from child to child, the order in which they progress does not. It is impossible for a student to operate at the formal operational, or abstract stage before he/she has mastered the skills and processes of the concrete operational stage. The influences that environment and upbringing, and this includes inherited traits, have on the student play a significant part in how rapidly, or how slowly, that student masters each successive intellectual stage.

During the second stage of development, the preoperational stage according to Piaget, a child begins to form the intellectual habits which he will carry with him throughout the

rest of his life. Although this is not a developmental stage with which secondary or post-secondary education usually deals, how well the child comes through this stage will play a significant role in his/her later intellectual development. The concrete operational stage usually begins at age 7, and it is during this stage that a child shows the most improvement in language skills, vocabulary development, and begins to deal successfully with numerical concepts. At this stage of development students are still working with concrete ideas, that is ideas which can be demonstrated with physical objects. They have not yet developed the ability to reason "abstractly". Students might still be "in" this stage as late as secondary or post- secondary school if their past educational experiences have not helped them progress beyond the concrete stage to the formal operational or abstract stage. Students who have not successfully mastered the third stage of development and who are "stuck" at this level will not be able to master some of the advanced courses offered by the high schools and post-secondary schools.

Between the ages of 11 and 15 most children begin to develop the ability to solve concrete and abstract problems through logical operations. It is during this period that the child's cognitive structure reaches maturity, although there is no set definite age at which this is achieved. Each individual reaches this stage of development at different periods depending on his/her own experiences and rate of cognitive growth. When

this stage is mastered there are no further significant structural changes in the cognitive thinking patterns. Not all of the students who are admitted to post- secondary education have fully mastered this final stage in cognitive development. While the structures of intelligence do not significantly alter after this period, the content and scope of the students' intelligence may increase. The basic structure, or thinking style, is already set. However continued exposure to increasingly difficult problems will improve the ability of the student to exercise this potential. The content and function of thinking is free to vary and improve throughout life giving the adult a more mature outlook and thinking pattern than that of the adolescence, simply because there are more experiences backing up the adult's perspective.

At this point one may wonder how formal operations (abstract thinking) differ from concrete operations. Both of these levels employ logical operations, but the major difference between the two types of thinking is the larger range of applications available to an individual who has reached the formal operations, or abstract, stage. The concrete level of operations is limited to solving tangible problems situated in the present. Students still at this third stage lack the ability to extrapolate from the past and into the future, and lack the ability to fully comprehend problems that are conceptual rather than concrete in nature. A student still at the concrete level cannot successfully deal with complex verbal

problems or with hypothetical problems both in the present and in the future. By the same token, a student who has reached the abstract, formal, operations stage can begin to deal with all of these types of problems. Because of that, a student who has reached the abstract stage of cognitive development is liberated from dependence on the content of problems. A student at this final stage of development can employ theories to solve problems in an integrated manner. In fact, this student can bring several operations to bear on a single problem and is not as limited as one who is still in the concrete development stage. Some of the types of reasoning that students are able to accomplish when they have reached the formal, or abstract, reasoning stage are scientific reasoning, hypothesis building and hypothesis testing, and the ability to reflect a true understanding of causes. During this final stage the student begins to learn to operate within the logic of a problem independent of its content. The abstract thinker evolves out of concrete thought in the same way that each new level of thought incorporates the processes of the previous level. A student who has reached the abstract thinking stage is better able to organize data, reason logically, and generate hypothesis. These characteristics are present in the types of problems that are easily solved using abstract reasoning, but are impossible to solve using only concrete reasoning. Some examples of this type of problem might include combinational thought, complex verbal problems, hypothetical problems, proportions, and conservation

of movement problems.

In education certain courses must be postponed until a student has successfully reached the abstract level of cognitive development. A particularly obvious example of this in the field of mathematics is the algebra sequence of courses found at the secondary level. There are some students at this age, 14 to 15, who have not yet reached the abstract cognitive level and they find it impossible to successfully complete this sequence of courses. Frequently, when they repeat the course a year or two later they find they have no difficulty with the reasoning processes required. Their success was not as much a function of their study habits and concern as it was of the stage of cognitive development they had then reached.

Developing Teaching Strategies Based on Individual Learning Styles

An extremely important step when preparing to teach is to recognize the different intellectual levels and learning needs of the learner(s), whether it is an entire class, a small group of students, or a single student. When preparing materials for whatever audience, it is important to identify the characteristics of the learner(s), for it is these characteristics that will influence the selection of instructional materials and activities to be used (Turner,1985, p.99). One of the first learner characteristic to determine is the cognitive stage of development the students have achieved. A second step is to determine the learning style preferences of those same students.

Cross, in 1976 stated that people see and make sense of their world in different ways. They pay attention to different aspect of their environment, they solve problems in a different manner, they relate to others in distinctive patterns, and they process information in consistent, but unique ways. Learning style, asserts this author, has many influences on personality and behavior, on perception, memory, problems solving, interests and even social behavior and self-concepts. These assertions are as true today as they were in 1976.

One of the primary tasks faced by educators is taking this fact into consideration when planning learning activities and instructional materials. It has only been in the last 30 years that there have been tests developed to help determine the ways

in which people differ in their learning styles. According to Dunn and Dunn (1978) learners are affected by:

1 -- their immediate environment (sound, light, temperature, and design);
2 -- their own emotionalism (motivation, persistence, responsibility, and need for structure or flexibility);
3 -- sociological needs (self, peers, teams, adult, varied);
4 -- physical needs (perception, strengths, intake, time and mobility).(p.6)

Is it possible for teachers to take each of these factors into consideration when planning their class activities so all students can make the best use of their dominate learning style? Just a few years ago the answer to this question would have been either "no" or "not without more equipment and time than the teacher has available." Today however, that is no longer the case.

Because students receive information through a combination of stimuli to one of the five senses -- seeing, hearing, speaking, smelling and doing (writing) -- accommodating these styles is critical to successful classroom experiences for all students. When learning occurs, it is through a combination of these senses. In the past it was simply "hoped" that the format in which learning was presented met the learning needs of the student to which it was presented. Unfortunately, making this connection had been hit or miss by teachers until recently. Work done by Dunn and Dunn indicates that teachers tend to teach in the style in which they prefer to learn or were taught. This study also showed that teachers prefer to work with students who exhibit the same learning style preferences they do (p.11). If

teachers tend to teach using a single learning style, those students who do not share this preference will be short changed in the classroom.

O'Keefe, in Assisting Student Learning Styles: An Overview (1982, p.44) described learning characteristics as "cognitive, affective, and physiological traits" that serve as indicators of how these learners perceive, interact and respond to a learning environment. For each learner characteristic some learners will possess it in a high degree, some in a more moderate degree, and some not at all. Because the study of learning characteristics is relatively new, there does not appear to be a great deal of consistency in the literature about how to measure and interpret them. Of the 28 instruments listed in the 1982 NASSP publication Student Learning Styles and Brain Behavior, all but three of these were developed after 1970, with six being developed between 1980 and 1982. One of the three general areas of "learner characteristics" is the physiological domain. This includes such topics as the individual's preferences in learning environments or the need for specialized adaptations for handicaps. Individual learner preferences may include such considerations as temperature of the room, brightness of the lighting, presence or absence of background noises, etc. For handicapped students, special considerations may also need to be made for deafness or the blindness. A second general characteristic is the affective domain, or motivation and interest. Learners can be motivated by any number of things.

Working in groups, alone, or with an adult, working under class supervision or independently may be motivating forces for students. The last major characteristic is that of the cognitive domain. Within this domain have been identified seven "stages" in the learning process which can be summarized by the following list.

1- Apprehending -- the learner is stimulated to select critical information from among noncritical materials presented.
2- Acquisition -- this information enters the short-term memory of the learner matched against other similar information and coded for long-term storage.
3- Retention -- the new information is stored in long-term memory along with other similar information. In Bloom's Taxonomy of Educational Objectives (1956) this stage is termed the "knowledge" stage.
4- Recall -- at a given request the learner can recall the information previously stored. Bloom calls this stage "comprehension".
5- Generalization -- the learner is able to take all similar information, analyze and synthesize this information to present a generalization. This stage is similar to the higher level thinking skills that Bloom calls analysis and synthesis.
6- Performance -- at this stage the learner is able to demonstrate that he has mastered all of the previous steps which have occurred.
7- Feedback -- the learner at this step is informed of the correctness, or incorrectness, of the performance. individual learner preferences during these stages will differ. Some learners will prefer slow-paced concrete examples and situations, while others will prefer fast-paced abstract information. This stage Bloom calls evaluation.

Another aspect of the cognitive domain is gathering information through hearing and touching. While some learners can pick out embedded information easily, others cannot. These preferences and ability characteristics are what primarily make up cognitive learning characteristics.

One of the several learning preference inventories that can be used by classroom teachers to profile their classes is the Student Learning Styles -- A Survey developed at the Murdock Teacher Center, Wichita Kansas (Project CITE, 1976). This inventory consists of 45 statements about learning which the students is asked to respond to on a 1 to 4 scale, from "least like me" (1) to "most like me"(4). Questions such as "If I need help in the subject, I will ask a classmate for help" are used on this inventory. This question is one that gauges the degree of "group learner" characteristic the students posses. After this instrument is completed by the students it is self-scored using a very simple worksheet. The scores for each of the nine areas are added. This sum is then doubled to obtained the area score. Possible scores for each area range from 10 to 40. The nine characteristics used to describe learning preferences in this inventory are:

1- visual linguistic (VL)-- prefers to see words (read) in order to learn;
2- visual numerical (VN)-- prefers to see numbers in order to learn;
3- auditory linguistic (AL)-- prefers to learn by means of the spoken word or through listening;
4- auditory numerical (AN)-- learns easily from hearing numbers and oral explanations;
5- audio-visual-kinesthetic combination (AVK)-- likes a combination of the three basic modalities - seeing, hearing and doing;
6- individual learner (IL)-- works best alone;
7- group learner (GL)-- likes learning with others;
8- oral expressive (EO)-- prefers to share knowledge by telling others or giving oral reports;
9- written expressive (EW)-- prefers to share knowledge by writing out the answers or reports.

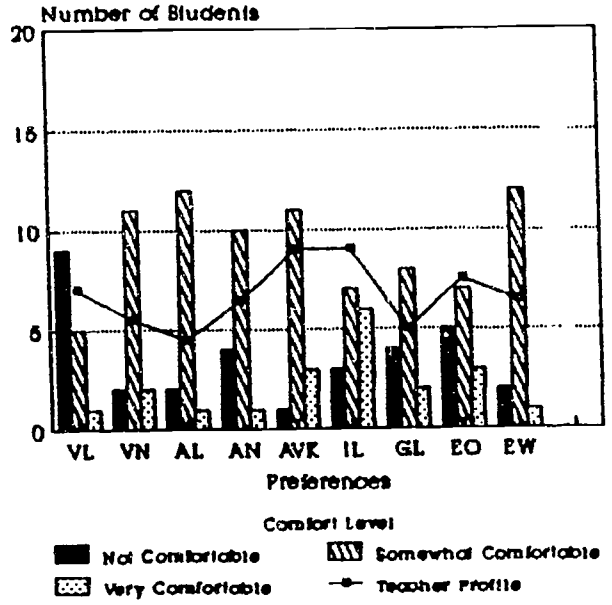
A score of 24 to 32 in any of the nine areas indicates a minor

preference for that characteristic. Scores above 32 indicate a major preference for that characteristic. Each characteristic has listed recommendations for teaching strategies that best address the characteristic. This is a simple instrument that can be quickly given by a teacher to an entire class and which will provide a class profile, as well as individual learning style profiles for each student. A microcomputer program has been developed for this instrument by Brown and Cooper (1983) which makes administration and scoring of the inventory even easier. This survey gives information on input and output preferences, but many of the non-cognitive learning characteristics are not covered.

As a part of the research for this paper, the Murdock survey was given to three mathematics classes, one in the fall of '91, one the winter '92 quarter, and the last in spring quarter of '92. Each class completed the instrument within 15 minutes and then scored them on their own in an additional 10 minutes. The instructor also took this survey and the composite graphs which appear on the following page gives the overall class profile for each of the three classes as well as the instructor's profile of learning preferences. The nine symbols across the bottom of the graph indicate the characteristic being recorded. These correspond with the list of nine characteristics found on the previous page of this paper. Some of the obvious facts that the profile for Class I shows is that:

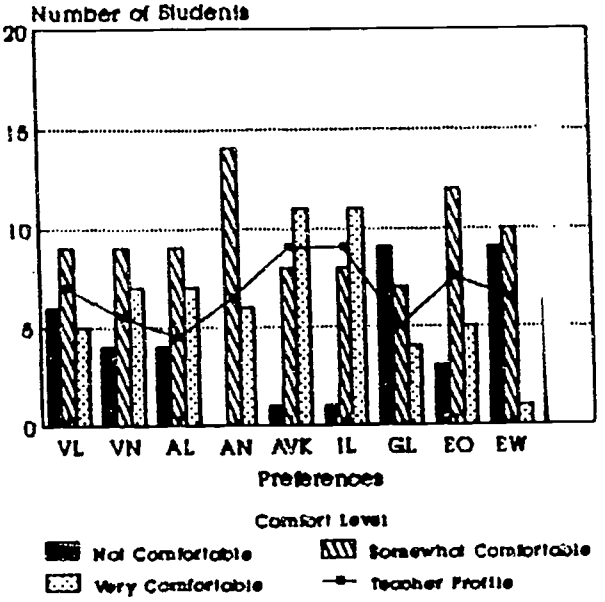
1) nine of the students in the class do not read comfortably

Learning Style Profile



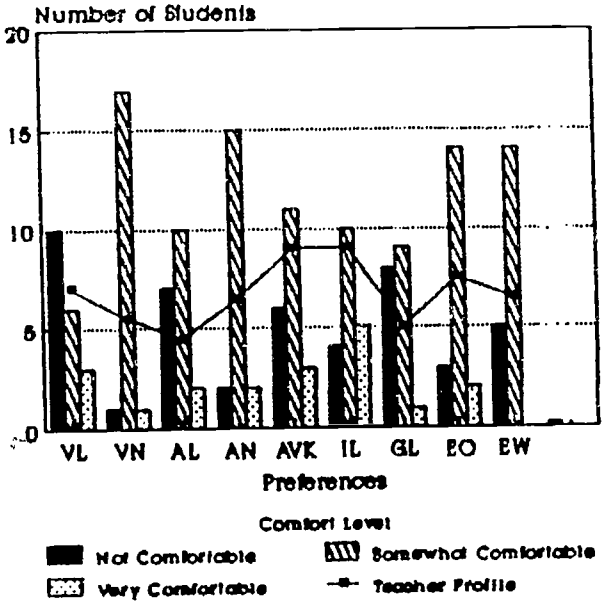
Class I

Learning Style Profile



Class II

Learning Style Profile



Class III

or well;
2) twelve of the students are comfortable writing while two are not;
3) the class seems to be equally divided between individual learners and group learners;
4) over half of the class could best be described as combination learners who respond equally well to all three presentation modes, visual, auditory and kinesthetic.

The instructor's profile, the line that cuts across the bar graph, indicates there could be a potential problem between the instructor and his class if compensation is not made for auditory input. The instructor shows a very low profile for this learning preference while the class shows a very high profile for that preference. Translated into every day language this difference in learning preferences means that the instructor needs to make sure all materials are very carefully explained and all questions completely answered.

For Class II, as can be seen in the second graph, the data from the Learning Styles inventory shows that;

1) approximately half of the class was not comfortable writing or working in small groups.
2) two-thirds of the class was fairly comfortable having auditory learning experiences with numerical concepts;
3) over half of the students were very comfortable with a multiple learning format, and;
4) an additional 8 members of the class expressed themselves as "somewhat comfortable" with this approach.

Because of these preferences, using cooperative learning techniques with this particular class might not prove effective. As with class I, the instructor should make every attempt to explain problems and solutions as completely and clearly as possible. The most important finding in the learning styles

survey for Class II is the classes' comfort with all learning formats. This indicates that new materials should be presented in as many different learning formats as possible so that students have the opportunity to experience learning with all their facilities.

With Class III, the profile indicates that over half of the students were:

1) not comfortable with reading text for new information;
2) were comfortable with lecture formats for new information, including math materials;
3) 17 of the 19 students were not comfortable, or only somewhat comfortable, with a varied media format presentation;
4) 17 of the 19 students were not comfortable, or only somewhat comfortable with small group learning.

These figures indicate that this class would not respond well to cooperative learning situations, they might find it confusing to be presented new materials in too many conflicting formats, and they seemed to find a lecture type learning situation comfortable for them. Again, as with the other two classes, the instructor needs to be sure that all materials are completely and fully explained, and the class given every opportunity to ask questions about the material they are studying. A complete copy of the survey instrument and scoring forms has been included in the appendix to this paper. *

What Is Multimedia?

"Ask and almost anyone will tell you that multimedia is the combination of video, sound, text, animation, and graphics with a computer to tie these components together" (Bruder, September 1991,p.22). This basic definition is well established. What is not so well understood is the extent of this technology's ability to help improve the teaching/learning environment for students. This point however, is one that should be of great interest to the classroom teacher.

The Media Lab at MIT plays a leading role in the continued development of new approaches to using multimedia and new media formats. From this Lab have come such innovations as holographic presentations, computer-controlled machinary, virtual reality, "talking" and voice activated computers and many, many more projects that "aim to reframe the way the individual addresses the world and the world addresses the individual" (Brand, p.15). Because communications are so fundamental to a society, when the approach to communications alters just about everything in that society alters. To most people, the term "media" has come to mean the broadcast media, or radio and television, newspapers and magazines. In its broadest definition, media refers to every way in which people communicate, or in which information is transferred from one person to another. The adoption and use of multimedia is now taking place on a world wide scale (O'Keefe, 1991, p.6). One of the primary concerns of those institutions which have begun using this new configuration is

that until now there has been a rapid obsolescence of the hardware. In most cases this happens in 3-5 years. Also, until now hardware producers have lacked unified standards for most of their products, which has, in turn, meant a duplication of effort in many areas. Until now also, there has been little or no resource sharing between one platform and another because of this lack of standardization. However, with both IBM and Apple newly committed to developing shard platforms and software, these problems are being reduced to manageable size. Software development has reached a more advanced stage than the hardware development because most new programs can now be used with more than one platform, or can easily be translated from one operating system to another.

The general application of multimedia to education has only been a significant factor in the K - 12 classroom during the last two years. Before that there were too many obstacles, making its use unlikely. The primary obstacle was cost of the hardware and software, and the incompatibility of one system with another. With the developments during the past two years, these obstacles are decreasing. One of the multimedia formats that is rapidly gaining acceptance among educators is the laser disc. This technology offers educators three classroom applications. The first is the Level I, or basic system which is composed of the laserdisc player with a monitor or TV. This system brings the advantages of laser optics into the classroom giving students access to high quality video and audio

reproduction, random access to images on the disc, and instant search potential. The system also allows for rapid searches, repeat and freeze frame use of the images. The second application, or Level II systems, includes the laserdisc player, internal manual programming capability for the player, and the TV or monitor. This system gives the operator the option to automatically pre-program the sequence of images that are shown. This system can be interrupted manually at any time. The third application, or Level III system, is the truly interactive system. This system includes the player, plus a computer with interactive software, and the TV or monitor. The player is connected to the computer via an I/O port which allows two way communication between the disc player and the computer. While this system is the most expensive, it can be built gradually to take advantage of money as it is acquired. These systems, at any level, truly represent the state-of-the-art technology in video and audio reproduction. While many educational situations can take advantage of the Level I and II systems, there is an emerging body of educators who have found that applying Level III technology to their teaching has opened new frontiers in their classrooms (T. H. E. Journal, Spring 1990,p.6). There are 10 everyday uses for this laserdisc technology that have been identified by educators. These are:

1- to provide a compact, easily accessed library of information in both video and audio format. This information can be instantly cross referenced and indexed for rapid searching. By using an auto-changer, up to as many as 72 complete discs can be searched as accessed at once to locate required information;

2- to provide lecture illustrations and support materials through the use of authoring software and a computer. This systems allows the teacher to construct the presentation of his materials beforehand and then access the required segments on the video disc as needed. With an additional barcode reader attached to the player, access to the library is even easier;

3- to develop and present pre-programmed demonstrations and programs that combine still, moving and animated images, that can access audio segments and that will allow review and reputation of individual segments easily;

4- to allow students to use these pre-programmed segments for review and study;

5- to facilitate desktop publishing by combining the Level III system with a word processing program and graphics program to create sophisticated curriculum materials;

6- to help create permanent courseware for teachers that can be transferred to video tape and even other laserdiscs. Through the use of editing software, the educator can combine the information found on many sources into one unified package;

7- to access materials that can be incorporated into quizzes and exams, thus giving the students high quality images to examine and evaluate. These tests can be given either to the whole class or to individual students;

8- to create truly interactive one-on-one instruction where the system presents the materials, asks questions and then responds according to the answers received. With the branching capability of the authoring systems, these program can become highly sophisticated and responsive teaching/learning tools;

9- to allow sophisticated and complex student projects and reports. Through the use of this technology the students can research the information they need, write the accompanying materials and choose and insert appropriate images and illustrations for their subject matter;

10- to introduce students to the complexities of computer programming through the use of authoring systems. With this approach students can learn about the function of branching, loops, and other programming features quickly and easily.

Of the 10 uses described above, there are four that relate directly to the topic of this paper, meeting the diverse learning preferences of students. When instructors use this format to develop truly interactive presentations, when these presentation can be used by the students for study, review, quizzes and exams, and when this technology allows students to choose their own methods of reporting about the information they

have learned, then this technology has addressed the individual learning styles of each student who uses the system.

How Multimedia Can Meet The Needs Of The Different Learning Styles

As has been previously discussed in this paper, students learn best from different formats, at different speeds, and with different needs. Laserdisc technology is one multimedia format that offers students the opportunity to use all of their preferred learning modes singularly or in combination. Even though a student may learn more effectively using only one learning style, he/she should still be exposed to all styles because in the "real world work place" information is transferred in all available formats, not limited to only that preferred by the student. Students must be helped to learn to gather information, process it, and use it in whatever form it is available. Those who do not learn this basic fact will find themselves at an increasing disadvantage in the work place.

Currently there is little hard research that effectively proves the ability of multimedia to enhance learning for students. Multi- media needs to be put through the cycle of experimentation, discovery and reinvention before concrete proof of its effectiveness can be shown. This technology is moving so fast that even the most aggressive users are having trouble keeping up with the rapid advances in the hardware and software. The actual extent of this technology to help educate students better is not readily understood at this time. Even though there have been no verified, lab-proven answers found to the question of effectiveness with this technology, almost everyone who has used or experienced the use of this approach will agree

that it does seem to be working. Current classroom use has out-paced research in this technology. Because of the pace of advances in this technology, educators have not been able to keep up with the uses that might be made with it. In most instances where multimedia is used, learning becomes an active process involving both the student and the teacher in the learning. Students not only use the technology to learn, but they also use it to communicate their understanding of the subject to those around him. This type of use changes the classroom structure from passive to active, with the teacher and students both becoming actively involved in the research and presentation of information. Teachers become more "facilitators of information" than "teachers" and students become actively caught up in the processing and dissemination of information themselves (Bruder, p.23)

While little laboratory research has been completed on the uses of multimedia, interviews with educators and industry spokesmen have brought to light six benefits that multimedia brings to the teaching/learning situation ("Benefits... p.22).

First, multimedia reaches all the senses, thus enhancing learning. it can be tailored to the learning styles of individuals whether that style is verbal, auditory, verbal, or physical.

Second, multimedia encourages and validates self-expression by allowing students to decide how they want to create a project, or assimilate information. With this approach teachers are telling students that it is OK to have more control and voice in your own educational process.

Third, this technology gives a sense of ownership to the user. Students are actually creating what they learn and there is

physical
evidence for this process gathered in the form of portfolios and collections of their work.

Fourth, multimedia creates an active rather than passive atmosphere for learning. It forces the students into participation, making them think about what is being presented.

Fifth, the technology fosters communication between students, and between student and teacher. It acts as a catalyst for conversation about what is being presented, or how information can be organized and presented to others.

Sixth, the use of multimedia makes a lot of sense for the teacher today. Technology is already built into the everyday life of all students, from automatic bank machines, to video games, television, and even the drive-in ordering systems at fast food places.

This technology is something that students are comfortable with, and can "relate" to easily. A last, and almost equally as important, component of multimedia is that it is fun to participate in, either as a presenter of information or as its receiver (Bruder, p.22).

Watson (1991-92), in his article on cooperative learning and computers, suggests that using computers in conjunction with cooperative learning projects is an excellent way to address the variety of student learning styles that exists in a classroom. His same arguments can be extended to the use of computers linked interactively to laserdiscs, or CD-ROM players. He points out three reasons that students working cooperatively, in pairs or threes, seem to be more effective.

1- Students working together seem to do better work.
2- Students working together appear to be more able to solve their own problems and need less direct one-on-one from the teacher.
3- Students working together seem to be on-task more of the time and have greater on-task endurance (p.5).

Studies done at the Laboratory of Comparative Human Cognition (1989) Harvard, found similar results.

> Children who work together at a computer are routinely observed to correct each other's mistakes, cooperate in the completion of assigned tasks, and discuss the assignments in ways that clarify the task, even when neither partner appears to understand it at the outset... Growing evidence suggests that collaboration at a machine reduces low-level errors and creates support for higher level activities.

Other researchers have found much the same results in their studies. Krendl and Lieberman (1988) found that working in small groups at the computer enhanced learning and in some cases improved academic achievement for the students. Webb (1984) and Fisher (1984) found that having small groups interact with a computer as well as among themselves improved group cooperation and peer collaboration. In a study done by Mevarech, Stern and Levita (1987) and in the study done by Johnson and Johnson (1985) it was found that group work involving computer use increased social interaction and peer modeling for the students, as well as bypassing social isolation of some students. All of these positive aspects of computer oriented cooperative learning help the teacher address students' individual learning styles. In "classrooms where differences among students are accepted and even appreciated... groups are able to structure themselves so that each student is challenged without being over-burdened." (Watson, 1991, p.7).

Ted McClurer, Assistant Associate Director of Instruction for the State Board for Technical and Comprehensive Education in South Carolina told a group of visiting educators recently (Fall

1991) that there had been an increasing number of grants for multimedia development and/or use during the past several years. Out of the ten grant proposals submitted this year to his State Board, five of them were for the implementation of multimedia on either a school- wide or division-wide basis. Here in South Carolina there are two K - 12 model project sites for student involvement in the use of multimedia. The Blue Ridge Project at Blue Ridge High School in Greer South Carolina uses the Macintosh platform with Hyper-Card stacks for the work their faculty and students do, while the Orangeburg District 5 Project at Orangeburg-Wilkenson High School, Orangeburg South Carolina, uses the IBM platform and LinkWays with their students and faculty. Both of these model sites began their second year of operation in the Fall of 1991. They are delighted to host guests and groups from other districts and other states.

Conclusions

Interactive technology, better known as "multimedia", is here to stay according to both Thomas Plati, coordinator of educational technologies for Shrewbury Public Schools, and David Thornburg, director of the Thornburg Center for Professional Development (Plati, 1991, p.57). Both of these experts stress the ability of multimedia formats to meet the varied instructional needs of students and contend that this ability is the primary reason that this new tool will continue to make such an impact on education. As Thornburg says, "It (multimedia) supplies both source materials and access methods that exploit the different learning modality and it facilitates cooperative learning in the classroom"(p.57). Dr. Ron Simeral, (1991) Director of the Instructional Media Center at Nicholls State University, believes that "...solutions to the daily grinding problem of keeping all students on track are varied...one is the increased integration of a variety of instructional media in class activities...(because) a variety of media approaches in teaching is necessary to make the most of the variety of learning styles among students..."

Multimedia is also getting a lot of attention and press these days among higher education professionals. According to Saldarini (1991, p.16) it is usually viewed as an additional tool of instruction. That is, it is used by professionals as an instructional format to enhance lectures and to provide students with information on a one-to-one basis or in small groups. This

can be easily done by purchasing or developing the needed materials. Self-paced multi-media applications often prove to be invaluable back-up learning experiences for students who have missed lectures or lab experiments. From a second perspective, as well as being simply an added tool of educators, multimedia is also being studied as a subject itself. There are new courses in multimedia construction and applications being implemented each year at major universities (Saldarini, p.22). These courses teach how to design good multimedia presentations for almost all subject areas. In the November/December 1991 issue of Instructional Delivery Systems, on pages 18-21, can be found a listing of 29 colleges and universities that offer "interactive instructional technology programs." Most of these are graduate degree programs, although there are a few offered at the undergraduate level. A copy of this guide has been included in the appendix.

Satin, in his recent article on improving American education (1990), makes nine suggestions which he feels will give schools a much- needed boost. These are:

1 - Deregulate teachers -- allow them to try alternative approaches with penalizing them for minor set-backs;
2 - Empower teachers -- make them part of the educational decision making machinery so that they have some control over what affects their classroom;
3 - Let kids tutor each other -- research has shown that peer tutoring improves the learning of the tutor as well as the "tutee";
4 - Use experts as co-teachers -- not just other teachers, but experts from the community or business world as well;
5 - Allow open enrollment -- let students and parents choose their own schools based on individual preferences;

6 - Diversify schools -- allow for more curricular as well as population diversity in schools;
7 - Make schools smaller -- research has shown that lower teacher/student ratios increases student learning;
8 - Practice democracy in the classroom -- again, research has shown that participants that "own" the system them are a part of function within that system more effectively, and this applies for the students as well as for adults;
9 - Acknowledge individual learning styles of students -- this is perhaps the strongest way to help all students achieve at their fullest potential.

Annette Kolodny, in her article in the Chronicle of Higher Education (1990), agrees with Satin in that schools, in this case, colleges and universities, must accept and adjust to the fact that not all students learn in the same way. If learning styles are ignored, many talented people may be barred from entry into fields in which they are needed and many students will not be offered the full learning opportunities open to them. Two other recent studies of individual learning styles show that by matching teaching strategies and learning styles, academic achievement and self-esteem can be improved for all students. O'Neil (1990) found that by adjusting to the individual learning styles of students, focus can be placed on strengths within that student rather than on their weaknesses. Perrin (1990) found the same to be true, that by adjusting teaching strategies to student learning styles, the gains in academic achievement are concrete and measurable, while the gains in self-confidence and self-esteem were immeasurable.

Even though educators have known for several decades that students learn best from their own individual styles, there has been little done about systematically incorporating this fact

into the classroom. It was just too difficult, too time consuming, and too expensive. Now however, with the interactive technology currently available, and the easy-to-use materials that have been developed to utilize this technology, teachers can, and should, incorporate multimedia into daily classroom activities. Fred D'Ignazio, president of Multimedia Classrooms, Inc, and a pioneering teacher/user of technology, asserts "the real revolution has nothing to do with technology. The real revolution is a matter of control. The teachers have to realize that they can assume a new role that is both better for them and for the student. It will be a role that passes control, along with trust, to the kids who can then participate to their fullest potential" (Bruder, p.26).

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Appendix

Student Learning Styles — A Survey

WICHITA PUBLIC SCHOOLS
MURDOCK TEACHER CENTER
670 North Edgemoor
Wichita, Kansas 67208

LEARNING STYLES ANSWER SHEET

Name_____ School_____ Grade___ Date_____

Instructions

Read each statement carefully and decide which of the four responses agrees with how you feel about the statement. Mark out the number of the response on the answer sheet.

Sample Statement

I would rather do school work in the morning than in the afternoon.

On the answer sheet, there are four possible responses ranging from "MOST LIKE ME" to "LEAST LIKE ME". Decide which response best describes the way you feel about the statement and mark out that number in the parentheses. Respond to the sample statement here by marking out the one response that best describes your feelings.

STUDENT LEARNING STYLES--A SURVEY

1. When I make things for my studies, I remember what I have learned better.

2. Written assignments are easy for me to do.

3. I learn better if someone reads a book to me than if I read silently to myself.

4. I get more done when I work alone.

5. I remember what I have read better than what I've heard.

6. When I answer questions, I can say the answer better than I can write it.

7. When I do math problems in my head, I say the numbers to myself.

8. If I need help in the subject, I will ask a classmate for help.

9. I understand a math problem that is written down better than one I hear.

10. I don't mind doing written assignments.

11. I remember things I hear better than the things I read.

12. I like to work by myself.

13. I would rather read a story, than listen to it read.

14. I would rather show and explain how a thing works than write how it works.

15. Saying the multiplication tables over and over helped me remember them better than writing them over and over.

16. I like to work in a group because I learn from the others in my group.

17. When the teacher says a number, I really don't understand it until I see it written down.

18. Writing a spelling word several times helps me remember it better.

19. I find it easier to remember what I have heard than what I have read.

20. I learn best when I study alone.

21. When I have a choice between listening or reading, I usually read.

22. I feel like I talk smarter than I write.

23. When I'm told the pages of my homework, I can remember them without writing them down.

24. I get more work done when I work with someone.

25. Written math problems are easier for me to do than oral ones.

26. I like to do things like simple repairs or crafts with my hands.

27. The things I write on paper sound better than when I say them.

28. I study best when no one is around to talk or listen to.

9. I do well in classes where most of the information has to be read.

30. If homework were oral, I would do it all.

31. When I have a written math problem to do, I say it to myself to understand it better.

32. I can learn more about a subject if I am with a small group of students.

33. Seeing a number makes more sense to me than hearing a number.

34. I like to make things with my hands.

35. I like tests that call for sentence completion or written answers.

36. I understand more from a class discussion, than from reading about a subject.

37. I learn better by reading than by listening.

38. I would rather tell a story than write it.

39. It makes it easier when I say the numbers of a problem to myself as I work it out.

40. I like to study with other people.

41. Seeing the price of something written down is easier for me to understand than having someone tell me the price.

42. I understand what I have learned better when I am involved in making something for the subject.

43. The things I write on paper sound better than when I say them.

44. I do well on tests if they are about things I hear in class.

45. I can't think as well when I work with someone else as when I work alone.

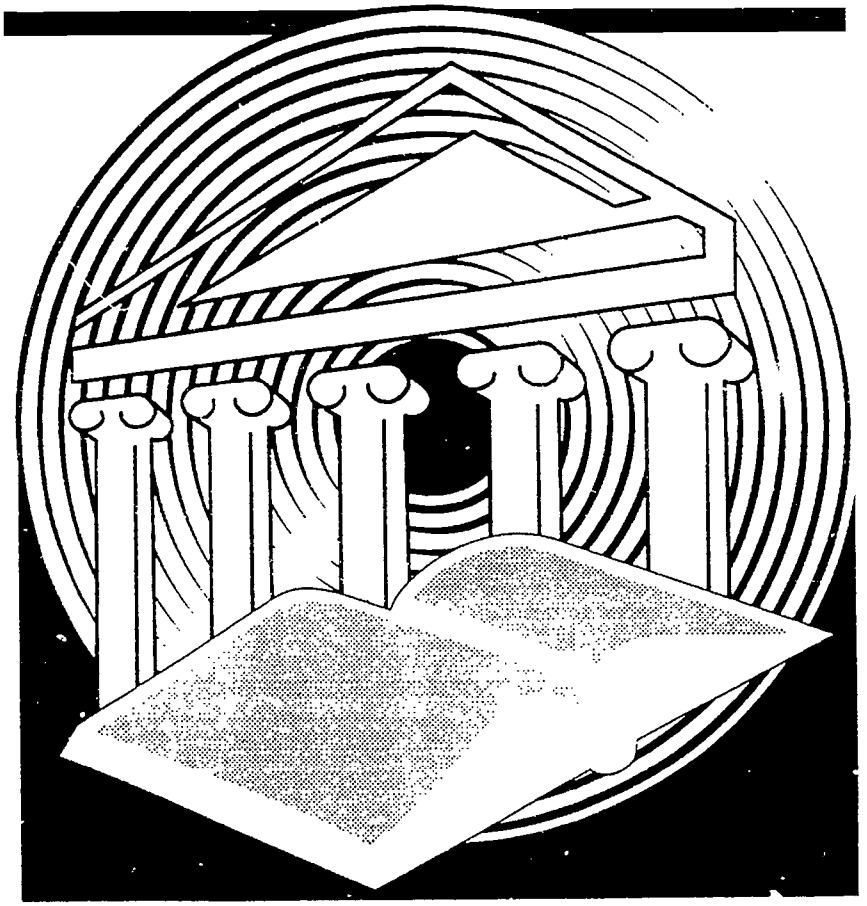
	MOST LIKE ME			LEAST LIKE ME
1.	(4)	(3)	(2)	(1)

Explanation of Responses

If you are the sort of person that rises early and enjoys working before noon you would probably respond by marking out the (4). If you start slowly and usually begin to work better later in the day you probably would respond by marking out the (1). If you are somewhere in between, then your response should be a (3) or a (2) depending on where you think you fit. You cannot make a mistake because there is no right or wrong answer; only the way you feel about the statement. There are 45 statements on the three pages to which you will be asked to respond. Mark your answers on the answer sheet the same way you did for the sample statement. You may have all the time you want so please respond to every statement.

INSTRUCTION DELIVERY SYSTEMS' 1991 GUIDE TO:

INTERACTIVE INSTRUCTIONAL TECHNOLOGY PROGRAMS AT COLLEGES AND UNIVERSITIES



INTERACTIVE INSTRUCTIONAL TECHNOLOGY PROGRAMS AT COLLEGES AND UNIVERSITIES

BANK STREET COLLEGE OF EDUCATION

Center for Children and Technology
610 West 112th Street
New York, NY 10025
(212) 222-6700

Contact: Dr. Kathleen S. Wilson
Courses Offered: Research and Development Center
Degree Program: None
Cooperative Arrangements with Business/Industry: Some projects funded by computer and publishing companies

BLOOMSBURG UNIVERSITY OF PENNSYLVANIA

Instructional Technology
1210 McCormick Building
Bloomsburg, PA 17815
(717) 389-4848

Contact: Dr. Harold J. Bailey
Courses Offered: (Instructional Design and Advanced Instructional Design). Two semesters of Instructional Design, Introduction to Interactive Technologies, TV Production and Design, Interactive Graphics, Multimedia Applications, Managing Multimedia, Authoring Systems 1 and 2, Electives from Communications and Human Resources Development
Degree Program: Graduate, Master of Science in Instructional Technology
Prerequisites: Undergraduate degree in any academic discipline from accredited institution of higher education
Cooperative Arrangements with Business/Industry: Affiliated with the academic program is the University's Institute for Interactive Technologies, which has a Corporate Advisory Council of approximately 15 members
Program Start-up Date: Summer, Fall semesters preferred; Spring semester acceptable

BRIGHAM YOUNG UNIVERSITY

Humanities Research Center
3060 JKHB BYU
Provo, UT 84602
(801) 378-3511

Contact: Kim Smith
Courses Offered: Undergraduate or graduate minor offered through the linguistics department: Introduction to Humanities Computing, CAI in Humanities Applications, Programming in Humanities Applications, Computers and Translation, Humanities Computing Project
Degree Program: 4-year, graduate, undergraduate
Prerequisites: Linguistics - Introduction to Word Processing or computing experience

BRIGHAM YOUNG UNIVERSITY

Instructional Science
201 McKay Building
Provo, UT 84602
(801) 378-7072

Contact: Paul F. Merrill
Courses Offered: Instructional Design, Microcomputer Materials Production, Audiovisual Production, Principles of Learning, Assessing Learning Outcomes, Authoring Interactive Video, Project and Instructional Resource Management, Empirical Inquiry in Education, Evaluation in Education
Degree Program: Graduate
Prerequisites: Undergraduate degree, 3.0 GPA, GRE, three letters of recommendation, personal letter of intent
Cooperative Arrangements with Business/Industry: Internships with firms such as IBM, Arthur Anderson, Motorola, WICAT, WordPerfect, Novell, and LDS Church
Program Start-up Date: Fall and Summer

CALIFORNIA STATE UNIVERSITY, CHICO

Communication Design
Instructional Technology Option
Chico, CA 95929-0504
(916) 898-4048

Contact: John Ittelson
Courses Offered: Extensive; contact the University
Degree Program: 4-year, graduate
Program Start-up Date: August/January

CORNELL UNIVERSITY

Communication
331 Kennedy Hall
Ithaca, NY 14853-4203
(607) 255-7737

Contact: Dr. Geri Gay, Assistant Professor and Director, Interactive Multimedia Group
Courses Offered: Interactive Multimedia: Research and Design, Social Design of Technology (MS in Communications)
Program Start-up Date: September and January

FLORIDA STATE UNIVERSITY

Communication
356 Diffenbaugh
Tallahassee, FL 32306-4021
(904) 644-8742

Contact: Dr. Ed Forrest
Courses Offered: An entire curriculum, including Interactive Communication Research and Interactive Media Programming and Design
Degree Program: Graduate
Cooperative Arrangements with Business/Industry: Interlight Productions, Philips Electronics Media, International Interactive Communications Society (IICS), FSU/edits and publishes the journal *Interact*
Program Start-up Date: Spring 1990

INDIANA STATE UNIVERSITY

Secondary Education
Terre Haute, IN 47809
(812) 237-2959

Contact: Dr. Jerry Summers
Courses Offered: Graduate courses including Instructional Design and Interactive Learning Systems, Internship in Interactive Learning, Research in Interactive Learning Systems, and a wide variety of courses in instruction, curriculum, and supervision
Degree Program: Graduate; also offers a certificate in Instructional Design
Prerequisites: Admission to graduate studies; others depend on experience and education
Cooperative Arrangements with Business/Industry: Work closely with several business and industrial leaders such as Pfizer, Inc.
Program Start-up Date: 1989

INTERACTIVE INSTRUCTIONAL TECHNOLOGY PROGRAMS AT COLLEGES AND UNIVERSITIES

INTERACTIVE MULTIMEDIA TRAINING INSTITUTE

Education
P.O. Box 5182
Bellingham, WA 98227
(206) 671-1155

Contact: Carol Anderson, Director
Courses Offered: Introduction to Interactive Multimedia, Creating Interactive Multimedia 1–4 (Concepts and Design, Beginning Authoring, Advanced Authoring, Video for IVD)
Degree Program: Graduate, undergraduate
Prerequisites: Familiarity with Macintosh and IBM computers, video cameras and equipment
Cooperative Arrangements with Business/Industry: On-site training available for week-long, intensive workshops
Program Start-up Date: On demand

ITHACA COLLEGE

Corporate Communication
Roy H. Park School of Communications
Ithaca, NY 14850
(607) 274-3242

Contact: Dr. Steven Seidman, Dr. Diane Gayeski
Courses Offered: Interactive Video, Microcomputer Media, Computer-based Instruction
Degree Program: Graduate, undergraduate
Prerequisites: Vary with each course
Cooperative Arrangements with Business/Industry: Internships
Program Start-up Date: BS since 1972; MS since 1975

KENT STATE

Educational Psychology and Leadership Studies
405 White Hall
Kent, OH 44242
(216) 672-2294

Contact: Dave Dalton
Courses Offered: CAI, IVD, Emerging Technologies, Authoring Systems
Degree Program: Graduate

LEHIGH UNIVERSITY

Educational Technology
111 Research Drive
Bethlehem, PA 18015
(215) 758-3231

Contact: Professor Leroy J. Tuscher
Courses Offered: Extensive; contact the University
Degree Program: Graduate
Prerequisites: BA or BS with GPA of at least 2.75 or 75 percent on MAT or GRE or GGPA of at least 3.0
Cooperative Arrangements with Business/Industry: Internship program with area corporations
Program Start-up Date: Fall 1980

NEW YORK INSTITUTE OF TECHNOLOGY

Department of Instructional Technology
NYIT - FC104
Old Westbury, NY 11568
(516) 686-7777

Contact: Dr. Angus Reynolds
Courses Offered: Instructional Systems Design, Advanced Technology-based Training, Hypermedia, Expert Systems, CAI Design and Development
Degree Program: Graduate
Prerequisites: Bachelor's degree
Cooperative Arrangements with Business/Industry: Programs at the New York City Police Academy and Long Island Lighting Co.
Program Start-up Date: September, January, and June

NEW YORK UNIVERSITY

Program in Educational Communication and Technology
239 Greene Street, Suite 300
New York, NY 10003
(212) 998-5520

Contact: Professor Francine Shuchat Shaw, Program Director
Courses Offered: Design and production of instructional programs for television, computer-based interactive and multimedia environments, and multi-image; cognitive science approach to learning and design; applications include wide-ranging educational and training settings
Degree Program: Graduate; Master of Arts, PhD and EdD
Prerequisites: Admission to NYU's School of Education, Health, Nursing, and Arts Professions (SEHNAP)
Cooperative Arrangements with Business/Industry: Internships in every aspect of the field throughout greater metropolitan area; selected courses include seminars and site visits with industry professionals; joint projects with professional organizations
Program Start-up Date: Fall, Spring, or Summer term

THE PENNSYLVANIA STATE UNIVERSITY

Instructional Systems
270 Chambers Building
University Park, PA 16802
(814) 865-0473

Contact: Dr. Kyle L. Peck
Courses Offered: Extensive; contact the University
Degree Program: Graduate
Prerequisites: Bachelor's degree, one course in statistics
Program Start-up Date: January/May/August

ROCHESTER INSTITUTE OF TECHNOLOGY

Office of Distance Learning
1 Lomb Memorial Drive
Rochester, NY 14623
(716) 475-5080

Contact: Christine Geith, Program and Market Developer
Courses Offered: Those leading to an MS in Telecommunications Software Technology, BS in Applied Arts and Science, Certificate in Applied Computing and Communications, Certificate in Data Communications, Certificate in Health Systems Administration. Certificate in Voice Communications; other lower- and upper-division courses
Degree Program: 4-year, graduate
Program Start-up Date: Lower-division courses started in 1980, MS and BS programs offered for first time in distance learning format in Fall 1991.

INTERACTIVE INSTRUCTIONAL TECHNOLOGY PROGRAMS AT COLLEGES AND UNIVERSITIES

SYRACUSE UNIVERSITY

Instructional Design, Development and Evaluation
330 Huntington Hall
Syracuse, NY 13244
(315) 443-3703

Contact: Don Ely, Chair
Courses Offered: Extensive; contact the University
Degree Program: Graduate
Prerequisites: Bachelor's degree from accredited college or university
Cooperative Arrangements with Business/Industry: Internships, co-op study, joint R&D projects, minority fellowship program, collaborative seminars, faculty professional fellows exchange
Program Start-up Date: Fall semester for regular academic program, August 1991

TEMPLE UNIVERSITY

Educational Media
350 Ritter Hall, 13th and Montgomery Street
Philadelphia, PA 19122
(215) 787-6001

Contact: Dr. Elton Robertson
Courses Offered: Characteristics of Computer-based Instruction, Advanced Interactive Video Workshop
Degree Program: Graduate
Program Start-up Date: 1966

TROY STATE UNIVERSITY AT TROY

Interactive Media Center (IMC)
Wright Hall Suite 104
Troy, AL 36082
(205) 670-3102

Contact: Drs. Angela Roling, Gertrude Schroeder, Gene Omasta
Courses Offered: Intensive training workshops in producing interactive video programs, including work in analysis, design, development, and evaluation phases of productions; workshops offered twice a year
Degree Program: None at this time
Prerequisites: None
Program Start-up Date: 1984

UNIVERSITY OF ALBERTA

Adult, Career & Technology Education
University of Alberta
Edmonton, AB
(403) 492-0715

Contact: Dr. Michael Szabo
Courses Offered: Core: four in CBI; 18 others in Instructional Systems Design
Degree Program: Graduate
Prerequisites: Teaching degree or equivalent experience in a training environment
Cooperative Arrangements with Business/Industry: Internship course offered
Program Start-up Date: September 1990

UNIVERSITY OF CENTRAL FLORIDA

Instructional Systems,
College of Education
Orlando, FL 32816
(407) 823-2595

Contact: Dr. Gary Orwig
Courses Offered: Those leading to majors in Instructional Technology/ Media and Instructional Systems; contact the University
Degree Program: Graduate
Prerequisites: Undergraduate degree from an accredited institution, 840 to 1,000 on GRE depending on undergraduate grade point average
Cooperative Arrangements with Business/Industry: Many internship possibilities in central Florida, including Martin Marietta, Analysis and Technology, Stromberg Carlson, banks, tourism, and others
Program Start-up Date: Fall term for best sequencing

UNIVERSITY OF DELAWARE

Instructional Technology Center
Willard Hall Education Building
Newark, DE 19716
(302) 451-8162

Contact: Pam Sine
Courses Offered: A variety of seminars on the development of multimedia materials; a full calendar of courses throughout the year
Degree Program: None at this time
Prerequisites: None
Cooperative Arrangements with Business/Industry: Consulting and development services available
Program Start-up Date: October 1991

THE UNIVERSITY OF GEORGIA

Instructional Technology
607 Aderhold Hall
Athens, GA 30602
(404) 542-3810

Contact: Thomas C. Reeves, PhD, or Murray H. Tillman, PhD
Courses Offered: Introduction to Computer-based Education, Techniques of Computer-based Education, Preparing Educational Software, Implementing and Managing Computer-based Education, Instructional Design and Development, Design of Interactive Multimedia, Artificial Intelligence in Education, Instructional Product Evaluation, Applied Project in CBE
Degree Program: Graduate
Prerequisites: None
Cooperative Arrangements with Business/Industry: Collaborative projects under way with Apple Computer, Inc., IBM Corporation, Delta Airlines, Army Research Institute, U.S. Air Force Academy, and others
Program Start-up Date: Each quarter

UNIVERSITY OF IOWA

College of Education
N459 Lindquist Center
Iowa City, IA 52242
(319) 335-5566

Contact: Dr. Barry Bratton
Courses Offered: Extensive; contact the University
Degree Program: Graduate
Prerequisites: BA or BS required for admission
Cooperative Arrangements with Business/Industry: Practicum arrangements with several businesses

INTERACTIVE INSTRUCTIONAL TECHNOLOGY PROGRAMS AT COLLEGES AND UNIVERSITIES

UNIVERSITY OF NEW MEXICO

Training and Learning Technologies Department
College of Education, University of New Mexico
Albuquerque, NM 87131-1256
(505) 277-4131

Contact: Dr. Guy Watson, Dr. Frank Field
Courses Offered: Instructional Design, Video Techniques, Authoring Languages, Interactive Video, and others; contact the University
Degree Program: Graduate
Prerequisites: For masters degree: Bachelor's degree with 3.0 GPA; for doctorate degree: Relevant masters degree or previous experience and 3.0 GPA
Cooperative Arrangements with Business/Industry: Internships arranged with local and national organizations, including Intel, Sandia National Laboratories, Ethicon, Los Alamos National Laboratories, and others
Program Start-up Date: 1984

UNIVERSITY OF SOUTH ALABAMA

Instructional Design and Instructional Development
205 ILB
Mobile, AL 36688
(205) 460-6201

Contact: Dr. John Dempsey
Courses Offered: Those leading to an MS in Instructional Design and a PhD in Instructional Development
Degree Program: Graduate
Prerequisites: MS: Bachelor's degree with a 3.0 GPA and an acceptable GRE or MAT score; PhD program: Masters degree and certain instructional design courses
Cooperative Arrangements with Business/Industry: Internship and assistantship arrangements made with various organizations
Program Start-up Date: Masters program: August; doctoral program: September

UNIVERSITY OF TEXAS-HOUSTON, HEALTH SCIENCE CENTER

Biomedical Communications
Doctor's Center
P.O. Box 20708
Houston, TX 77225
(713) 792-4466, ext. 3075

Contact: Allan J. Abedor, PhD
Courses Offered: Instructional Systems Development I and II, Visual and Verbal Communication Computer Assisted Instruction, Video for Instruction; Interactive Video Development; Professional Seminar I & II; Statistics and Measurement; Internship; Management curriculum is one calendar year long - 44 semester credit hours
Degree Program: Graduate
Prerequisites: Baccalaureate degree from an accredited four-year institution
Cooperative Arrangements with Business/Industry: 220-hour internship with health care, business, government, or educational organizations
Program Start-up Date: September

THE UNIVERSITY OF WISCONSIN

Curriculum and Instruction
225 North Mills Street
Madison, WI 53706
(608) 263-4670

Contact: Dr. Michael J. Streibel
Courses Offered: Critical Analysis of the Use of Computers in the Curriculum, Curriculum Development in a Desktop Computer Environment, Theories and Models of Instructional Systems Design, Interactive Media and Computers in the Curriculum, and Research with Computer-based Tools in Curriculum and Instruction
Degree Program: Graduate, undergraduate

VANDERBILT UNIVERSITY, PEABODY COLLEGE

Department of Human Resources, Corporate Learning Institute
P.O. Box 321
Nashville, TN 37203
(615) 322-8414

Contact: J. Olin Campbell
Courses Offered: Instructional Strategies, Instructional Design, Advanced HRD and Technical Programs, Advanced Instructional Strategies, Program Evaluation, Adult Learning, Consultation Skills
Degree Program: Graduate
Prerequisites: Prior relevant experience or excellent academic grades in a related area with strong GRE/MAT
Cooperative Arrangements with Business/Industry: Internships with local and national businesses, including Northern Telecom, Pillsbury, Federal Express, IBM, and others
Program Start-up Date: Fall and Spring for masters program, Fall only for doctoral program