THE EFFECTS OF MULTIMEDIA ENHANCED INSTRUCTION VS THAT OF NON-MEDIA ENHANCED INSTRUCTION IN AN AVIATION EDUCATION PROGRAM WHEN TEACHING LIMITED ENGLISH PROFICIENT STUDENTS IN AN OKLAHOMA MIDDLE SCHOOL

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INTRODUCTION

The computer age has made revolutionary advances in many fields, cutting cost and labor and increasing productivity by large factors. The advances can be seen in many areas of our society from the advertising industry, to the medical world, and to the field of education. As a consequence of these new advances, a new technology has evolved since the first computers were introduced into the classrooms about twenty years ago. A case in point is the Oklahoma network called the OneNet. "OneNet is Oklahoma's official telecommunications and information network. It electronically links public schools, colleges and universities, courts, libraries, hospitals, and local, county, state, tribal, and federal government agencies across the state" (OneNet Newsletter, 1998 February). This Fiber-Optic network is rapidly becoming recognized as a very comprehensive network in the nation. Through OneNet schools in Oklahoma, including middle schools and high schools, that have access to computers and the OneNet could have access to education courses and special programs to include remedial bilingual programs. If desired, these programs could be re-delivered to others students in others cities and countries.

Thanks to this fiber optic technology, and the incorporation of new computers and advanced software in the classrooms the future is already brighter, not only for Oklahomans but also for many international students who come here from many places,

and to the many ethnic groups of native and immigrant populations who live in this state and are Limited in English proficiency (LEP).

> According to the U.S. census updated in 1996, the total number of international students, nonimmigrant coming to the U.S to enroll in college, was 454,000. This number was a 17% increase since 1990, and this number continued to increase. Furthermore, in 1996 the total enrollment of elementary and high school students in the United States was 46 million. Of that number, 7.4 million (16.3%) were black; 2.3 million (5.2%) were other races, 6 million (13%) where of Hispanic origin; and 30.1 million (65.5%), were considered to be non-Hispanic white. If the current trends continue, the white percentage of the total population was expected to drop to 53% by the year 2050. Hispanics were expected to increase to 24%, Blacks to 15%; American Indian, Eskimo and Aleuts to slightly more than 1%, Other races to 8%. (Riche, 1996)

This ethnic diversity of native and foreign students was also seen in Oklahoma's classrooms and presented a number of challenges for educators to enhance the delivery of education. On March 27, 1986 the Oklahoma State Board of Education declared its intent to help provide direction for Oklahoma's schools in developing appropriate delivery systems to best meet the needs of LEP students:

1. LEP students have particular educational needs which should be recognized and addressed.
2. A proper plan for identifying LEP students and diagnosing their educational needs to be developed.
3. In keeping with the Law Vs. Nichols, Supreme Court decision and the Oklahoma Attorney General's Opinion, schools should provide instruction for LEP students that will result in increased English proficiency and academic performance.

4. Effective programs for LEP students draw on the experiences and the conceptual and linguistic development that students already possess upon entering schools. (OKC schools, 1992-1993)

To validate these directives and to insure LEP student achievement, educators must not only meet the above challenges but also meet them with the same technical and effective level as other business professionals are meeting them in others professional fields in the state. LEP student achievements need to have a high priority for excellence among parents, educators, and administrators. Student achievement scores have made some progress in Oklahoma the last few years. However, there is a decline of LEP students graduating from Middle and High schools including less pursuing aviation careers.

Changes in the Delivery of Education

According to Sternburg "Thinking Styles"(1997), in the theory of mental self management, educators can help make a difference in school performance:

> For those who teach and assess students at any level–young children, adolescents, or adults–the theory of self management implies modes of rendering teaching more effective. The key principle is that in order for students to benefit maximally from instruction and assessment, at least some of each should match their styles of thinking. (Sternburg,1997)

Sternburg's mental self management theory and its thinking style inventory can be a very effective tool to educators. If it is utilized as a bilingual teaching method it will help address LEP students' learning needs to their thinking styles.

Sternburg's Mental Self Government

Theory of Thinking Styles

No one in particular seems to consider Individualized Instruction. Although educators are talking a lot about it and have begun to emphasize it due to the many English levels in the typical bilingual classroom, Individualized Instruction could be a goal of a teacher's strategies to attempt to provide LEP students' instruction. Sternburg's Theory could fill that void if we could match student's thinking styles to learning outcomes. It would mean to be getting closer to our goal of providing individualized instruction to really make a difference in the LEP student's learning outcomes.

Teaching Limited English Proficient Students

Up to now in grades six through eight, LEP students' schedules accommodated content classes as for example, math and science courses staffed with regular teachers with bilingual assistants. The teacher and the bilingual assistant planned the lesson following the Preview and Review Model (Native Language Instruction) using these guidelines:

1. Content area concepts are previewed in the native language by the bilingual assistant;
2. Language structures and vocabulary related to the concepts are previewed using English as a second language (ESL) methodology;
3. Concepts are taught in English as part of the regular lesson by the teacher; and

4. Concepts are reviewed in the native language by the bilingual assistant to reinforce understanding. (OKC Schools, 1992-1993)

Resource teachers are available to teach English as second language (ESL) and provide specific tutoring. This seems to be the more predominantly LEP teaching model. However, one approach is not enough to fit the needs of all students. An example of this is in the Oklahoma City Public Schools, and many other districts across the state. In fact, it is not unusual to find half of the students in a classroom speaking Spanish and the other half speaking English as second language (ESL), with one teacher trying to address all the needs of the limited English proficient (LEP) students. To meet all the LEP students' needs is not an easy task for any middle school or district in Oklahoma. To help meet the students' needs, the Oklahoma State Department of Education has begun to study the effectiveness of the existing bilingual programs and teaching approaches that are used to teach core knowledge in math, science, social studies, and other subjects in the Oklahoma public schools. By federal law, each state shall make every effort to develop English assessment (PL 98-511, 1994) and it is required by state law to test LEP students after three years in any ESL program, with the Iowa Test of Basic Skills (ITBS). School districts are showing more responsibility in staying within the margin of this law. Another reason for school efforts to implement and develop effective school programs is parents' demands for change. In this respect, Oklahoma has begun to develop alternative educational approaches to the traditional methods. An example of an alternative approach happened on March 16,2000, when the Oklahoma City School Board approved a concept that created Oklahoma's first charter school, scheduled to open in the Fall of 2000. Other reasons for the alternative approaches are judicial actions and legislative

actions and initiatives have played a big role in forcing schools to further develop and implement appropriate instructional programs for LEP students in public schools. Examples of those judicial actions are three statutory acts that serve to define bilingual education.

The first statutory act was called the "Title VI of the Civil Rights Act (1964)." Originally, it did not contain a prohibition against discrimination on the basis of language, but in 1967 Texas Senator Ralph Yarborough and six other sponsors introduced the American Bilingual Education Act on the senate floor. At that time the concept of bilingual education, says James L. Lyons, a Washington attorney, "proved politically popular, and soon more than three dozen bilingual education bills were introduced in the House of Representatives" (Harlan, 1991, p. 45). After debates, the American Bilingual Education Act was born. The nation was willing to spend money in new and sometimes experimental bilingual programs.

The second statutory act was an attachment to a controversial piece of legislation designed to achieve integration in education through busing; it was the Equal Educational Opportunity Act of 1974. This attachment was Section 1703(f) which prohibits denial of equal opportunity due to failure to overcome language barriers that impede instructional participation. In the years to come, due to these previous acts, there were several lawsuits involving LEP students. For example, Lau v. Nichols (Y72-6520 1/21/74). 0n this issue The Supreme Court of The United States ruled in 1974:

> There is not equality of treatment merely by providing students with the same facilities, textbooks, teachers, and curriculum: for students who do not understand English are effectively foreclosed from meaningful education. (p. 33)

In this lawsuit it was charged that Chinese American students were being denied an education because they were not receiving special English classes with bilingual teachers. As a result of that, the Supreme Court ruled that the San Francisco School District had violated Title VI of the Civil Rights Act of 1964 and the Department of Health, Education, and Welfare's 1970 amendment. Lau v. Nichols is the most important court case in bilingual education's recent history. It set the stage for expanded bilingual programs and even today is the basis for many arguments in favor of bilingual education.

The third statutory act was the new guidelines for the Department of Health, Education, and Welfare Act. These came to be known as the Lau Remedies. These new guidelines outlined specific methods that school officials were to use in their federally funded programs for LEP students remedial programs. In fact between 1975 and 1980, the federal government examined nearly 600 programs to see if they were following the guidelines set up by the Lau Remedies.

Alternatives

A. Inventory to Match Thinking Styles to Instruction –

> If a teacher wants to reach and truly interact with a student, he or she needs the flexibility to teach different styles of thinking, which means varying teaching style to suit different styles of thought on the part of students. (Sternberg, 1997, p.115)

Sternburg's model called the Mental Self-government Theory is based in the forms of government we have. That is, the Legislative, the Executive, the Judicial, the Monarchic, the Oligarchic, the Anarchic, the Global, the Local, the Internal, the External, the Liberal and the Conservative Styles of government. According to Sternberg (1997)

> These forms of government are not coincidental. They represent alternatives ways of organizing our thinking. Thus, the forms of governments we see are mirrors of our mind. The executive, the legislative and the judicial branch of government are also needed by people in their own thinking and working. (p.19)

Sternberg also specified that in these four forms of self government: Monarchic. Hierarchic, Oligarchic, and Anarchic, people use them to approach the world's problems. Sternburg talked about two levels of thinking Global and Local. Two types of scopes Internal and External, with two ways of leanings Liberal and Conservative are also mentioned in Sternburg's model of mental self-government.

TABLE I

THINKING STYLES AND METHODS OF INSTRUCTION

Method of Instruction	Style(s) Most Compatible with Method of Instruction
Lecture	Executive, Hierarchical
Thought-based questioning	Judicial, Legislative
Cooperative (group) learning	External
Problem solving of given problems	Executive
Projects	Legislative
Small group: students answering factual questions	External, Executive
Small group: students discussing ideas	External, Judicial
Reading	Internal, Hierarchical

Data in Table I indicates various methods of instructions and the thinking styles that are most compatible with students. Sternberg Inventory was used by given students

108 statement like "If I worked on a project, I like to plan what to do and how to do it" and were asked to rate how well the statement describes them on a 1-7 scale. Subgroups of eight questions each were given for each type of government or Thinking Style. "A second measure in the inventory was a set of Thinking Style Tasks for students. These questions measure styles via performance rather than inventory format."(Sternberg,1997, p24). A grade sheet type was used to match scores to each particular thinking style appears in Appendix G.

B. Multimedia Enhance Instruction – As an alternative approach, Multimedia Enhanced Instruction (MEI) can help provide the basics in aviation education to LEP students, as an enhancement to traditional teaching methods such as lectures and laboratory. If not as a part of the core courses maybe as elective or intermission courses.

Five years ago, the challenge of providing quality education to LEP students would have been a very expensive and time-consuming. This was due to students' great diversity of background and lack of formal knowledge in math, science and other subjects that would have required the hiring, if available, of many different kinds of tutors with the same background as the students to coach them through their learning. However, today, thanks to the availability of many computers and appropriate software, this is feasible. Within the last two years the number of computers in the schools across the state has doubled, and with the implementation of the Oklahoma network, OneNet, there is a great push to provide more tools in the quest for knowledge. "Whether you believe, we all understand that computers have altered our ability to manage information" (Pinheiro, 1996, p.343). Some say multimedia can answer all those needs and more. This is because

Multimedia has the advantage of providing vast amounts of information from a variety of sources to supply individual needs with high quality and speed. Such high performance may be the reason that computers have experienced a tremendous growth within the last few years, touching just about every part of our modern society.

According to the *World Almanac 2000*, the percentage of households in 1994 with computer owners was 24%, and has increased in 1998 to 42%. It is estimated that these numbers will continue to grow for years to come. Many factors can be credited with this computer growth, such as the increase in performance (faster processors), a decrease in costs, and the availability of a great diversity of software applications. As a consequence of this growth, it is easy to see how computers continue to impact education. The amount of electronic book volumes, lessons plans, encyclopedias, and software on just about every subject, are available with the click of a button. If the current trends continue, according to Roblyer, Edwards, and Havriluk (1997) by the year 2000 the number of applications in computer technology may have double–that is to say more software, larger electronic book volumes, better servers, and greater speed to access these resources. To continue to provide these resources, teachers and administrators must continue to enhance the fundamentals on how to use computers to meet the new challenges that are conducive to improve quality of education. Contrary to the early computer, "today there is a renewal of interest and involvement about computers," Texley and Wild (1996). In addition, computer peripherals are becoming easier to use and less technical. That is why teachers today are developing new skills and getting involved in software design and educational server applications in regard to lesson plans and curriculum. An example of these are

various math and science software programs developed with the help of teachers, such as "Frog" made by Scholastics.

Computers can help us meet the challenge of bringing a large number of students back to the field of science and aviation education, with a great outcome. To make it happens, administrators need to continue to provide the available economical resources needed to provide those computers that teachers are desperately needing to deliver high quality education to LEP students.

C. Increase Effort to Effectively Satisfy Lep Students' Needs – Teaching LEP students to use computers can be a very effective tool in school districts and state. However, to satisfy LEP students' needs there has to be a greater administrators' effort. That is allocating moneys in buying not only the computers and advanced software but also to provide teacher's training. Eventually this effort will be translated into more effective citizens in our state even if there is a great deal of controversy on how to teach LEP students, or what teaching approach is to be. A controversy is that LEP students' needs are changing constantly, needing to be redefined according to new goals. Later the students must be matched with new capabilities, with specific technology resources, and teaching methods to supply individual needs. If this matching of needs and resources is not accomplished, then the best chance to supply those needs effectively is doomed to fail. A second point in the controversy about how to teach bilingual students is the money issue. The learning outcome does not seem to justify the money invested. Politicians and legislators don't seem to agree on this subject. In fact Texas and California has just passed legislation to get away from bilingual education. However, "Education Secretary Richard

Riley, noting that Hispanics will be the largest U.S. minority in five years, urged the nation's schools Wednesday to adopt a 'dual language' approach to education" (The Daily Oklahoman, 2000, March 16).

Statement of the Problem

Regardless of the increased of LEP students in Oklahoma Middle and High Schools, there has not been an increase in the number of Limited English Proficient students going into entry College level Aviation Education Programs in comparison to traditional students. LEP students have more trouble progressing through the aviation education curriculum as compared with Non LEP students. This study provides information which can help alleviate the learning problem.

Purpose of the Study

The purpose of this study was to compare two educational approaches to assess the delivery of Aviation Education instruction, Multimedia Enhanced Instruction(MEI) versus Non-Media Enhanced Instruction (NMEI) or Traditional Instruction. The study was conducted to determine which approach will be more effective in teaching the aviation education curriculum to Limited English Proficient Students in an Oklahoma middle school. A secondary purpose of the study was to determine whether the students' performance can be explained by Sternburg's Thinking Style Theory.

The control variable was the Non-media Enhance Instruction or traditional Instruction. The dependable variables were the Multimedia Enhanced Instruction(MEI) in

the first part of the experiment. In the second part of the experiment the Executive, Legislative and Judicial Thinking Styles were the dependable variables.

The following directives guided this study:

1. Is there a difference between the mean gain scores of students receiving multimedia (MEI) and the students receiving non-media enhanced instruction (NMEI)?
2. Is there a difference between the students gain scores and different thinking styles?
3. Is there an interaction between the method of instruction, MEI and NMEI and the Executive, legislative and Judicial Thinking Styles as measured in the Sternberg's inventory.
4. To determine the most efficient educational approach in terms of knowledge gained through an analysis of Pre and Post-test scores determined during the research.

Limitations of the Study

The students could not be randomly chosen to participate in the study due to the fact that there were only two classes of LEP students in the eighth grade. The study is not a true experiment. This study is of a quasi-experimental design. Each class was split in half. Half of the students went into the computer lab to receive MEI and the other stayed in the classroom to receive NMEI. The numbers of computers limited the Multimedia class to 16 students. A second limitation was the level of English comprehension. This LEP class was mixed with levels four and five in the LASO standards due to the fact there were

not other teachers available to teach LEP students in this Middle School for levels four and five. These particular classes were made up of only eighth graders. Time was also a limitation. Teachers wanted to move on with another subject due to limitations in the curriculum schedule. The level of computer expertise was also different among the students. Some of the students were very proficient in getting from subject to subject. Other students were not very proficient and experienced a draw back when applying themselves in the study. Also, students' maturation and focus were varied.

Definitions

LEP – Limited English Proficient

CEI – Computer Enhanced Instruction

NECI – Non enhanced Computer Instruction

TI – Traditional Instruction

CAI – Computer Assisted Instruction

ESL – English as a Second Language

ITBS – Iowa Test of Basic Skills

CHAPTER II

REVIEW OF LITERATURE

The Multimedia Concept

Multimedia is a relatively new term, it includes being able to communicate through the aid of a computer. Multimedia allows one to move from text and data into the realms of graphics, sound, images, and full motion video; thus multimedia allows one to use the power of computers in new ways (Pinheair,1990). Many teachers, however, confirm that multimedia is not a new concept. Many teachers are familiar with the term educational technology or instructional technology because of their pre-service and in-service training. Roblyer, Edwards, and Havriluk,(1997) found references of these terms as early as 1948 in a development project developed by the National Education Association.

One reference reflected on these two views of technologies, past or instructional technology and present technology or multimedia. If one was to reflect about these two concepts, one had to say that both are similar. They both focus on the process of applying tools for educational purposes. These applied tools are many and vary depending on the school needs. Tools such as:

A. Media and Audio Visual Communications Tool. This tool goes back as early as 1900, when it was called audio visual movement or "ways of delivering information that could be used as alternatives to look" and

lectures it was developed by instructors in higher education who held that media such as slides and films delivered information in more concrete and effective ways. At that time and still does today that concept had to do primarily with the design and use of messages that control the learning process.

B. The Instructional System Tool. This tool goes back to the 1960s and 1970s adding another view to the media and audiovisual communication concept in education. This concept held the belief that booth human and non-human resources (teachers and media) could be parts of a system for addressing instructional needs. The process carefully moved along to supply those identified needs and objectives.

C. The Vocational Training Tool. Originally was referred as technology education, it came from industry trainers and vocational educators. The idea was to prepare students for the workforce.

D. The Multimedia Tool. Originated in the last half of this century and still is strong to accompany the implementation of computers and its recognition as instructional tool. In 1960 and 1970s this perspective was called educational computing and was compounded by tools and needs together.

Historical Overview of the Multimedia Concept

The history of multimedia did not really start until the birth of microcomputers about twenty years ago. The first computers where used as calculators. Later models were designed to also include word processing. Expressing ideas freely with the aid of

computers definitely open new opportunities into the world of communications by making the tasks simpler and easier. As computers improved, programmers and operators could utilize more pictures, graphs, charts, and figures. Other applications which came about was Desktop publishing. Page layout with different typesetting and shapes emerged and, together with graphics, became the standard. Next, sound was added to computer software. Then, as sound cards and more advanced chips became available, people began adding voice to their computer documents opening another way to communication, making computers and multimedia even more attractive. By now computers had all the needed components in place for multimedia to continue to grow to become the new method that will allow one to express ideas in a non traditional way with graphics, sound, and text capabilities. Much of the information in the above summary was gleaned from the Multimedia Handbook, (Kayes, 1996).

Another Perspective of the Multimedia Field

There is another historical perspective of the field of Multimedia and that was provided by Niemiec and Walberg (1989). They consider computer history as being divided into two periods; before and after the introduction of microcomputers. The separation began when the microcomputers entered schools (see Figure 1).

The Era Before Microcomputers

1950 Flight simulator used to train pilots at MIT

1959 First used with school children: IBM 650

1966 Dedicated mainframe instructional computing systems (IBM 1500) offered. First authoring system (Coursewriter).

1967 CCC offers microcomputer-based instructional system (DEC PDP/1) Mitre Corporation offers the TICCIT instructional computing television systems.

1970 CDC offers the PLATO instructional system.

The Microcomputer Era and Beyond

1977 The first microcomputer enters the school.

1980 Seymour Papert writes about LOGO in Mindstorms; he starts the LOGO movement.

1980s MECC offers microcomputer software; publishers begin developing courseware. MicroSIFT, EPIE, and others offer courseware evaluations. The computer literacy movement emerges then wanes after 1987.

1990s Multimedia and other network systems are used; multimedia use increases; widespread use of the Internet.

Figure 1. Milestones and Trends in Educational Computing.

Learning Theories When Integrating Curriculum and Multimedia

Taylor stated in 1980 our learning theories when integrating curriculum and multimedia are of three types.

A. Those who advocated using computers as tools such as in word processing and numerical calculations.

B. Those who viewed computers mainly as teaching aids or "tutors" such as in drills, tutorials, and simulations

C. Those who believed the most powerful tool of computers was programming.

These earlier views were very independent and could not be compromised for any one of them to have a particular time and place before the other. Today the extend of the argument has spread much more. Technology to date has made it possible for many tools or resources to be used in multimedia.

Roblyer, Edwards, and Havriluk (1997) discussed two strategies in integrating technology into teaching and learning (see Table II).

> One view is the Directed view or the Behaviorist learning theory. The second view is the constructivist view or the Cognitive learning theory. The differences between these two methods are that advocates of directed instruction believe that learning happens when the knowledge is transmitted to the learner. On the constructivist side, philosophers believe that human construct all knowledge in their minds, so learning happens when a learner constructs both mechanism for the Learning, and his/her own version of knowledge. In addition, the advocates of directed instruction say that the instruction has to be systematic and that the learning has to be directed through a structural approach or model. On the other hand, the constructivists say that learning should be unstructured and the approach to do should be self-structured and constructed shaped by experiences, and attitudes. (p. 56)

TABLE II

INSTRUCTIONAL NEEDS ADDRESSED BY TWO METHODS OF INSTRUCTION

Method of Instruction	Instructional Need
Directed	A. Individual pacing and remediation, especially when teacher time is limited. B. Making learning paths more efficient (e.g., faster), especially for instruction in skills that are prerequisite to higher-level skills. C. Performing time-consuming and labor-intensive tasks (e.g., skill practice), freeing teaching time for other, more complex student needs. D. Supplying self-instructional sequences, especially when human teachers are not available, teacher time for structured review is limited, and/or students are already highly motivated to learn skills.
Constructivism	A. Making skills more relevant to students' backgrounds and experiences by anchoring learning tasks in meaningful, authentic (e.g., real-life), highly visual situations. B. Addressing motivation problems through interactive activities in which students must play active rather than passive roles. C. Teaching students how to work together to solve problems through group-based, cooperative learning activities. D. Emphasizing engaging, motivational activities that require higher-level skills and prerequisite lower-level skills at the same time.

Instructional and Technological Tools to Integrate Curriculum and Multimedia

Instructional tools will vary depending on what instructional learning model is designed; directed learning or the constructivist model. If it is directed learning tools more likely will be needed in the instruction. If the instructions are used in the software it is known as computer assisted instruction (CAI). Examples of these tools are drill and practice, tutorials, and simulation software. On the other hand, if the model chosen is

Constructivist, tools will be needed to manage the instruction and when used in the computer are called computer managed instruction (CMI). Example of these tools are testing, record keeping, and reporting software. In reality it has been found that in both the directed learning and in the constructivist methods, there is an integration of both CAI and CMI which is referred as integrated learning systems (ILS).

In order to help defining these common tools, Roblyer, Edwards, and Havriluk (1997) have classified them in:

A. Instructional Software –

1. Drill and Practice Software. Program which allow learners to work problems or answer questions and get immediate feedback on correctness;
2. Tutorial Software. Programs that act like tutors by providing all the information and instructional activities that a learner needs to master a given topic (e.g., information summaries explanation, practice routines, feedback, and assessment);
3. Simulation Software. Programs that model real or an imagined systems to show how those systems or similar ones work;
4. Instructional Games. Programs designed to increase motivation by adding games and rules to learning activities (usually either drills or simulations);
5. Problem-Solving Software –
   a. Programs That Teach Directly (through explanation and/or practice) the steps involved in solving problems;

b. Programs That Help Learners acquire problem solving skill by giving students opportunities to solve problems.

B. Technology Support – Materials that are generator tools. Tools that assist in a teacher' production of instructional materials.

1. Data Collection and Analysis Tools. Resources that help teachers collect and organize numerical information that indicates student progress.

2. Graphics Tools. Tools that allow production of pictures and illustrated written products.

3. Planning and Organizing Tools. A variety of tools that help teachers and students conceptualize their work before beginning the assignment.

4. Research and Reference Tools. CD-ROM versions of encyclopedias, atlases, and dictionaries.

5. Tools to Support Specific Content Areas. Tools that assist with activities associated with certain content areas.

Methodology to Learning/Teaching Limited English Proficient Students

> There is no real agreement within the educational community over which program works best, ESL, Immersion, Bilingual Education methods, or any combination of these. Every school is unique, with its own set of problems and its own blend of students. Educators across the country study the programs that have been successful. Then they try to adapt these to their own student needs. (Harlan, 1991, p. 17)

However, Harmayan and Damiko (1991) only accepted two formal ways to teach LEP students; True Bilingual method and The ESL combined with some kind of Immersion or Inclusion.

True Bilingual Education – Contrary to popular perception, True Bilingual Education can involve a wide range of programs. One of the ways of teaching it, would be at home where the students learn English and whatever native language their parent's speak at the same time. This teaching happens in early childhood at school, at home, or both. This program involves children of bilingual parents who teach their kids at home or reinforce what their kids are learning at bilingual school. Another range of programs that teaches Bilingual Education involves the teachings of English after helping the students to master their first language, for example Spanish. In the classroom, this Bilingual Education can be extended for the first few years of instruction in the native language with English being introduced only gradually. (Hamayan & Damico, 1991)

The ESL Program – involves LEP students who have been placed in an English classroom. This program emphasizes drills on grammatical structures and dialogues. As mentioned earlier, there is a large variation of these programs. They are being used with instructional processes such as the "reciprocal interaction" model (Cummins,1984) also called Cooperative learning and the "instructional scaffolding" model (Langer & Applebee,1986). The major focus of these models is the purposeful nature of learning, where the learner actively seeks to learn skills or information in pursuit of a relevant goal. Components of any learning task are always seen in the context of their relation to the whole task or goal. However, "the teaching of sub skills (e.g., spelling, phonics, and part

of speech) in isolation, where they are not related to a conceptualized whole, is considered to undermined student interest" (Collins, 1994). In addition, these ESL approaches focus on purpose and context learning. These approaches generally stress the importance of interaction between the learner and the teacher in both oral and written forms, with the mutual exploration of ideas rather than one-way transmission from the teacher to the learner. In this type of relationship, the teacher tried to help the student relate the new knowledge to what the individual already knows. This theory is being presented using "Reciprocal Interaction," "Communicative Relationship," and "Cooperative Learning."

This ESL approach emphasizes the need for the teacher to relinquish control of student learning and to replace it with guidance and communication which encourages collaborative activities and student-student communication. This ESL approach refers to a variety of classroom techniques in which students work on learning activities in small groups in a structure that encourages mutual cooperation. Typically, These groups consist of four to five members that are heterogeneous in regard to sex, ethnicity and/or ability. The idea with this approach is to focus primarily on the acquisition of basic skills. Each team is responsible for the learning of all of its members and rewards are earned by teams rather than individuals.

While ESL programs differ substantially in the role of the first language, they differ significantly less in terms of their goals. In a study concluded by the Development Associates, every district surveyed listed as a goal, the development of the student's English to the level of participation in all English classrooms. In addition, 91 percent listed as a goal the development of other academic skills concurrently with the student's

language development. Only 15 percent listed as a goal the maintenance of the student's first language.

> This poor interest for maintaining or improving the student's first language seems to be the result of a commonly held belief among Americans that childhood bilingualism led to cognitive and linguistic deficits as well as a sense of personal rootlessness. (Hamayan,1991, p.50)

Sternburg's Mental Self Government

Thinking Style Inventory

Sternburg-Wagner Inventory is comprised of 108 questions. Each set of questions in groups of eight questions each. Each set of questions contained statements that matched students different and thinking styles. These questions contained statements give an opportunity to select a legislative, executive, or judicial response. These responses will match not only students serving three functions, the Legislative, the Executive and the Judicial functions; but also these responses will match four forms of mental self-government. Each form results in a different way of approaching the world and its problems, the Monarchic, the Hierarchic, the Oligarchic and the Anarchic forms. In addition, these responses will match the student's leanings of mental self-government, the Global, the Local, the Internal, the External, the Liberal, and the Conservative leanings. There is not right or wrong response, however. Below are the characteristics Sternburg (1997) used to students and thinking styles:

1. <u>The Legislative Style</u> students like to do things their own way. They like creating, formulating, and planning things. In general, they tend to be people who like to make their own rules.

2. The Executive Style students prefer problems that are given to them and like to be and take pride in being doers-in getting things done. The legislative person often gets his satisfaction out proposing things, the executive person, out of getting done what was in the proposal. The two kinds of people thus well complement each other.
3. The Judicial Style students like to evaluate rules and procedures and to judge things. Also they prefer problems in which they can analyze, evaluate things and ideas and judge both structure and content.
4. The Monarchic Style students are individuals that are single-minded and driven solving a problem. Monarchic people can be counted on to get a thing done, given that they have set their mind to it.
5. The Hierarchic Style students have a hierarchy of goals and recognizes the need to set priorities, as all goals cannot always be fulfilled, or at least fulfilled equally well. This student tends to be more accepting of complexity than is the monarchic person, and recognizes the need to view problems from a number of angles so as to set priorities correctly.
6. The Oligarchic Style students are like the hierarchic student in having a desire to do more than one thing within the same time frame. But unlike hierarchic people, oligarchic people tend to be motivated by several, often competing goals of equal perceived importance. Often these individuals feel pressure in the face of competing demands on their time and other resources.

7. The Anarchic Style students seem to be motivated by a potpourri of needs and goals that can be difficult for him or her, as well as for others to sort out. Anarchic student take what seems like a random approach to problems; they tend to reject systems, and especially rigid ones, and to fight back at whatever system they see as confining them.

8. The Global Style students prefer to deal with relatively large and abstract issues. They ignore or don't like details, and prefer to see the forest rather than the trees. Often they loose sight of the trees that constitute the forest.

9. The Local Style students are individuals that like concrete problems requiring working with details. They tend to be oriented toward the pragmatics of the situation and are down-to-earth. Global and local people can work particularly well together, because each attends to an aspect of task completion than the other would rather forget.

10. The Internal Style students are concerned with internal affairs- That is to say, these individuals turn inward. They tend to be introverted, task oriented, aloof, and socially less aware. They like to work alone. Essentially their preference is to apply their intelligence to thing or ideas in isolation from other people.

11. The External Style students tend to be extroverted, outgoing, and people oriented. Often they are socially sensitive on what is going on with others. They like working with other people whenever possible.

12. The Liberal Style students like to go beyond existing rules, and procedures, to maximize change, and to seek situations that are somewhat ambiguous.

The individuals are not necessarily "politically" liberal. Thrill seekers tend to have liberal styles, as do people who, in general, quickly becomes bored.

13. The Conservative Style students like to adhere to existing rules and procedures, minimize change, avoid ambiguous situations where possible and stick with familiar situations in work and professional life (refer to Appendix G).

Summary

Two sectors of our society, the ethnic groups who have recently come into the USA, and LEP students that are going to Middle Schools or High Schools are facing different cultural and linguistic needs. These needs have to be addressed and met in order to enhance the delivery of education to LEP students and other students in Oklahoma. Some of those needs are :

A. The need to learn/teach basic core knowledge in a variety of ways, since one way is not adequate.

B. To allow other possibilities that will bring us closer to individualized instruction and to more specialized education, such as aviation education.

Multimedia Enhanced Instruction and student's Thinking Styles matching can enhance the effectiveness of the Teaching Instruction and Education. Such effective education could then offer these ethnic groups or minorities a winning edge.

CHAPTER III

METHODOLOGY AND DATA COLLECTION

Introduction

The purpose of this study was to compare two educational approaches to assess the delivery of aviation education instruction, Multimedia Enhanced Instruction (MED) versus Non-Media Enhanced Instruction (NMEI) or traditional instruction. The study was conducted to determine which approach will be more effective in teaching the aviation education curriculum to Limited English Proficient (LEP) students in an Oklahoma middle school. A secondary purpose of the study was to determine whether students' performance can be explained by Sternburg's Thinking Style Theory. Asimov's Library of The Universe software was used and compared with a Non-Media Enhanced Instruction. Permission was given by the Oklahoma State University Review Board to conduct the study on human subjects, please see Appendix C. Also, permission from Jackson Middle School was granted to use two ESL Science classes to conduct the study. A letter from Aims Multimedia was granted to use the Aim's Multimedia assessment module in determining the student knowledge gain Vs teaching method. A copy of the parental consent form, both in English and Spanish is included (see Appendix B).

Population

This study was conducted during the second semester of the school year 1998-1999 at Jackson Middle School in the Oklahoma City Public School District. The total number of students at Jackson was approximately 700 in 1999. The school population is made up of approximately 65% Hispanic students, with approximately 80 LEP students in the eighth grade. The population of LEP students for this study was 32, all from the eighth grade. The student population consisted mostly of hispanic Limited English Proficient students in level 4 and 5 in the Laso scale from one to five where five is the most proficient level.

Data Collection and Sampling

Special precautions were taken to keep the two groups as equal as possible with regard to their English proficiency level. Each class was divided into two groups, for teaching purposes, one half of the class received Non-Media Enhanced Instruction, the traditional way, lecture type; the other half received instruction through the Multimedia Enhance technology. In the traditional time format, the lesson was given for 55 minutes over two weeks time period. During this time, the teacher lecturer passed out worksheets for the students. On the other hand, the Enhanced Multimedia Instruction was delivered through the computer, under the supervision of the same classroom teacher and the assistance of a teacher-aid. The students were able to work interactively using Multimedia with a computer software developed by Asimov called "The Library of The Universe." Asimov also had computer designed questions which allow the students to draw their own

conclusions. As images were accessed and presented on the computer screen, both the teacher and the students have the opportunity to interact with the information. Pictures from the different planets were shown on the screen in a planet's sequence. Such sequence and subtitles were established by the teacher prior to class. The objective was to direct the students to a different subject area every other day. After each lesson, the students were tested by the aid of computer tests on the lesson studied and learning outcome grades were given for reviewing purposes. Refer to Appendix E where a copy of the lesson plans are included for review.

Sample

The sample of the study consisted of 32 students, all eighth graders, enrolled in Science in the ESL team. The sample consisted of two ESL classes. Each class was divided in half. Half from each class was exposed to MEI and the other half was exposed to NMEI with a Bilingual teacher, the same Bilingual teacher also conducted the other class but all the instructions were given only in English by the computers.

Pre-Post AIMS Test

The Pre-post Aims test used in this study was designed using Benjamin's Bloom "Six Levels of Cognitive Complexity" which is included in the AIMS Multimedia Teacher's module. The idea was to evaluate a student's knowledge at this particular time that the test was given and student's thinking skills on the following levels, from the simple to the complex: Knowledge (rate memory skills), Comprehension (the ability to relate or retell), Application (ability to apply knowledge outside its origin), Analysis

(relating and differentiating parts of a whole, Synthesis (relating parts to a whole, and Evaluation (making a judgment or formulating an opinion).

The main concepts covered in the Solar System test were:

- To explain the theory of the origin of the Solar System.
- To explain the influence of the Sun's magnetosphere on all the planets of the Solar System.
- To show the planet's surface characteristics.
- To show the size and relative position of inner/outer planets in the Solar System.
- To show the features of Earth that allow for Life.
- To give a comparison of all the planets.

A copy of the Pre and Post test is shown in Appendix F. The Pre-Post tests were given to all individuals, only in English, and without picture graphics or sounds.

Thinking Style Inventory

The Thinking Style Inventory by Sternburg (1997) was also given to both group of students at the beginning of the study. Data collected form the inventory was used to determine student thinking styles, in particular the Executive Thinking Style and their relationships to learning outcomes.

Research Design

Two reasons pushed the study to the quasi-experimental side. The randomness of the sample was not there due to the fact that the classes are already made when the study

started. The second reason was the researcher's desire to compare the outcomes of these two instructional teaching methods.

Statistical Analysis

An Analysis of Variance (ANOVA) technique was used to test any significant difference between the Multimedia Enhance teaching Instruction and the Non-Media Enhanced Instruction and the learning outcome (knowledge gain) given by the post tests. A single classification ANOVA was used to find any differences. The post test being the dependable variable and the two teaching methods of instruction, MEI and NMEI were the independent variables.

The Multiple classification ANOVA was used to find significant differences between the teaching methods, and where there was any relationships with The Sternburg's Thinking Styles, Executive, Legislative, and Judicial.

CHAPTER IV

FINDINGS

The purpose of this study was to compare two educational approaches to assess the delivery of Aviation Education instruction, Multimedia Enhanced Instruction (MEI) versus Non-Media Enhanced Instruction (NMEI) or Traditional Instruction. The study is to determine which approach will be more effective in teaching the aviation education curriculum to Limited English Proficient Students in an Oklahoma middle school. A secondary purpose of the study was whether the performance of the students could be explained using Sternberg's Thinking Style Theory.

The following directives guided this study:

1. Is there a difference between the mean gain of students receiving multimedia-enhanced instruction and the students receiving non-multimedia enhanced instruction?
2. Is there an interaction between the method of instruction and the thinking styles as measured in the Sternburg-Wagner Inventory?
3. To define the most efficient educational approach in terms of knowledge gain through the analysis of Pre and Post-tests implemented during the research.

Learning Outcomes (Knowledge Gain)

Knowledge gain was the difference between the Post test and the Pre-Test Scores. In terms of the two different teaching methods, the knowledge gain is more important than the grade itself. The score per se does not tell us which teaching method is best. Gain comes about by taking the difference between Post test and Pre-Test. Both the Pre-Test and Post test consisted of twenty two multiple choice questions, one reading comprehension that included twelve items, and one matching best answer that included ten items. Refer to Appendix F for the Pre-Post test. The Post test contained a total of 22 items for a maximum of 100 points. Summary statistics for the knowledge gain (g) are provided in Table III.

TABLE III

SUMMARY STATISTICS FOR POST TEST SCORES

Category	Statistics
Number of persons	32
Number of Items	22
Mean Score	5.78
Median Score	10
Standard Deviation	7.55
Possible low score	0
Possible high Score	100
Obtained low score	4
Obtained high score	37

An examination of data presented in Table III revealed that the mean for the Post test for both Multimedia and Non-Media Enhanced instruction was 5.78 and a standard deviation of 7.55; The highest percentage gain was 64 and the lowest was 05. Data presented in Table IV shows gain frequency, percentile Rank, and a Histogram of the gain. The mean, median, and mode are very close to each other. The Histogram showed almost no skewness.

TABLE IV

GAIN SCORES FOR MULTIMEDIA AND NON-MEDIA ENHANCED TEACHING

Gain Score	Frequency	% rank	Histogram of Gain
18	4	100	xxxx
17	0	93	
16	0	86	
15	0	79	
14	5	72	
13	1	65	x
12	0	58	
11	0	51	
10	1	44	x
09	3	37	xxx
08	0	30	
07	0	13	
06	0	10	
05	7	07	xxxxxxx

A comparison of the Descriptive statistics for the Multimedia and the Non multimedia classes showed that the gain mean percentage of the Non Media type of instruction was higher (11.56%) than the Multimedia gain mean percentage (8.81%) as shown previously in Table V. The standard deviation for the gains in both classes were close (9.55 Vs 7.67) Distributions for the Gain in the Multimedia class was slightly positively skewed. The same can be said about the Non Media enhanced class. The most frequent gains in the Multimedia Class were 5% and 18% in the Non Multimedia.

Method of Instruction and Sternburg Thinking Styles

Two Way Analysis of Variance

Two way Analysis of Variance was used to test the gains vs the types of Instruction: 1) To find whether there were significant differences between Multimedia and Non-Multimedia in relation to the outcome; 2) to find whether there were significant differences between the Legislative, Executive and Judicial Thinking Styles against their learning outcome gains.

The corresponding statistical Null hypothesis were tested:

1. There is no significant difference between gain scores of students receiving Multimedia Enhanced Instruction and Non-Media Enhanced Instruction.
2. There is no significant interaction between the two different methods of instruction and Sternberg Thinking Styles.

Data presented in Table VI revealed that the mean gain scores for the Multimedia Enhanced Instruction was not significantly different from the Non-media enhance

instruction, ($F_{1,34}$ =.98, p>.05). Therefore the null hypothesis of no difference between the method of instruction was not rejected. The mean gain score for the Multimedia class was 8.81 and the mean score for the Non media was 11.56. Refer to Table VII.

TABLE VI

TWO WAY OF VARIATION FOR METHOD OF INSTRUCTION AND LEARNING OUTCOME

Source of Variation	df	Sim of Squares	Mean Square	F-value
Within	1	1873.22	1873.22	.86
Among	1	56.55	56.55	

TABLE VII

GAIN SCORES OF STUDENTS IN MULTIMEDIA AND NON-MEDIA CLASSES

Multimedia		Non-Media
Mean	8.81	11.56
Standard Error	2.8	3.2
Sample Size	16	16

It was found when using the ANOVA that there was significant interaction between the Thinking Styles and outcome (gain) (F 1,28,p >10.95). Therefore the null hypothesis of non-interaction was rejected.

Discussion

The purpose of this study was to compare two educational approaches to assess the delivery of aviation education instruction, Multimedia Enhanced Instruction (MED) versus Non-Media Enhanced Instruction (NMEI) or traditional instruction. The study was to determine which approach will be more effective in teaching the aviation education curriculum to Limited English Proficient Students in an Oklahoma middle school. A secondary purpose of the study was whether the performance of the students could be explained by Sternburg's Thinking Style Theory.

Is There a Difference Between Gain Scores of Students Receiving Multimedia Enhanced Instruction And Non-media Enhanced Instruction.

Although the gain mean of the Multimedia class was lower than the Non-Media, it was not greatly different. This result was surprising considering the student were very excited about the computers and Multimedia. There are a few reasons that can help understand the difference.

One is the fact that the comprehension level of these LEP students is not quite up to the level that is required in the high-speed setting of the multimedia enhanced instruction. The way the multimedia lesson was structured may have influenced the result. The Asimov's "Library of The Universe" presentation was not available in Spanish, only in

English. However, multimedia bilingual presentations are becoming more accessible in the science fields, which may help to overcome this problem.

A second fact was the size of the sample. A sample size of 32 students makes it more difficult to detect any significant differences. However, it is hard to plan in a middle school setting due to the fact that things are always changing, leaving the researcher expecting the unexpected. An example in case is that the days when the study was conducted.

Finally, the level of competency in the use of computers may have had an influence. There was a difference in the ability of students using the computers. Some did not feel comfortable because they had never studied a subject with the aid of a computer.

Is There an Interaction Between the Two Different Methods of Instruction and Sternburg's Thinking Styles

In this study the Sternberg Thinking styles were used for the analysis. Sternberg has 13 subjects but due to the limitation of time, this study only utilized three: Executive, Legislative and Judicial. The scales used to grade the thinking styles were:

1. Not at all; 2. Not very well; 3. Slightly well; 4. Somewhat well;

5. Well; 6. Very Well; and, 7. Extremely well. Refer to Table VIII.

After analyzing the correlations, significant relationships were found in the data from Sternberg's Executive, Legislative and other thinking styles and the outcome (knowledge gain) of both methods of instruction.

TABLE VIII

KNOWLEDGE GAIN COMPARED TO STERNBURG'S LEGISLATIVE, EXECUTIVE, AND JUDICIAL THINKING STYLES

Knowledge Gain	Legislative Think Style *High Scores	Executive Think Style **Low Scores	Judicial Think Style ***Other Scores
Multimedia Enhanced Instruction			
5	0	3.25	4.0
18	0	0	0
13	0	0	4.5
4	0	3.125	2.25
4	5.75	0	2.75
9	6.875	0	3.5
0	0	0	1.375
14	0	2.75	3.875
18	0	0	6.175
5	0	0	4.625
4	0	0	3.75
37	0	0	3.875
0	0	0	0
0	0	3.5	4.375
5	0	0	4.25
5	0	0	2.0
Non-Multimedia Enhanced Instruction			
10	0	0	3.625
14	5.875	3.0	3.5
4	0	0	2.25
18	0	0	5.375
9	0	0	2.625
18	0	0	0
18	0	0	4.75
18	0	3.5	4.2
14	0	0	4.8750
9	0	0	3.125
4	0	0	3.3
14	6.0	0	2.75
5	6.0	0	1.75
5	0	0	5.0
5	0	0	0
5	0	0	0

Note: *=Based on Sternburg's Thinking Style High Scale, 6.1–7.0; **=Sternburg's Low Scale, 1.0–4.8; ***=Sternburg's Other Scale, 4.9–6.0

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to compare two educational approaches to assess the delivery of aviation education instruction, Multimedia Enhanced Instruction (MED) versus Non-Media Enhanced Instruction (NMEI) or traditional instruction. The study was conducted to determine which approach is more effective in teaching the aviation education curriculum to Limited English Proficient (LEP) students in an Oklahoma middle school. A secondary purpose of the study was to determine whether the students' performance could be explained using Sternberg's Thinking Style Theory.

This study was conducted in an urban middle school in Oklahoma City. The school population was approximately 65% Hispanic, with approximately 80 (LEP) students in the eighth grade. The population of LEP students for this study was 32 all from the eighth grade. The student population consisted mostly of Hispanic Limited English Proficient students in level four and five in the LASO scale. The LASO scale goes from one to five with five being the most proficient level.

Two-way ANOVA calculations were used to test any significant difference between the Multimedia Enhance teaching Instruction and the Non-Media Enhanced

Instruction and the learning outcome (Pre-Post test gains). The post test being the dependable variable and the two teaching methods of instruction, MEI and NMEI were the independent variables

The Multiple Analysis of Variance was used to determine whether there were relationships between thinking styles theories and student learning outcomes (Knowledge gains).

Conclusions

Although the mean of gain of student progress utilizing the Multimedia Enhanced Instruction was lower than the Non- Media Enhanced Instruction there was not a significant difference. The Multimedia Enhance instruction gave close results in the gain and yet may be an excellent alternative to teach LEP students in the future when LPD students become more proficient in the use of computers.

The Isaac Asimov's "Library of the Universe" could be used by other aviation or science classes. The amount of material covered by the Multimedia Enhanced Instruction included many pictures and graphics with sound, which tended to bring Science alive. Multimedia can be an alternative tool to teach aviation education to LEP students.

Recommendations

There is a need to further study Multimedia Enhanced Instruction in the classroom for longer periods of time and in other subject areas. The idea is to get more observations in other fields and to compare outcomes.

The computer expertise of the students is a requirement. Maybe a little introductory course on the use of computer would greatly benefit the students. This factor affected our data very significantly. The more prepared the students are as a group the more consistent the data are going to be, making this experiment more effective.

1. Encourage other teachers to further their studies in bilingual education so they can be proficient in two or three languages.
2. Incorporate a second language into teaching programs (pre-service teaching) to make teachers proficient in a second language.
3. Incorporate in-service training for teachers in the bilingual field and multimedia methods and aids.
4. Use the Internet to incorporate multimedia or to make it accessible to these LEP students at the schools' sites. The idea is to give the student another tool to enhance their learning.
5. Use Multimedia to enhance the teaching of science to LEP students as an alternative method to NMEI.
6. Consider the student thinking styles to make the teaching more effective.

Finally, the use of computers with high performance processors that can handle the large files and vast amount of sound and graphics it takes to produce a second language is encouraged in science courses such as aviation education. Most of the middle schools and high schools have doubled the number of computers in their classrooms, yet there are still a large number of classrooms without computers. Multilingual or bilingual software is desperately needed in the classrooms where bilingual students are taught.

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APPENDIXES

APPENDIX A

THINKING STYLES INVENTORY

Instructions

·· Rate yourself by selecting from the drop down menus beside each item, the rating that corresponds to how well the statement describes you:

Thinking Styles Inventory

Read each of the following statements, and then rate yourself on a 1-7 scale, where each rating corresponds to how well a statement describes you:

1 =Not at all; 2 =Not very well; 3 = Slightly well; 4= Somewhat well; 5= Well; 6 = Very well; and 7 = Extremely well.

(28-29)

1. When making decisions, I tend to rely on my own ideas and ways of doing things.
2. When faced with a problem, I use my own ideas and strategies to solve it.
3. I like to play with my ideas and see how far they go.
4. I like problems where I can try my own way of solving them.
5. When working on a task, I like to start with my own ideas.
6. Before starting a task, I like to figure out for myself how I will do my work.
7. I feel happier about a job when I can decide for myself what and how to do it.

8. I like situations where I can use my own ideas and ways of doing things.

(33-34)

1. When discussing or writing down ideas, I follow formal rules of presentation.
2. I am careful to use the proper method to solve any problem.
3. I like projects that have a clear structure and a set plan and goal.
4. Before staffing a task or project, I check to see what method or procedure should be used.
5. I like situations in which my role or the way I participate is clearly defined.
6. I like to figure out how to solve a problem following certain rules.
7. I enjoy working on things that I can do by following directions.
8. I like to follow definite rules or directions when solving a problem or doing a task.

(37-38)

1. When discussing or writing down ideas, I like criticizing others' ways of doing things.
2. When faced with opposing ideas, I like to decide which is the right way to do something.
3. I like to check and rate opposing points of view or conflicting ideas.

4. I like projects where I can study and rate different views and ideas.
5. I prefer tasks or problems where I can grade the design or methods of others.
6. When making a decision, I like to compare the opposing points of view.
7. I like situations where I can compare and rate different ways of doing things.
8. I enjoy work that involves analyzing, grading, or comparing things.

(45-46)

1. When talking or writing about ideas, I stick to one main idea.
2. I like to deal with major issues or themes, rather than details or facts.
3. When trying to finish a task, I tend to ignore problems that come up.
4. Use any means to reach my goal.
5. When trying to make a decision, I tend to see only one major factor.
6. If there are several important things to do, I do the one most important to me.
7. I like to concentrate on one task at a time.
8. I have to finish one project before starting another one.

(49-50)

1. I like to set priorities for the things I need to do before I start doing them.

2. In talking or writing down ideas, I like to have the issues organized in order of importance.
3. Before starting a project, I like to know the things I have to do and in what order.
4. In dealing with difficulties, I have a good sense of how important each of them is and what order to tackle them in.
5. When there are many things to do, I have a clear sense of the order in which to do them.
6. When starting something, I like to make a list of things to do and to order the things by importance.
7. When working on a task, I can see how the parts relate to the overall goal of the task.
8. When discussing or writing down ideas I stress the main idea and how everything fits together.

(52-53)

1. When I undertake some task, I am usually equally open to starting by working on any of several things.
2. When there are competing issues of importance to address in my work, I somehow try to address them simultaneously.
3. Usually when I have many things to do, I split my time and attention equally among them.

4. I try to have several things going on at once, so that I can shift back and forth between them.
5. Usually I do several things at once.
6. I sometimes have trouble setting priorities for multiple things that I need to get done.
7. I usually know what things need to be done, but I sometimes have trouble deciding in what order to do them.
8. Usually when working on a project, I tend to view almost all aspects of it as equally important.

(56-57)

1. When I have many things to do, I do whatever occurs to me first.
2. I can switch from one task to another easily, because all tasks seem to me to be equally important.
3. I like to tackle all kinds of problems, even seemingly trivial ones.
4. When discussing or writing down ideas, I use whatever comes to mind.
5. Find that solving one problem usually leads to many other ones, that are just as important.
6. When trying to make a decision, I try to take all points of view into account.

7. When there are many important things to do, I try to do as many as I can in whatever time I have.
8. When I start on a task, I like to consider all possible ways of doing it, even the most ridiculous.

(60-61)

1. I like situations or tasks in which I am not concerned with details.
2. I care more about the general effect than about the details of a task I have to do.
3. In doing a task, I like to see how what I do fits into the general picture.
4. I tend to emphasize the general aspect of issues or the overall effect of a project.
5. I like situations where I can focus on general issues, rather than on specifics.
6. In talking or writing down ideas, I like to show the scope and context of my ideas, that is, the general picture.
7. I then to pay little attention to details.
8. I like working on projects that deal with general issues and not with nitty-gritty details.

(62-63)

1. I prefer to deal with specific problems rather than with general questions.
2. I prefer tasks dealing with a single, concrete problem, rather than general or multiple ones.

3. I tend to break down a problem into many smaller ones that I can solve, without looking at the problem as a whole.
4. I like to collect detailed or specific information for projects I work on.
5. I like problems where I need to pay attention to detail.
6. I pay more attention to the parts of a task than to its overall effect or significance.
7. In discussing or writing on a topic, I think the details and facts are more important than the overall picture.
8. I like to memorize facts and bits of information without any particular content.

(66-67)

1. I like to control all phases of a project, without having to consult others.
2. When trying to make a decision, I rely on my own judgment of the situation.
3. I prefer situations where I can carry out my own ideas, without relying on other.
4. When discussing or writing down ideas, I only like to use my own ideas.
5. I like projects that I can complete independently.
6. I prefer to read reports for information I need, rather than ask others for it
7. When faced with a problem, I like to work it out by myself
8. I like to work alone on a task or problem.

(68-69)

1. When starting a task, I like to brainstorm ideas with friends or peers.

2. If I need more information, I prefer to talk about it with others rather than to read reports on it.
3. I like to participate in activities where I can interact with others as a part of a team.
4. I like projects in which I can work together with others.
5. I like situations where I interact with others and everyone works together.
6. In a discussion or report, I like to combine my own ideas with those of others.
7. When working on a project, I like to share ideas and get input from other people.
8. When making a decision, I try to take the opinions of others into account.

(71-72)

1. I enjoy working on projects that allow me to try novel ways of doing things.
2. I like situations where I can try new ways of doing things.
3. I like to change routines in order to improve the way tasks are done.
4. I like to challenge old ideas or ways of doing things and to seek better ones.
5. When faced with a problem, I prefer to try new strategies or methods to solve it.
6. I like projects that allow me to look at a situation from a new perspective.
7. I like to find old problems and find new methods to solve them.
8. I like to do things in new ways not used by others in the past.

(73-74)

1. I like to do things in ways that have been used in the past.
2. When I'm in charge of something, I like to follow methods and ideas used in the past.
3. I like tasks and problems that have fixed rules to follow in order to complete them.
4. I dislike problems that arise when doing something in the usual, customary way.
5. I stick to standard rules or ways of doing things.
6. I like situations where I can follow a set routine.
7. When faced with a problem, I like to solve it in a traditional way.
8. I like situations where the role I play is a traditional one.

APPENDIX B

CONSENT FORM

Jackson Middle School
2501 S Villa
Oklahoma City, Ok 73108
405-634 6357 x118

03-08-99

Dear Parents:
Estimados Padres:

Your child is eligible to participate in a English as a second language (ESL) project. In this project the students will study the Solar System in two different ways. One way is the traditional way with their teacher Mrs. Borga. The other way is on the computers, again under Mrs Borga's Supervision.

Su hijo califica para participar en un projecto para niños que usan el Ingles como seguanda lengua. En este projecto los estudiantes van a estudiar el Sistema Solar en dos formas. Una forma es la forma traditional con Mrs Borga. La otra forma es con computadoras tambien bajo la supervision the Mrs. Borja y Mrs Nordaff.

This project will last a week to two weeks. It is strictly confidential and there won't be any labels on names written in any of the test given before and after this Solar System study, learning style inventory or thinking style questionnaires. The study will be conducted like any other class given in the school. The benefits of this project is that it could help to determine if computers could enhance the teaching of Limited English Proficient students in Middle Schools.

Este projecto dura una o dos semanas. Es estrictamente confidencial. No se exigira ningun tipo de nombre en ninguno the los examenes de conocimientos del Sistema Solar, o del tipo de aprendisaje o de forma de pensar que se hagan durante el projecto. Los beneficios de este projecto son muchos. Uno de ellos es que este projecto puede ayudar a determinar si las computadoras pueden facililitar la enseñanza de conocimientos a ninos que necesitan ayuda en el aprendizaje del idioma Ingles.

We encourage you to let your child to participate in this project. Should you not want your child to participate, please call Mr. Martinez at 405- 634 6357 or send me this letter signed telling me that you don want your child to participate.

Le invitamos a que deje participar a su niño en este projecto. Si por alguna razon, Ud. no quire que su nino participe en este projecto, por favor llame al Sr. Martinez al telefono 634-6357 or mandeme esta carta firmada diciendome ques Ud. no quiere que sunino participe en este projecto.

Sincerely, Atentamente
Pedro J Martinez

I don't wish my child to participate in this school's project. Yo no quiero que mi niño participe en este projecto de la Escuela.

_____ _____
Parent's name Student's name

APPENDIX C

INSTITUTIONAL REVIEW BOARD

APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Date: April 12, 1999 IRB #: ED-99-107

Proposal Title: "THE EFFECTS OF MULTI-ENHANCED INSTRUCTION VERSUS THAT OF NON-MULTI-MEDIA ENHANCED INSTRUCTION IN AVIATION EDUCATION CLASSES WHEN TEACHING MIDDLE SCHOOL LIMITED ENGLISH PROFICIENT STUDENTS"

Principal Investigator(s): H.C. McClure
Pedro Martinez

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Signature:

Carol Olson

Carol Olson, Director of University Research Compliance

April 12, 1999
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modification to the research project approved by the IRB must be submitted for approval. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

APPENDIX D

CORRESPONDENCE

IDEO•LASERDISC•CD-ROM

9710 DeSoto Avenue
Chatsworth, California
91311-4409 USA
http://www.aims-multimedia.com

Tel: 800-367-2467
Tel: 818-773-4300
Fax: 818-341-6700
E-mail: info@aims-multimedia.com

OKLAHOMA STATE UNIVERSITY AT STILLWATER

OCTOBER 30,1999

TO WHOM IT MAY CONCERN:

THIS IS TO CERTIFY THAT PEDRO MARTINEZ HAS BEEN GIVEN THE RIGHT TO USE AIMS MULTIMEDIA'S TEACHERS MODULE FOR "EXPLORING OUR SOLAR SYSTEM" IN HIS CLASSROOM.
THIS RIGHT COMES WITH THE PURCHASE OF THE PROGRAM.

LYNN FASSETT
Lynn Fassett
CUSTOMER SERVICE REPRESENTATIVE

APPENDIX E

SOLAR SYSTEM LESSON PLAN

MEI Lesson Plan
Learning Objectives

Learning Objectives for the Solar System in this Chapter:

After students have studied the Solar System they should be able to:

1. Describe the Solar System and the characteristics of the Planets, and distinguish between an asteroid, a meteorite and a comet.

2.Describe the structure of the Sun, identify its features, and explain how it produces energy.

3.Describe the main features of the inner planets, and relate its features to the formation of the planets.

4.Describe the main features of the outer planets and relate its features to the formation of the planets.

5.Describes the uses for satellites and space probes and identify past and future space programs.

Lesson plan
Day 1
a. Objectives
1. Introduction to the Solar System and the characteristics
of the Solar System and how it relates to the Earth.
A. Selection of the Unit to measure planets and separation between planets.

NMEI Lesson Plan
Learning Objectives

Learning Objectives for the Solar System in this Chapter:

After students have studied the Solar System they should be able to:

1.Describe the Solar System and the characteristics of the Planets, and distinguish between an asteroid, a meteorite and a comet.

2.Describe the structure of the Sun, identify its features, and explain how it produces energy.

3.Describe the main features of the inner planets, and relate its features to the formation of the planets.

4.Describe the main features of the outer planets and relate its features to the formation of the planets.

5.Describes the uses for satellites and space probes and identify past and future space programs.

Lesson plan
Day 1
a. Objectives
1. Introduction to the Solar System

of the Solar System and how it relates to the Earth.
A. Selection of the Unit to measure planets and separation between planets.

B. Using some of its observable properties, define characteristics of the Solar System

3. Course lecture, reading assignment, handout.

a. Discuss the chapters objectives listed in the textbook student study guide.

b. Students will take a brief mastery test consisting of items in the study guide. These questions and answer will be used as a guide of the chapter.

1. Homework and reading assignment chapter___

ii. Students will finish filling the blanks in the homework sheet.

Iii. Student swill be responsible for finding out definitions to the new vocabulary,

iv. Students are encourage to write observations or thoughts at the end of class period on a log sheet throughout the study of the Solar System. These sheets will be collected at the end of the class period and kept by the teacher.

v. Students will receive an introductory handout or a guide of how to get in the program and how to run log-in and log-out,

vi. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

B. Using some of its observable properties, define characteristics of the Solar System

5. Course lecture, reading assignment, handout.

a. Discuss the chapters objectives listed in the textbook student study guide.

b. Students will take a brief mastery test consisting of items in the study guide. These questions and answer will be used as a guide of the chapter.

i. Homework and reading assignment chapter___

ii. Students will finish filling the blanks in the homework sheet.

Iii. Student swill be responsible for finding out definitions to the new vocabulary.

iv. Students are encourage to write observations or thoughts at the end of class period on a log sheet throughout the study of the Solar System. These sheets will be collected at the end of the class period and kept by the teacher.

v. Students will receive an introductory handout or a guide of how to get in the program and how to run log-in and log-out.

vi. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

Lesson plan
Day 2
a. Objectives
1. Introduction to the Solar System and the characteristics
of the Solar System and how it relates to the Earth.
A. Selection of the Unit to measure planets and separation between planets.
B. Using some of its observable properties, define characteristics of the Solar System
2. Course lecture, reading assignment, handout.
a. Discuss the chapters objectives listed in the textbook student study guide.
b. Students will take a brief mastery test consisting of items in the study guide. These questions and answer will be used as a guide of the chapter.
3. i. Homework and reading assignment chapter___
ii. Students will finish filling the blanks in the homework sheet.
Iii. Student swill be responsible for finding out definitions to the new vocabulary,
iv. Students are encourage to write observations or thoughts at the end of class period on a log sheet throughout the study of the Solar System. These sheets will be collected at the end of the class period and kept by the teacher.
v. Students will receive an

Lesson plan
Day 2
a. Objectives
1. Introduction to the Solar System

of the Solar System and how it relates to the Earth.
A. Selection of the Unit to measure planets and separation between planets.
B. Using some of its observable properties, define characteristics of the Solar System
2. Course lecture, reading assignment, handout.
a. Discuss the chapters objectives listed in the textbook student study guide.
b. Students will take a brief mastery test consisting of items in the study guide. These questions and answer will be used as a guide of the chapter.
3. i. Homework and reading assignment chapter___
ii. Students will finish filling the blanks in the homework sheet.
Iii. Student swill be responsible for finding out definitions to the new vocabulary.
iv. Students are encourage to write observations or thoughts at the end of class period on a log sheet throughout the study of the Solar System. These sheets will be collected at the end of the class period and kept by the teacher.
v. Students will receive an

introductory handout or a guide of how to get in the program and how to run log-in and log-out,
vi. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

Lesson Plan
Day 3
1.Describe the structure of the Sun, identify its features, and explain how it produces energy.

II. Make notes on the lesson. Ask questions after the lesson for future references.
III. Complete study activity handout.

Lesson Plan
Day 3
Enhanced
Instruction
a. Objectives
1. Description of the structure of the Sun
2. Importance of its understanding
Learning Objectives
Learning Objectives for the Solar System in this Chapter
After students have studied the Solar System they should be able to:
1.Describe the Solar System and the characteristics of the Planets, and distinguished between an asteroid, a meteorite and a comet.
2.Describe the structure of the Sun, identify its features, and explain how it produces energy.

introductory handout or a guide of how to get in the program and how to run log-in and log-out.
vi. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

Lesson Plan
Day 3
1.Describe the structure of the Sun, identify its features, and explain how it produces energy.

II. Make notes on the lesson. Ask questions after the lesson for future References.
11111. Complete study activity handout.

Lesson plan
Day 3
Traditional
Instruction
a. Objectives
1. Description of the Structure of the Sun
2. Importance of its understanding
Learning Objectives
Learning Objectives for the Solar System in this Chapter
After students have studied the Solar System they should be able to:
1.Describe the Solar System and the characteristics of the Planets, and distinguished between an asteroid, a meteorite and a comet.
2.Describe the structure of the Sun, identify its features, and explain how it produces energy.

vi. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

Lesson Plan
Day 4
Enhanced
Instruction
a. Objectives
1. Description of the structure of the Sun
2. Importance of its understanding

Learning Objectives

Learning Objectives for the Solar System in this Chapter

After students have studied the Solar System they should be able to:

1.Describe the Solar System and the characteristics of the Planets, and distinguished between an asteroid, a meteorite and a comet.

2.Describe the structure of the Sun, identify its features, and explain how it produces energy.

3. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

Lesson Plan
Day 5
Enhanced
Instruction
a. Objectives
Describe the main features of the inner planets, and relate its features to the formation of the planets.
2. Importance of its understanding

vi. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

Lesson plan
Day 4
Traditional
Instruction
a. Objectives
1. Description of the Structure of the Sun
2. Importance of its understanding

Learning Objectives

Learning Objectives for the Solar System in this Chapter

After students have studied the Solar System they should be able to:

1.Describe the Solar System and the characteristics of the Planets, and distinguished between an asteroid, a meteorite and a comet.

2.Describe the structure of the Sun, identify its features, and explain how it produces energy.

3. Students will be able to locate the Sun and pull out text or sound and images in any one of the subjects.

Lesson plan
Day 5
Traditional
Instruction
a. Objectives
3.Describe the main features of the inner planets, and relate its features to the formation of the planets.
2. Importance of its understanding

Lesson Plan
Day 6
Enhanced
Instruction
a. Objectives
Describe the main features of the inner planets, and relate its features to the formation of the planets.
2. Importance of its understanding

Lesson Plan
Day 7
I. Describes the main features of the outer planets and relate its features to the formation of the planets.

II. Make notes on the lesson. Ask questions after the lesson for future references.
III. Complete study activity handout.

Lesson Plan
Day 8
I. Describes the main features of the outer planets and relate its features to the formation of the planets.

II. Make notes on the lesson. Ask questions after the lesson for future references.
III. Complete study activity handout.

Lesson Plan
Day 9
I. Describes the uses for satellites and space probes and identify past and future space programs.

II. Make notes on the lesson. Ask questions after the lesson for future

Lesson plan
Day 6
Traditional
Instruction
a. Objectives
3.Describe the main features of the inner planets, and relate its features to the formation of the planets.
2. Importance of its understanding

Lesson Plan
Day 7
I. Describes the main features of the outer planets and relate its features to the formation of the planets.

II. Make notes on the lesson. Ask questions after the lesson for future references.
III. Complete study activity handout.

Lesson Plan
Day 8
I. Describes the main features of the outer planets and relate its features to the formation of the planets.

II. Make notes on the lesson. Ask questions after the lesson for future references.
III. Complete study activity handout.

Lesson Plan
Day 9
I. Describes the uses for satellites and space probes and identify past and future space programs.

II. Make notes on the lesson. Ask questions after the lesson for future

references.
III. Complete study activity handout.

Lesson Plan
Day 10

I. Describes the uses for satellites and space probes and identify past and future space programs.

II. Make notes on the lesson. Ask questions after the lesson for future references.
III. Complete study activity handout.

references.
III. Complete study activity handout.

Lesson Plan
Day 10

I. Describes the uses for satellites and space probes and identify past and future space programs.

II. Make notes on the lesson. Ask questions after the lesson for future references.
III. Complete study activity handout.

APPENDIX F

POST TEST REFERENCES

Pre-Post test

Each sentence below states an idea from AIMS Exploring Our Solar System. Read the sentences that follow each and circle the letter of the sentence that best supports the idea.

1. **The solar system is more than the Sun and nine planets.**
   A. Man-made satellites orbit Earth.
   B. The solar system is made up of interstellar dust.
   C. Nine planets, moons, asteroids, meteors, and comets orbit the Sun.
   D. The asteroid belt is considered to be a tenth planet.

2. **The Sun is the largest body in our solar system.**
   A. The Sun's magnetosphere is part of the measurement of the Sun.
   B. The Sun contains 99% of the mass of the solar system.
   C. The Sun can be seen from every planet.
   D. Sunspots and prominences are part of the measurement of the Sun.

3. **Atmosphere does not affect Mercury's surface features.**
   A. Without air or water, the ancient craters on Mercury are undisturbed.
   B. Mercury's surface is too rocky to be disturbed by atmosphere.
   C. Solar winds, rather than atmosphere, affect Mercury's features.
   D. Mercury's surface features are gaseous, and unaffected by atmosphere.

4. **The greenhouse effect on Venus makes it the hottest planet in the solar system.**
   A. All planets with environmental problems are extremely hot.
   B. The atmosphere allows harmful ultraviolet rays to reach the surface.
   C. The greenhouse effect is unique to Venus.
   D. The atmosphere reflects heat back to the planet's surface.

5. **Solar winds, colliding with Earth's magnetosphere, create visual effects.**
   A. Sunspots result from solar winds hitting Earth's atmosphere.
   B. The aurora borealis is the result of solar winds striking Earth's magnetosphere.
   C. Prominences are the results of solar winds colliding with Earth's atmosphere.
   D. Gaseous clouds circling the sun are the visual effects seen from Earth.

6. **Our moon influences daily life on Earth.**
   A. The lunar phases influence people's moods in daily life.
   B. The amount of light reflected from the moon affects the Earth.
   C. The moon's gravitational pull creates tides that rise and fall.
   D. Daily life depends on the regular rise and fall of the moon.

7. **Mars has a unique similarity with Earth.**
   A. Mars has night and day, just like Earth.
   B. Mars has an atmosphere and weather patterns.
   C. Mars orbits the sun in an elliptical pattern.
   D. Mars tilts on its axis as it rotates, creating seasons.

8. Jupiter is the largest planet in our solar system.
A. All the other planets of the solar system could fit inside Jupiter.
B. Jupiter's rings add to its great size.
C. Jupiter has more moons than all the other planets.
D. Since Jupiter is the first gaseous planet, it is the largest.

9.Saturn's moon, Titan, is unique.
A. Titan is named after a mythological character.
B. Titan is the only moon known to have an atmosphere.
C. Titan orbits inside Saturn's rings.
D. Titan orbits around other planets also.

1 0. The atmosphere of Uranus contains chemicals also present on Earth.
A. Uranus' atmosphere is somewhat like the smog on Earth.
B. Because the chemicals are similar, Uranus has an atmosphere like Earth's.
C. Because of similar atmospheres, Uranus could support life.
D Ammonia and methane make up most of the atmosphere on Uranus.

11. Neptune's moon, Triton, had a previous life.
A. Triton used to orbit Pluto.
B. Triton was the planet between Mars and Jupiter.
C. Triton was originally an interplanetary traveler.
D. Triton used to be part of the planet Neptune.

1 2. Pluto's orbit is the most unusual.
A. For part of its orbit, Pluto passes inside Neptune's orbital path.
B. Pluto's orbit takes the most number of Earth years to complete.
C. Pluto's orbit is circular, while other planets have elliptical orbits.
D. Pluto looks like an intensely bright star as it orbits.

For each item, read carefully and circle the letter of the BEST answer.

1. What explanation do scientists give about the formation of the solar system?
A. Four and a half billion years ago there was a big explosion.
B. Interstellar dust and gas pulled together under its own gravity.
C. Gases and metals separated to form different kinds of planets.
D. Gases and ore broke away from the Sun as it spun through space.

2. Which statement best describes the four inner planets?
A. These planets have gaseous atmospheres.
B. The inner planets all have one moon each.
C. These terrestrial planets have surfaces that are rocky and hard.
D. The inner planets were formed differently than the outer planets.

3. Which statement best describes the outer planets?
A. These giant planets are made up mostly of gases.
B The outer planets don't have atmospheres.
C. The giant planets affect the orbits of the inner planets.
The outer planets are less likely to support life.

APPENDIX G

OTHER TABLES

Table G1. Hardware and Software for multimedia classroom presentations.

Production work-station (Capture and edit text, image, audio, video)	*Processor: Intel 80486, 66 MHz, 16MB RAM* *Hard Drive: 500 MB+* *Input: Keyboard, mouse, 1.44 MB diskette drive* *Video Cassette Recorder (VCR)* *Video camera* *Audio Cassette Recorder Data-Capture devices for computer.* *Audio—Microsoft WAVE format compatible* *Video—Microsoft AVI compatible* *Image—Full color scanner Software: DOS 6.x, Windows 3.1 or better* *Springboard authoring and presentation tool* *Output: Computer Display: 1 MB VGA adapter; color display* *Optional devices:* *CD-ROM drive* *VGA-NTSC adapter (for videotape capture)* *Touch-screen display monitor*
Presentation workstation (Portable)	*Processor: Intel 80486, 50 MHz, 8 MB RAM* *Hard Drive: 200MB+* *Input: Keyboard, mouse, 1.44 MB diskette drive* *Output Display.' Color VGA monitor (touch screen optional)* *1MB VGA adapter* *Speakers and Microsoft WAVE format compatible sound card* *Optional: VGA-NTSC TV output adapter*

Table G2. Interpreting Scores for Sternburg's Thinking Style Inventory

Nonstudents Adults			
	Category	Male	Female
Very High	Top 1%-10%	6.6-7.0	6.5- 7.0
High	Top 11%-25%	6.1- 6.5	6.2- 6.4
High Middle	Top 26%-50%	5.5-6.0	5.2-6.1
Low Middle	Top 51%-75%	4.9-5.4	4.5-5.1
Low	Top 76%-90%	4.3-4.8	3.6-4.4
Very Low	Top 91%-100%	1.0-4.2	1.0-3.5
	College Student Adults		
	Category	Male	Female
Very High	Top 1%-10%	6.2-7.0	6.0- 7.0
High	Top 11%-25%	5.6- 6.1	5.6- 5.9
High Middle	Top 26%-50%	5.1-5.5	5.1-5.5
Low Middle	Top 51%-75%	4.4-5.0	4.5-5.0
Low	Top 76%-90%	4.0-4.3	4.1-4.4
Very Low	Top 91%-100%	1.0-3.9	1.0-4.0

The way you evaluate your score is to add up to eight numbers you wrote down above, and then divide by eight. Carry out the division to one decimal place. You should have a number between 1.0 and 7.0. There are six categories of scores, which depend on your status and your sex. These six categories are shown above.

If you score in the "very high" category, then you have all or almost all of the characteristics of that particular Thinking style. If this case it is a legislative person.. if you scored in the "high" category, you have many of these characteristics. And if you scored in the " high middle" category, then al least you have at least some of the characteristic

APPENDIX H

SCORE SHEET FOR THINKING STYLES

Score Sheet for Thinking Styles

Summary of Styles of Thinking

Functions	Forms	Levels	Scope	Leanings
_____ Legislative	_____ Monarchic	_____ Global	_____ Internal	_____ Liberal
_____ Executive	_____ Hierarchic	_____ Local	_____ External	_____ Conservative
_____ Judicial	_____ Oligarchic			
	_____ Anarchic			

Add up your scores for 1-8 in each of the sets on the survey. Divide the total by 8 and round to the nearest hundredths. The scale for each of the sets is provided below. Place your score in the space provided above for each set. Then circle the thinking style that is highest in each category (column). The circled styles are your composit style.

Category		Adult Male	Adult Female	College Male	College Female
(28-29) Legislative Style					
Very High	(Top 1% - 10%)	6.6-7.0	6.5-7.0	6.2-7.0	6.0-7.0
High	(Top 11% -25%)	6.1-6.5	6.2-6.4	5.6-6.1	5.6-5.9
High Middle	(Top 26%-50%)	5.5-6.0	5.2-6.1	5.1-5.5	5.1-5.5
Low Middle	(Top 51%-75%)	4.9-5.4	4.5-5.1	4.4-5.0	4.5-5.0
Low	(Top 76%-90%)	4.3-4.8	3.6-4.4	4.0-4.3	4.1-4.4
Very Low	(Top 91%-100%	1.0-4.2	1.0-3.5	1.0-3.9	1.0-4.0

Legislative style people like to do things their own way. They like creating, formulating, and planning things. In general, they tend to be people who like to make their own rules.

Category		Adult Male	Adult Female	College Male	College Female
(33-34) Executive Style					
Very High	(Top 1% - 10%)	6.0-7.0	5.8-7.0	5.5-7.0	5.1-7.0
High	(Top 11% -25%)	5.3-5.9	5.3-5.7	5.0-5.4	4.9-5.0
High Middle	(Top 26%-50%)	4.5-5.2	4.4-5.2	4.2-4.9	4.2-4.8
Low Middle	(Top 51%-75%)	3.6-4.4	3.4-4.3	3.6-4.1	3.7-4.1
Low	(Top 76%-90%)	2.9-3.5	2.7-3.3	3.1-3.5	3.1-3.6
Very Low	(Top 91%-100%	1.0-2.8	1.0-2.6	1.0-3.0	1.0-3.0

Basically, people with the executive style are implementers: They like to do, and generally prefer to be given guidance as to what to do or how to do what needs to be done. They are the contract lawyers that like to follow rules. These people often tolerate the kinds of bureaucracies that drive the legislative people batty.

Category		Adult Male	Adult Female	College Male	College Female
(37-38) Judicial Style					
Very High	(Top 1% - 10%)	5.6-7.0	5.8-7.0	5.3-7.0	5.6-7.0
High	(Top 11% -25%)	5.3-5.5	5.2-5.7	4.6-5.2	5.0-5.5
High Middle	(Top 26%-50%)	4.6-5.2	4.8-5.1	4.2-4.5	4.6-4.9
Low Middle	(Top 51%-75%)	4.1-4.5	4.1-4.7	3.9-4.1	4.2-4.5
Low	(Top 76%-90%)	3.6-4.0	3.4-4.0	3.5-3.8	3.2-4.1
Very Low	(Top 91%-100%	1.0-3.5	1.0-3.3	1.0-3.4	1.0-3.1

Judicial Style people like to evaluate rules and procedures and to judge things. As reporters, teachers, etc. they like to judge and evaluate situations, students' work, etc. more than working with the person to make progress.

	Category	Adult Male	Adult Female	College Male	College Female
(45) Monarchic Style					
Very High	(Top 1% - 10%)	5.2-7.0	5.0-7.0	4.6-7.0	5.0-7.0
High	(Top 11% -25%)	4.6-5.1	4.1-4.9	4.1-4.5	4.4-4.9
High Middle	(Top 26%-50%)	4.1-4.5	3.8-4.0	3.6-4.0	4.0-4.3
Low Middle	(Top 51%-75%)	3.4-4.0	3.2-3.7	3.2-3.5	3.5-3.9
Low	(Top 76%-90%)	3.1-3.3	2.6-3.1	3.0-3.1	3.1-3.4
Very Low	(Top 91%-100%	1.0-3.0	1.0-2.5	1.0-2.9	1.0-3.0

People who exhibit a predominantly monarchic style tend to be motivat4ed by a single goal or need at a time. If you get married to one of these people, it usually doesn't take you long to find out. If the person is monarchic about something, or worse, someone, other than you, you're likely to find out rather quickly. (Prince Charles & Camilla Parker-Bowles)

	Category	Adult Male	Adult Female	College Male	College Female
(49-50) Legislative Style					
Very High	(Top 1% - 10%)	6.2-7.0	6.5-7.0	6.8-7.0	6.1-7.0
High	(Top 11% -25%)	5.8-6.1	6.0-6.4	5.9-6.7	5.5-6.0
High Middle	(Top 26%-50%)	5.1-5.7	5.3-5.9	5.0-5.8	5.0-5.4
Low Middle	(Top 51%-75%)	4.5-5.0	4.2-5.2	4.8.4.9	4.3-4.9
Low	(Top 76%-90%)	4.1-4.4	3.4-4.1	4.0-4.7	3.9-4.2
Very Low	(Top 91%-100%	1.0-4.0	1.0-3.3	1.0-3.9	1.0-3.8

People with a hierarchic style tend to be motivated by a hierarchy of goals, with the recognition that not all of the goals can be fulfilled equally well and that some goals are more important than others. They tend to be priority setters who allocate their resources carefully. Hierarchic people like to divide up their resources. They are systematic and organized in their solutions to problems and in decision making.

	Category	Adult Male	Adult Female	College Male	College Female
(52) Oligarchic Style					
Very High	(Top 1% - 10%)	5.3-7.0	5.3-7.0	4.4-7.0	5.0-7.0
High	(Top 11% -25%)	4.7-5.2	4.5-5.2	4.0-4.3	4.3-4.9
High Middle	(Top 26%-50%)	3.7-4.6	3.5-4.4	3.4-3.9	3.8-4.2
Low Middle	(Top 51%-75%)	2.6-3.6	2.8-3.4	2.8-3.3	3.0-3.7
Low	(Top 76%-90%)	1.9-2.5	2.1-2.7	2.1-2.7	2.4-2.9
Very Low	(Top 91%-100%	1.0-1.8	1.0-2.0	1.0-2.0	1.0-2.3

Oligarchic style people share power equally. They tend to be motivated by several, often-competing goals of equal perceived importance. They have trouble deciding which goals to give priority so they may have trouble allocating resources. These people need to be guided in setting priorities.

	Category	Adult Male	Adult Female	College Male	College Female
(56-57) Anarchic Style					
Very High	(Top 1% - 10%)	5.8-7.0	5.8-7.0	5.2-7.0	5.5-7.0
High	(Top 11% -25%)	5.4-5.7	5.4-5.7	4.8-5.1	4.9-5.4
High Middle	(Top 26%-50%)	4.9-5.3	4.8-5.3	4.5-4.7	4.4-4.8
Low Middle	(Top 51%-75%)	4.1-4.8	4.0-4.7	3.9-4.4	3.8-4.3
Low	(Top 76%-90%)	3.5-4.0	3.5-4.0	3.4-3.8	3.4-3.7
Very Low	(Top 91%-100%	1.0-3.4	1.0-3.4	1.0-3.3	1.0-3.3

People with an anarchic style tend to be motivated by a wide assortment of needs and goals that are often difficult for others, as well as for themselves, to sort out. They tend to be not so much asystematic as antisystematic. They are likely to disdain the system in place, sometimes with good reason, but other times for less clear reasons. Anarchic people further tend to take a random approach to problems. These people are generally seen as creative as they can bring things together in ways that most people would never consider.

	Category	Adult Male	Adult Female	College Male	College Female
(60-61) Global Style					
Very High	(Top 1% - 10%)	5.5-7.0	5.2-7.0	5.3-7.0	5.5-7.0
High	(Top 11% -25%)	4.9-5.4	4.8-5.1	4.5-5.2	4.8-5.4
High Middle	(Top 26%-50%)	4.4-4.8	4.0-4.7	4.0-4.4	4.1-4.7
Low Middle	(Top 51%-75%)	3.6-4.3	3.5-3.9	3.5-3.9	3.6-4.0
Low	(Top 76%-90%)	3.2-3.5	3.1-3.4	3.1-3.4	2.9-3.5
Very Low	(Top 91%-100%	1.0-3.1	1.0-3.0	1.0-3.0	1.0-2.8

Global people tend to prefer to deal with relatively large and often abstract issues. They tend to focus on the forest, sometimes at the expense of the trees. These people often have difficulty selecting a career or identifying a specific problem. They see the whole picture and are not terribly good with details. These people are good at coming up with ideas and suggestions but have difficulty dealing with the implementation or even just getting started on the task.

	Category	Adult Male	Adult Female	College Male	College Female
(62) Local Style					
Very High	(Top 1% - 10%)	5.1-7.0	5.1-7.0	4.9-7.0	4.5-7.0
High	(Top 11% -25%)	4.4-5.0	4.4-5.0	4.4-4.8	4.3-4.4
High Middle	(Top 26%-50%)	3.9-4.3	3.8-4.3	3.8-4.3	4.0-4.2
Low Middle	(Top 51%-75%)	3.6-3.8	3.4-3.7	3.2-3.7	3.5-3.9
Low	(Top 76%-90%)	3.4-3.5	3.0-3.3	2.8-3.1	2.9-3.4
Very Low	(Top 91%-100%	1.0-3.3	1.0-2.9	1.0-2.7	1.0-2.8

Local people prefer to deal with details, sometimes minute ones, and often ones surrounding concrete issues. They tend to focus on the trees, sometimes at the expense of the forest. These people often have trouble coming up with solutions to large problems but if someone will propose a solution they can implement the steps to get to the goal.

	Category	Adult Male	Adult Female	College Male	College Female
(66-67) Internal Style					
Very High	(Top 1% - 10%)	6.1-7.0	6.1-7.0	5.3-7.0	5.0-7.0
High	(Top 11% -25%)	5.4-6.0	5.2-6.0	4.5-5.2	4.5-4.9
High Middle	(Top 26%-50%)	4.8-5.3	4.2-5.1	3.9-4.4	4.0-4.4
Low Middle	(Top 51%-75%)	3.8-4.7	3.3-4.1	3.1-3.8	3.5-3.9
Low	(Top 76%-90%)	3.4-3.7	2.5-3.2	2.8-3.0	3.0-3.4
Very Low	(Top 91%-100%	1.0-3.3	1.0-2.4	1.0-2.7	1.0-2.9

People with internal style tend to be introverted, task-oriented, sometimes aloof, and socially less sensitive than other people. They typically lack interpersonal awareness and prefer to work alone.

	Category	Adult Male	Adult Female	College Male	College Female
(68) External Style					
Very High	(Top 1% - 10%)	6.1-7.0	6.1-7.0	6.2-7.0	6.0-7.0
High	(Top 11% -25%)	5.7-6.0	5.7-6.0	5.6-6.1	5.6-5.9
High Middle	(Top 26%-50%)	5.0-5.6	4.8-5.6	5.1-5.5	4.9-5.5
Low Middle	(Top 51%-75%)	4.0-4.9	4.1-4.7	4.1-5.0	4.0-4.8
Low	(Top 76%-90%)	3.2-3.9	3.0-4.0	3.8-4.0	2.8-3.9
Very Low	(Top 91%-100%	1.0-3.1	1.0-2.9	1.0-3.7	1.0-2.7

People with an external style tend to be more extroverted, people-oriented, outgoing, socially more sensitive, and interpersonally aware of others. These people are more people oriented and social involved with peers, human causes, etc.

Category		Adult Male	Adult Female	College Male	College Female
(71-72) Liberal Style					
Very High	(Top 1% - 10%)	6.6-7.0	6.5-7.0	6.3-7.0	6.0-7.0
High	(Top 11% -25%)	6.0-6.5	6.1-6.4	5.6-6.2	5.8-5.9
High Middle	(Top 26%-50%)	5.5-5.9	5.4-6.0	5.0-5.5	5.0-5.7
Low Middle	(Top 51%-75%)	4.9-5.4	4.5-5.3	4.1-4.9	4.2-4.9
Low	(Top 76%-90%)	4.1-4.8	3.3-4.4	3.6-4.0	3.8-4.1
Very Low	(Top 91%-100%	1.0-4.0	1.0-3.2	1.0-3.5	1.0-3.7

Individuals with the liberal style like to go beyond existing rules and procedures and seek to maximize change. They also seek or are at least comfortable with ambiguous situations, and prefer some degree of unfamiliarity in life and work.

Category		Adult Male	Adult Female	College Male	College Female
(73) Conservative Style					
Very High	(Top 1% - 10%)	5.4-7.0	5.1-7.0	4.8-7.0	4.8-7.0
High	(Top 11% -25%)	4.6-5.3	4.4-5.0	4.2-4.7	4.4-4.7
High Middle	(Top 26%-50%)	3.8-4.5	3.4-4.3	3.9-4.1	3.8-4.3
Low Middle	(Top 51%-75%)	3.1-3.7	2.9-3.3	3.1-3.8	3.2-3.7
Low	(Top 76%-90%)	2.2-3.0	2.2-2.8	2.4-3.0	2.8-3.6
Very Low	(Top 91%-100%	1.0-2.1	1.0-2.1	1.0-2.3	1.0-2.7

Conservative style individuals like to adhere to existing rules and procedures, minimize change, avoid ambiguous situations where possible, and prefer familiarity in life and work.

Based on Robert Sternberg's (1997) Thinking Styles. New York, NY: Cambridge University Press.

VITA

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Doctor of Education

Thesis: THE EFFECTS OF MULTIMEDIA ENHANCED INSTRUCTION VS THAT OF NON-MEDIA ENHANCED INSTRUCTION IN AN AVIATION EDUCATION PROGRAM WHEN TEACHING LIMITED ENGLISH PROFICIENT STUDENTS IN AN OKLAHOMA MIDDLE SCHOOL

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