TRADITIONAL LECTURE AND DEMONSTRATION VS. MODULAR SELF-PACED INSTRUCTION IN TECHNOLOGY EDUCATION MIDDLE SCHOOL

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ABSTRACT

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Traditional Lecture and Demonstration versus Modular Self-Paced Instruction in Technology Education
(Title)

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Technology Education instruction is in the process of changing from traditional lecture and demonstration to self-paced modular instruction. (Modular is computer-generated text, graphics, questions, etc.)

This study served to determined whether there was any difference between the final scores of the seventh-hour eighth grade class and the final scores of the eighth-hour eighth grade class on the same final test when the seventh hour had been taught by traditional lecture and the eighth hour had been taught by the Modular Bridge Construction Unit in the computer lab at Burlington Middle School.

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CHAPTER I

INTRODUCTION

Educators are continually trying to teach students in a more efficient and effective manner. Some Technology Education instructors believe they have discovered a more efficient and effective teaching method in the form of Modular Technology Education. Technology Education – the study of man-made instruments that assist people in accomplishing work – has traditionally been taught by lecture and demonstration. Modular Technical Education is self-paced instruction by computer, wherein the teacher assumes a comparatively passive role as a "facilitator."

No school or school system should want to change from traditional to modular methods without sound reason to believe that students would benefit from the transition. Therefore, every effort should be made to explore the issues raised by each method's adherents and critics.

Many experts in the field of Technical Education have weighed in with pertinent opinions on the usefulness of abandoning traditional methods in favor of computer-based instruction. In his article about teaching drafting MacKenzie (1998) reported that traditional instructional design and drafting tools are of limited use in teaching difficult and complex concepts, and that standard methods present 3-D spatial information in 2-D format. He drew attention to the lengthy time required to present complex concepts and solve complicated drafting problems with large-format, manual-drawing instruments on the chalkboard. Noting that traditional instruction falls short of accomplishing its objectives as the number of introductory technical graphics concepts increases, Ross (1991) added that "the development of new and innovative instructional methods based on 3-D visual modeling represent the future of engineering and engineering graphics education” (p.16).

Even though Mackenzie and Ross made seemingly valid points in favor of modular instruction for drafting, other experts presented thoughtful arguments against it. In an editorial, Zuga (1999) wrote that she expected the primary concern of those selling modules to be content of the curriculum, what ideas children would learn when using the modules and “how those ideas fit together to tell a coherent story about the nature, role, and purpose of technology in society.” Instead she found that the prime concern of the module adherents she encountered was management and control, “with every child at a desk, monitored by a teacher at a computer console…and provided with a call light to avoid wandering about the classroom.” She lamented the loss of students’ ability to take responsibility for managing their own time, materials and project work. In her opinion, modular instruction eliminated valuable interaction among students, and that the loss of that interaction resulted made creativity obsolete. Zuga came to believe that modules, which she described as isolated and impersonal, make students more like “products on an assembly line." (p. 1)

Gloeckner and Adamsom (1996) emphasized the role of active teachers, writing that “facilitators or teachers have the responsibility of updating, customizing, and modifying their curriculum to meet the individual needs of the classroom" (p.21). Pat Hutchinson (1996) agreed that a legitimately design-based technology program would require the teacher to have an active role in context setup, inquiry guidance, reflection fostering, standard setting, and attention to individual student needs (Daugherty & Foster, p. 32).

Complete vendor modules (modules that include software and extensive written text) seem better than rudimentary programs, but present challenges to classroom instructors. Teachers report many problems once modular units have been installed by vendors. The challenges they encounter include class size (not enough materials for each individual student, equipment breakdowns, etc.), difficulties meeting individual students' needs, worksheets, tests, lesson plan construction, and software problems that can bog down lab operations. Conversely, developing modules has bee*n* described as time-consuming and expensive, and teacher-made tests may not be as valid as vendor tests (Loveland, 1999).

At least two studies have already compared traditional versus modular learning laboratories. The findings for both methods were basically the same, with neither method emerging as clearly more successful than the other.

Nejad (1998) determined that students learned more electronics circuitry concepts when they utilized traditional methods of instruction and then used computer simulations (Nejad, Mahmoud. 1998, p. 12).

Gohale (1991) reported that although there was a difference in items that involved "transfer" there was "no significant difference between the two methods of instruction…The objective of both activities, as described in the instructions to the students, was to explore the operation of logic gates. In other words, both activities were exploratory in nature. Thus, although there was variation in the nature of these activities, their overall 'cognitive' effect may have been very similar" (Gokhale, 1991, p. 22).

To promote scholarly debate, the editorial review board of a technical education trade publication asked four industry experts to critically oppose or defend the statement, "The modular approach in technology education is an exciting, efficient, and effective student-centered means of introducing students to a wide variety of broad technological concepts" (Daugherty, 1996, p. 27). The panel of experts answered as follows:

Gene Gloeckner of Colorado State University heartily agreed with the statement, admitting that some modules are more efficient than others, but adding that modules save school districts money because they require only one set of materials per module. Pat Hutchinson of Trenton State College did not find modules particularly effective in giving students transferable tools for real-world problem solving, and felt that when broader conceptual organizers such as 'mechanisms' or 'structures' were introduced, students need more time than is usually allowed to apply their experience to to a number of different contexts. Mike Jensen of Paonia (Colorado) High School felt that using modules to manage classroom and lab environments provides great opportunities for teaching technology, but felt that one of the greatest advantages of this educational reform was the ability to more easily manage large classes. Steve Petrina from the University of British Columbia emphatically rejected the veracity of the statement, arguing that modules are not student-centered but “module-centered,” and that module designs constrict student freedom of choice and expression of response. He added, “If the end of technology education is to impress students and administration with a glance at someone's narrow idea of the future, or train students in the use of certain narrow-minded technologies, then modules may be effective. But if the end is technological sensibility and political astuteness for students as citizens, then modules are irrelevant" (Daugherty, 1996, p. 27).

Mulford (1995) stated that curriculums marketed and developed by vendors augment technology education. Calling modules “one of the richest areas of curriculum expansion" in this field, she felt that they supply young people with needed adaptation and survival skills (Mulford, 1995; Good Morning America, 1995).

Pullias (1997) argued that neither traditional instruction nor modular learning stations is the answer. He wrote that technology education is "locking itself into obsolescence" through the use of modular labs that stifle students through their lack of flexibility and synergy (p. 29).

Not only are modules difficult to revise but, because of difficulties opening the program (thus leading to inflexibility), they are much like the learning stations designed in the 1930s. Petrina (1993) wrote that modular technology education brings to mind an instructional system that is self-contained, "defined by programmed learning theory, technological devices and equipment." He adds that modules are a contemporary incarnation of teaching machine and programmed learning theory of the 1930s-1960s (Petrina, 1993, p. 77).

In addition to conflicting views from experts on the value – or uselessness – of modular technical education teaching methods, there are other conflicts surrounding decisions to either accept or reject modular methods. Some say modules are more expensive; some insist they are less expensive than traditional labs. Some say that they lack the problem solving development that real life requires. Others say modules teach problem solving better than traditional settings. Two papers document research on which approach actually resulted in higher test scores using traditional vs. modular instruction, but neither found conclusive evidence supporting either method. This investigation will attempt to find whether one method is significantly more effective than the other, at least in relation to student performance.

Problem Statement

Burlington Middle School's Technology Education curriculum is considering a change from traditional lecture and demonstration to self-paced, computer-generated modular instruction. Numerous public schools have made this change in the past few years. Since Burlington was contemplating this transition as well, research was conducted to determine whether the change to modular instruction could be quantitatively proven superior to traditional instruction. Historically, research on this topic has been inconclusive. Experts in the field of Technology Education have disagreed as to the effectiveness of modular instruction or any significant difference between it and traditional instruction. Since available research could not substantiate the advantage of change, an experiment was conducted at Burlington Middle School.

Purpose of the Study

The purpose of the study was to determine which direction Burlington Middle School should take regarding traditional technology education and modular technology education. The study's objective was to find which method – if either – is more effective, using a unit on bridge construction as the sample. This study served to determine any statistically significant difference between the final test scores of two sections of eighth graders. Seventh hour was taught by traditional lecture and demonstration. Eighth hour was taught by modular instruction in the computer lab of Burlington Middle School. Final test scores on the Bridge Construction Unit were compared between seventh and eighth hour technology education students. Conclusive findings would have allowed the researcher to use the better of the two methods to instruct students, and provided Burlington Middle School solid criteria upon which to base any decision regarding the way technology education students are taught.

Research Question

Do technology education students perform better through modular instruction or traditional teaching methods?

Significance of the Study

This study was significant because this question needs to be answered before either teaching method can be confidentially embraced as preferable. Because of strong differences of opinion between experts in the field of Technology Education, only conclusive findings can guide fruitful dialog and sound decisions on this issue.

Limitations

The study was limited to eighth grade students at Burlington Middle School. The results are not intended to be generalized to a larger population. The parents/guardians of five of the 24 seventh hour technology education students did not provide written permission, so the final test scores of those five students could not be used in the outcome of this study.

Definition of terms

Technology Education – Technology Education is an educational program that helps people understand design, production and use of technology products and systems.

Traditional classroom – Teacher-conducted classroom setting in which an instructor develops the curriculum and conveys information through lecture and demonstration.

Modular classroom – Within the context of this discussion, a modular classroom is one that employs a *modular approach to technology education* (MATE). MATE is a self-contained instructional system defined by programmed learning theory and technical equipment. In a modular setting, the teacher becomes a facilitator, dispensing the learning system rather than actively instructing students.

Vendors – Vendors are the corporations that develop modular systems and market them for sale to school districts and individual learning institutions.

CHAPTER II

REVIEW OF LITERATURE

In the early 1960s, Russia surpassed the United States in the space race after successfully launching Sputnik. A nervous U.S. Government asked for educational reform and got it. Industrial Arts joined the reform movement. Many reformers looked to an industry-based approach to curriculum content (Wright 1998). Two main programs of that era were the Industrial Arts Curriculum Project -- which focused on manufacturing and construction, and the American Industry Project -- which studied industry through thirteen concepts: energy, processes, materials, production, management, marketing, relationships, procurement, research, property, finance, transportation and communication. (AVA, 1970, p. 21-23, as cited by Wright, 1998, Feb. p. 39.).

In the 1970s the term “technology” began to be bandied about by the leaders of the educational reformers. Devore (1966) thought that content should be organized under the areas of communication, production, and transportation. Then Jackson’s Mill Curriculum Project changed production to construction and manufacturing.
Most leaders of the reform movement had accepted the name change from Industrial Arts Education to Technology Education. They agreed upon the *name* change but the actual change of curriculum was still in progress in 1999! In fact, many school doors say Technology Education Department, while teaching the Jackson’s Mill curriculum of production, communication, and transportation. It has long been time for the curriculum to match the name.

Standards were created by the International Technology Education Association (ITEA) with the intent of emphasizing technology as a body of knowledge rather than discrete careers or skills on the level of vocational education. The standards were meant to ensure that technology education addresses what students should know and be able to do, rather than merely teaching them *about* technology" Starkweather (1996).

Wisconsin has followed the ITEA and produced its own version of technology education standards. The state standards are in sections: Content Standard, Systems, Human Ingenuity, and Impacts (Wisconsin's Model Academic Standards for Technology Education, June, 1998.) From these standards we have a technological literacy baseline in which all students in grades 4-12 should be proficient. The question, then, is this: "How do technology education teachers present this state curriculum most effectively?'

The traditional way for teachers of any discipline to teach has been the lecture/demonstration method, but during recent years the modular learning station has gained popularity. Is this a better way of getting across the state standards that all technology education instructor are charged with, or is the traditional way still the best way of imparting this knowledge to students?

The reports are inconclusive, and there are many different opinions about what role, if any, modules should play in technology education. Gohale (1991) reported that she could find "no significant differences between the two methods of instruction" (p. 22.). Nejad's (1998) finding that students learned more electronics circuitry concepts when computer simulations were used *after* traditional instruction seems to negate any insistence that simulations are in any way superior. (p. 12 Clark (1995) found in his research that when two lessons are designed using similar instructional methods presented through different media (i.e., traditional instruction versus computer based instruction), "the results are pretty much the same" (p. 3.). There can be no conclusions drawn from these studies because they all fail to find differences in student scores whether modules or traditional methods are used. Still, modules are being used increasingly in schools to teach technology education. The next question addressed what people in the teaching industry thought about instructiong technology education students with modules.

When asked what they thought of modular technology instruction units (DeGraw, Smallwood, 1997), only 2 percent of the Kentucky technology educators surveyed said they depend entirely on the manufactured materials. Fifty-five percent design their own materials and performance appraisals for use with the modules, and 53 percent feel that modules should be supplemental rather than a singular approach to instruction. Sixty percent believe modular instruction does not provide everything needed to develop the skilled thinkers and workers a global economy demands. Eighty-three percent of respondents believe modular instruction enhances the relationship between math, science, and technology. Seventy-nine percent feel modules reflect current and emerging technologies and 53 percent believe they need the modular curriculum to teach students adequately about industry and technology and their impacts on our society. Seventy-nine percent also feel that changing to a modular technology approach will broaden the scope of what technology educators are trying to accomplish. A large number (77 percent) disagree with eliminating full-sized forming and shaping equipment from technology education programs, and 81 percent believe that psychomotor skills, hand-eye coordination, and materials and processes characteristic of past instructional endeavors in their field are still very important. Forty-five percent of the respondents believe parents favor a modular approach to technology education, and 57 percent felt the same about school boards and administration. Forty-three percent believe students will be more likely to sign up for a modular-based technology class than a traditional class in woods or metals. The researchers concluded that "those leading the technology education charge in Kentucky have made a commitment to the modular instruction approach and believe this will better prepare students for life in the twenty-first century. As always, only time will tell if this commitment is the right choice" (p. 4).

The research could not show which is the better delivery method in terms of state standards or any other unit of measurement. Teachers in the field of technology education do not agree on which method of instruction is a better delivery method of teaching technology education. Other experts in the field – experts who are not actually teachers – have weighed in with their observations as well.

Karen Zuga (1999), a much-published author in the field of technology education, wrote an editorial for the *Journal of Industrial Teacher Education* about modules or, rather, what she refers to as "the selling of modules." Despite her initial anticipation that the primary sales point of the modules being 'pitched' by competing vendors would be curriculum content and ideas, she soon found that her expectations were 'off the mark.' She recalled seeing "one sales team who opened with this concern, and their presentation did not go over well with the practitioners on the committee." The better-received presentations were those that promised better classroom control, "with every child at a desk, monitored by a teacher at a computer console, kept on task with up-to-the-minute software-generated reports of progress at each work station, and provided with a call light to avoid wandering around the classroom." Zuga believes that modules eliminate students' excitement for a subject that allowed them to work on their own "after being chained to a desk for five other periods each day," and that the further loss of whole class interaction negates important educational principals (p. 4).

Stephen Pertain, another expert in the field of technology education, is wary of modular curriculums because they are "grounded in behaviorists' beliefs about learning." He believes that curriculum control – what is included and what is excluded -- is left to equipment vendors. Sanders (1990) observed that technology educators seem 'enamored' with new technologies without consideration for how they fit into the curriculum. Hearlihy (a popular vendor of modular education programs) variations of Modular Approach to Technology Education (MATE) are predominantly used to access the codified bio-related communication, production, and transportation disciplinary system. These systems have been extensively promoted (e.g. DeVore, 1992; Hales & Snyder, 1982; Savage & Morris, *1985;* Savage and Sterry, 1990a, 1990b: Wright, 1992) and widely accepted for state curriculum guides (Putnam, 1992). Tech-prep and other vocational organizations of curriculum are also reinforced through MATE. ITEA's relationship with corporate MATEs seems intimate. The December 1992 issue of *The Technology Teacher* -- the ITEA's journal -- ran a cover advertisement for Hearlihy's MATE. The fact that the cover photo of students in a classroom with a Hearilhy manager was contrived was not made known readers of *The Technology Teacher*. With authority like that which was granted through that cover ad, Hearlihy defines technology education (and benefits from free advertising by the ITEA). MATE advertisements appeared in issues of the journal as articles rather than sales promotions. According to Sanders, “presumably, the only thing missing from these MATESs, similar to the “canned units” of the 1930’s and the programmed packages of the 1960’s, is the student” (p. 72-76).

Zuga and Petrina both dislike modules: Zuga, because they restrict movement and class interaction; Petrina, because he is suspicious of corporate control over curriculum and standards. They both make valid arguments, but others in the field -- who are just as qualified to make judgements -- embrace modular instruction.

In an article for *The Technology Teacher*, Loveland (1999) found modular education to be a method of delivery used in technology education labs on many levels throughout the world.” He cites vendors’ having gone to great expense to carefully research, develop, field test and modify their modules, and believes the methodology models the real world of work management. Loveland finds modular education economical since schools purchase only one set of curricular materials, and working with technological tools in a variety of settings gives students adaptability and flexibility. Students working in a modular learning system are introduced to four types of learning: active, cooperative, individualized and interdisciplinary. Technology labs become a center of teacher training for curriculum integration and therefore improve the image of the school within the community (Daugherty and Foster, 1996, as cited by Loveland, 1999, p. 10-15). He acknowledges that module development is time consuming “Watching videos, writing worksheets, key concepts, definitions, instructions, daily activities and post-tests while linking all to state technology education standards can be tedious, but this careful planning is necessary for student success” (p. 15).

Steven K. Barnhill, a technology education teacher from Colorado, investigated modules and found that “in the average high school or middle school, students enter the room exuding an attitude of ‘I don’t want to be here,’ and throw their books on the desk. They sit and wait for the teacher to start class. In this teacher-centered environment, the teacher must interest, captivate, and entertain, all at the same time…. Students in the Technology Lab 2000, on the other hand joyfully enter the lab, put down their books, get their portfolios and the curriculum du jour, and start to work on a vast array of applicable and relevant technology” (p. 30).

While technology education teachers have been on both sides of the fence about modular versus traditional instruction, and other professionals similarly clash on the topic, the only people not heard from – and the ones who really matter most – are the students.

In 1998, Boser and Daugherty, from Illinois State University, and Palmer, a technology education teacher from Virginia, examined student attitudes toward modular technology education labs. They focused on “four teaching approaches typically used to deliver technology education in the middle school... Differences were found in only *5* of the 24 sub-scales. In the integrated approach, statistically significant differences were found on the Attitude toward Technology and Consequences of Technology sub-scale. Differences were also found on the Attitudes toward Technology and Concept of Technology sub-scales of the modular approach. In both approaches, the change *was in a negative direction*, indicating that students exhibited a more negative attitude toward the Consequences of Technology on the post-test than on the pre-test**.**

The studies have shown no conclusive evidence that either modular or traditional lecture/demonstration methods of instruction is superior.

CHAPTER III

METHODS AND PROCEDURES

The purpose of the study was to determine which direction Burlington Middle School should take regarding traditional technology education and modular technology education. The study's objective was to find which method – if either – is more effective, using a unit on bridge construction as the sample. This study served to determine whether there was any difference in the final scores of the seventh hour eighth grade class and the final scores of the eighth hour eighth grade class on the same final test when the seventh hour students had been taught by traditional lecture and the eighth hour had been taught by modular instruction in the computer lab. Conclusive findings would allow the researcher to use the better of the two methods to instruct students, and give Burlington Middle School solid criteria upon which to base any decision regarding the way technology education students are taught.

Sample Selection

The two classes used for the study were determined by the Burlington Middle School administration. The course is an elective, so the students signed up for the class the year before. They were put into seventh or eighth hour technology education class based upon other electives they had selected the year before. All eighth graders had electives in the afternoon at Burlington Middle School.

The student's parents or guardians had to sign permission slips allowing their sons or daughters to participate in the study. The class size should be 24 students in each section.

Instrumentation

The final test was constructed during a class called "Principles of Assessment." This was a three-credit 700-level course offered through UW-Stout. The instructor was Dr. Lee. The test instrument had at least five questions in each format, which included True/False, Matching, Fill-in-the-Blank, Multiple Choice, and five essay questions (students were asked to answer any two essay questions). Dr. Lee approved the test instrument after a few revisions. Chris Ness, at UW-Stout's computer center, had the test instrument modified slightly so that the students put letters by the number on the seven matching questions instead of drawing lines between the words and their matching definitions.

The questions had to have content covered by both the modular tutorial during the eighth hour modular instruction class and the seventh hour class that was taught by traditional lecture and demonstration.

Procedures Followed

First, the privacy of the minor-aged students had to be ensured. UW-Stout provided a form letter that was modified for this study and sent to the parents/guardians of each student in both the seventh and eighth hour technology classes. All the slips were signed and returned for the eighth hour modular class, but only nineteen of twenty-four were returned for the seventh hour traditional lecture class.

Method of Analysis

Two charts were created using Microsoft Excel; these illustrated the number of correct responses out of 60 possible points, as well as the percentile scores by group. On both bar charts (Chapter 4, pages 20 and 21), B-2 represented the seventh hour traditionally taught students and B-1 represented the modular-taught eighth hour class.

<u>Procedure</u>

The seventh and eighth hour classes were already intact. One group was assigned as the modular group and the other was assigned as the traditional group. The groups were not randomly assigned student by student, in each hour, so the study was considered quasi-experimental. The boy-girl variable was not manipulated because the students signed up for the class last year, the schedules were printed and the students already knew which electives they had and what hour they would attend. The subjects comprised of a mixture of boys and girls who were already assigned to the seventh and eighth hour.

CHAPTER IV

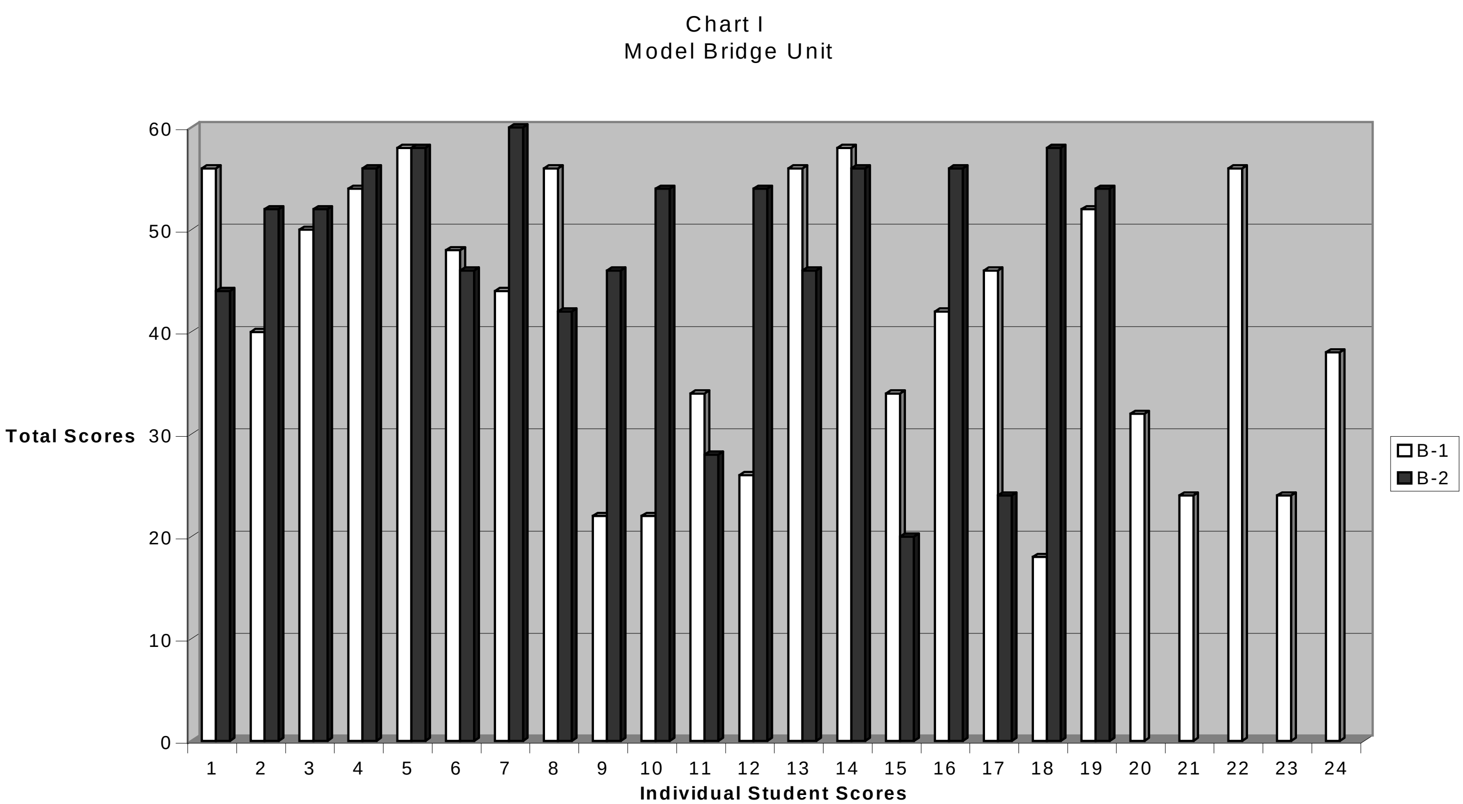
DATA ANALYSIS AND DISCUSSION

The purpose of the study was to determine which direction Burlington Middle School should take regarding traditional technology education and modular technology education. The study's objective was to find which method – if either – is more effective, using a unit on bridge construction as the sample. This study sought to compare the performance of students who were taught a technology education unit by traditional methods with the performance of students taught the same information by way of self-paced modular learning stations. Statistically significant results might lead to a clear answer to the question "Do technology education students learn better when taught by modular instruction than traditional demonstration and lecture?" The research was meant to be specifically relevant to Burlington Middle School and its decisions regarding the curriculum of its Technology Education department.

The subjects were eighth-grade boys and girls at Burlington Middle School. The control group was the seventh-hour class, made up of 19 students taught by the traditional method. The eighth-hour class – the experimental group – consisted of 24 students taught with modules. The subjects were not randomly selected. Although classes included students of both genders, the boy-girl variable was not considered. All students in both groups were taught a unit on bridge construction and subsequently subjected to the same final test. The scores were then compared.

The highest possible score on the final exam was 60 points. Chart I, Model Bridge Unit, indicates individual scores in each group, with B-1 (white bars) representing the experimental, or module-taught, group and B-2 (black bars) representing the control, or traditionally taught, group.

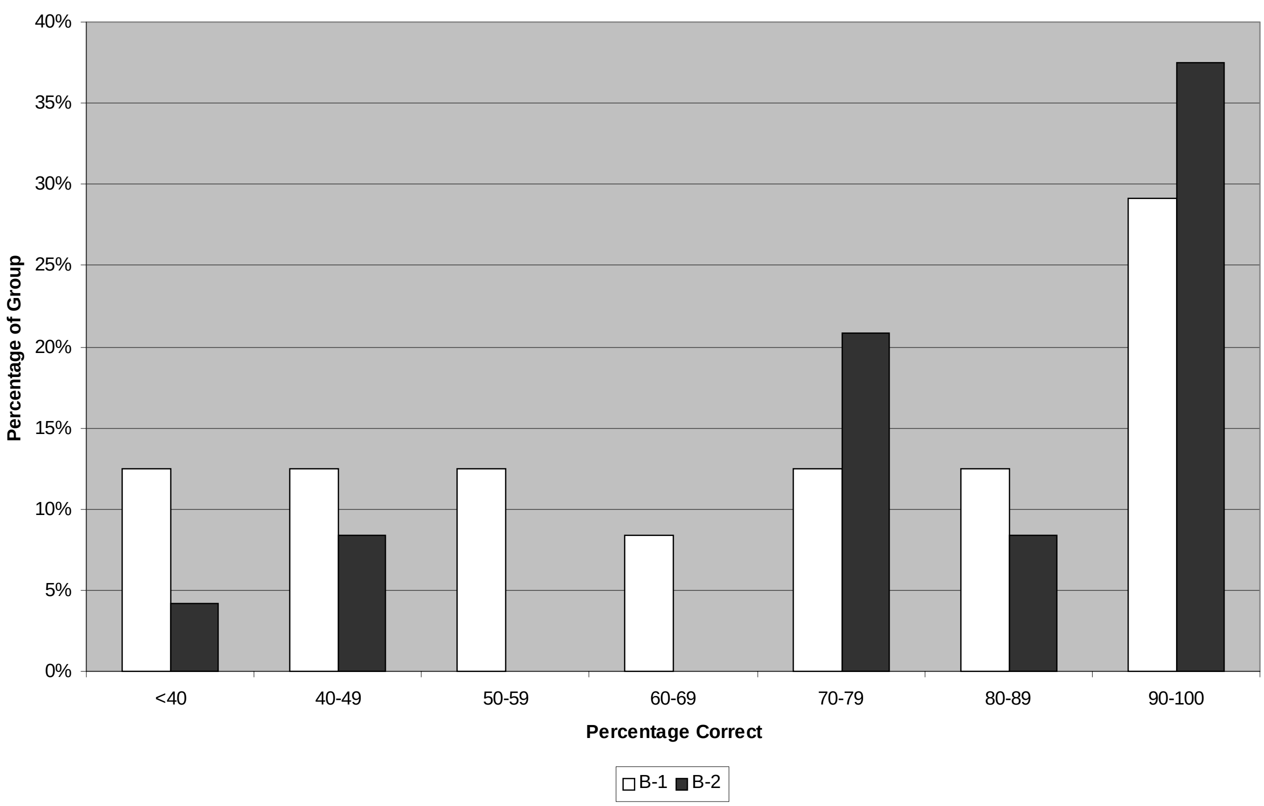
B-1 subject number 18 had the lowest score at 18 of 60 possible points. If each numbered pair is compared from numbers 1-19, the graph shows that sometimes the B-1 group (traditional lecture) scored better, and sometimes the B-2 group (modular instruction) scored better. There is no data on subjects number 20 through 24 on the model bridge unit score comparisons. Those five students never returned their permission slips; therefore, their test scores could not be displayed.



The findings of the computer center at UW-Stout indicated no significant difference at the .05 level. The findings imply no statistically significant difference between the modular taught section of eighth graders at Burlington Middle School and the traditionally taught section of eighth graders at the same school. This data was also analyzed by Chris Ness at the computer center at UW-Stout. The line item analysis was very detailed and involved; yet she, too, found no statistically significant difference between the two groups in her group comparison statistics at the .05 level.

Chart II, Percentile Scores, displays the data in percentile scores. With 60 points as the maximum score (100%), this chart indicates what percentage of individuals in each group performed in which range. Chart II shows the largest group of students scored between 90 and 100% correct in both the B-1 and the B-2 groups. The B-2 group seemed to do either very well or very poorly -- note that there are no B-2 students at all in the 50-70 percent correct range. The B-1 group was relatively well-represented in each 10 percent increment (with the exception of the 90 – 100 % group, which had almost twice the number of students in it as any other of the 10% increments).

Chart II
Percentile Score



SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Burlington Middle School's Technology Education curriculum is considering a change from traditional lecture and demonstration to self-paced, computer-generated modular instruction. Numerous public schools in Wisconsin have made this change in the past few years. Since Burlington Middle School was contemplating this transition as well, research was conducted to determine whether the change to modular instruction could be quantitatively proven superior to traditional instruction. Historically, research on this topic has been inconclusive. Experts in the field of Technology Education have disagreed as to the difference between it and traditional instruction.

Since available research could not substantiate the advantage of change, an experiment was conducted at Burlington Middle School. One group of eighth grade students was taught a specific unit by traditional method, while a second group of eighth grade students was taught the unit by modular instruction. Both groups were given the same final test and the results were compared. The test instrument was designed, then reviewed, by a University professor. The results indicated no statistically meaningful difference between the two groups at the .05 level of significance. This finding was in line with previous research, but does not indicate that a change to modular instruction is in order.

Restatement of the Problem

Burlington Middle School is considering a change in its Technology Education curriculum, effecting a transition from traditional lecture and demonstration to self-paced, computer-generated modular instruction. Numerous schools have made this transition;

however, it was felt that Burlington Middle School should at least attempt to discern whether modular instruction would be more effective than current practice. Experts in the field of Technology Education assert conflicting opinions on the value of modular education, and past studies done in the hopes of demonstrating clear superiority of one method have been inconclusive. Therefore, a closer look was appropriate. Can technology education students actually perform better using learning stations versus traditional demonstration and lecture? Research was conducted to determine whether modular instruction could be proven, quantitatively, to be superior to traditional instruction within the context of one particular school.

Methods and Procedures

Eighth-graders in the seventh-hour class were taught, using traditional means, a unit on bridge construction. These 19 students made up the control group. The 24 students in the experimental group were the eighth-hour class, and were taught the same unit. Both groups were given the same final test and their grades compared.

Major Findings

The research revealed no significant difference between scores of students learning the bridge construction unit through traditional methods and those learning the same information through modular methods. Like other research studies referenced in this paper, the results indicated a null hypothesis – differences between the performance of the two groups failed to be statistically significant and gave no support to expectations about the effectiveness of modular teaching methods.

While the charts might have seemed to indicate that traditionally taught students performed “better” than module-taught students (note that the highest scores belonged to students in the B-2 group, and that B-2 subject number 7 on the Model Bridge Unit chart had the only perfect test score of either class), the results were not consistent across the board. Control group scores are clearly higher for those who correctly answered more than 90% of the final exam questions, yet this group does not continue to demonstrate a distinct advantage over the experimental group as the number of correct answers subsides. Reasons for the inconsistency cannot be reliably explained, but it makes the performance margin between the groups inconclusive at best. Data implies that traditionally taught students perform better, but this cannot be strongly supported, or debunked, by the findings. The data indicates that there is no advantage using one method over the other.

Conclusions

It seems clear from the results of the procedure that modular technology instruction is *not* indisputably better than traditional teaching; however, traditional methods show no significant advantage either. The absence of distinct and consistent research results on this topic continues. At present, the two methods of instruction appear to produce very similar test score outcomes regardless of how many times – or at what academic level – studies are done. Critics and advocates of modular technology education methods each raise pertinent issues about student interaction, innovation and future trends. Still, without reasonable assurances of its effectiveness, the adoption of modular teaching methods can be difficult to justify except under the dubious reasoning that everyone is doing it.

Recommendations

There is no doubt that further, more extensive, studies on this issue would eventually help school systems make more knowledgeable curriculum decisions. Modular instruction requires that the student read the text, then answer questions from that reading. Naturally, if the student has difficulty reading his score would be affected negatively, more so than the same student's score would be affected in a traditional lecture format. This problem could be alleviated by newer software that speaks the word out loud as the word is highlighted on the computer screen. Different findings may have been demonstrated had newer, user-friendlier software been used in this experiment. This experiment should be redone using software that students can "hear" rather than merely "see". Research using such software – or any other features that may help "equalize" the potential of students in each group – may lead to more conclusive proof of the superiority of student performance under one teaching method or another.

SELECTED BIBLIOGRAPHY

Adams, C.T. “The Effect of Implementing Technology Education on the Teaching Methods of Southeastern Wisconsin: Unpublished Master’s Thesis.” Menomonie, WI: University of Wisconsin-Stout, 1990.

Bosner, Richard, A.; Daugherty, Michael, K.; and Palmer, James, D. “Students Attitudes toward Technology in Selected Technology Education Programs.” *Journal of Technology Education*, Vol. 10. No. 1, p. 4-19), 1998.

Burke, Barry. “Designing the Technology Facility of the Future.” *The Technology Teacher*, Nov. 1995, p. 3-8.

DeGraw, Beverly; Smallwood, Jim “Modular TE Instruction--What Kentucky Teachers Think.” *Tech Directions,* April 1997.

Daugherty, M., Foster, P. “Educators address modular instruction”. *The Technology Teacher,* 55(6), 2 7-32, 1996.

Gloeckner, G., Adamson, G. “Modular technology education.” *The Technology Teacher,* 56 (1), 16-21, 1996.

Gokhale, Anu. “Effectiveness of Computer Simulation vs. Lab and Sequencing of Instruction in Teaching Logic Circuits.” *Journal of Industrial Teacher Education,* 28, (4), 1991.

Gonzales, Ronald, F. “The perspectives of Technology Education.” *Techniques: Making Education & Career Connections,* October, Vol. 72 Issue 7, p. 60-61, 1997.

Green, Ray; Quinn, Gail. “Project T. E. A. M. (Technical Education Advancement Modules).” *T.H. E. Journal*, March, 1994.

Havice, William L. “A Comparison of College Students’ Achievement Following Traditional and Integrated Media Presentations.” *Journal of Industrial Teacher Education,* 35, (4), (29-43), 1998.

Loveland, Tom. “Adapting Modular Curriculum in the Classroom.” *The Technology Teacher*, June, 1999.

Mackenzie, D. S. “Impact of Multimedia Computer-based Instruction on Student Comprehension of Drafting Principles.” *Journal of Industrial Teacher Education*, V35, N4, 1998.

Mulford, C. “Spotlight on Technology: Say Goodbye to the Woodshop.” *Vocational Educational Journal,* 70 (3), 33-34, 1995.

Nejad, Mahmoud “Comparisons of Computer Simulations vs. Traditional Laboratory Instruction in Solid State Electronics.” *Journal of Industrial Technology,* Winter 1998.

Pertain, Steven. “Under the Corporate Thumb: Troubles with our MATE (modular approach to technology education).” *Journal of Technology Education,* Vol. 5, No. 1, Fa11 1993.

Pullies, Dave. “The Future is Beyond Modular.” *The Technology Teacher.* April, 1997.

Quam, Greg; Smet, Chuck. “Technology Education: A Performance-Based Approach.” *Tech Directions,* April, 1998 p. 24., *Bulletin,* Sep. 1996.

Ross, W. A. “3-D modeling: Making the modeling-to-drawing interface seamless.” *Engineering Design Graphics Journal*, 55(1), 16-23, 1991.

Starkweather, Kendall, N. “Technology Education in Tomorrow’s Curriculum.” *Bulletin,* p. 6-7, Sept. 1996.

Starkweather, Kendall, N. “Being #1 in Technology Teaching.” *The Technology Teacher*, p. 12-13, Sept. 1998.

Welty, Kenneth; Wei-Kun, Tsai. “Impacts of Individualized Instruction - Materials on Technology Education Programs.” *International Journal of Instructional Media,* VoL 22 Issue 4, 1995.

Wright, Thomas. “Are you caught in a Time Warp?” *Tech Directions,* p. 39-41, Feb. 1998.

Zuga, Karen, F. Editorial. *Journal of Industrial Teacher Education*, 36(2), 2-4, 1999.