Research Report

The Research Basis for the *A+dvanced Learning System*® and the *A+nyWhere Learning System*® Instructional Software Programs

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Introduction

Doing what works has always been the concern of teachers. Over the years, there have been many methods for determining "what works." Some include tradition, word-of-mouth, observation, advertisements, and personal experience. A more stringent means of deciding what works is research, which can take many forms.

With the passage of the No Child Left Behind Act of 2001 (NCLB Act), using effective teaching methods has come to the forefront of everyone's thinking because the NCLB Act places a tremendous emphasis on doing "what works." The framers of NCLB Act and the U.S. Department of Education point to a history where a prominent way of deciding "what works" has been word-of-mouth, untested, unproven theory sometimes referred to as educational dogma. During this time, the U.S. Department of Education, as well as the popular media, have pointed out the extraordinary number of children who fail to meet basic competencies. As a result, there is a new drive for education based on research.

This current drive places the emphasis on basing instructional practices on scientific research, which is not case study or mere observation. Rather, scientific research requires testing of an idea or question in controlled conditions, eliminating the possibility that some variable other than the one of interest caused the effect observed. An extensive review of the qualities and characteristics of scientific-based research can be found at the U.S. Department of Education website. (www.nochildleftbehind.gov/next/overview/presentation/slide024.html)

With the emphasis on scientific research-based instructional practices, the U.S. Department of Education has two goals. The first goal is to have schools base their instructional programs on practices that have been shown in scientific research to work. The schools are required to spend the money provided from the federal government on developing programs that are based on research. The principle is extended to apply to the money spent on commercially prepared programs, which must also be based on principles demonstrated in scientific research.

The second and long-term goal is for published instructional programs to have scientific research that shows they work. The "gold standard" target is for commercially prepared instructional programs to have the same kind of rigorous testing required of FDA-approved drugs. The purpose of this testing is to have clinical trials with control groups. Nevertheless, the U.S. Department of Education acknowledges that this kind of data is not currently available for commercial programs, nor will it be in the near future. Therefore, their emphasis is on programs that are based on scientific-based research.

This paper will show that the *A*+*LS* instructional programs are based on principles derived from scientific-research. Data presented will demonstrate the effectiveness of these programs. The long-term goal of The American Education Corporation (AEC) is to provide scientific research that shows the efficacy of the *A+LS* programs as instructional programs. The aim will be to present scientific research that:

- shows *A*+*LS* instructional programs work.
- shows with what students the *A*+*LS* instructional programs work.
- shows under what conditions the *A*+*LS* instructional programs work.

Overview of the *A*+*LS* Instructional Programs

The *A*+*nyWhere Learning System*® and the *A*+*dvanced Learning System*® programs (otherwise known as *A*+*LS*™) are scientific research-based learning instructional programs. They consist of core curriculum content supported by an extensive instructional management system. The content addresses reading, writing, mathematics, science, and social sciences for first through twelfth grades containing over 6,000 lessons with over 100,000 exercises, and representing over 6,700 hours of instruction.

The content is focused on essential skills using proven teaching methods, human voice, and engaging graphic support. The emphasis is on clear, focused instruction with extensive, frequent feedback containing review and re-teaching when necessary. The presentation is always concise and direct with carefully planned sequences of lessons to assure mastery of content. These design principles are based on scientific research and are the basis for the *A*+*LS* instructional programs.

Summary of Key Research Findings of Scientifically-Based Research

As noted in the introduction, the *A*+*LS* instructional programs were developed based on scientific research that demonstrates three effective instructional practices.

- The first is an overall approach to instruction generally known as “Instructivism.”
- The second is specific instructional practices that have been shown by scientific research to be effective.
- The third is the scientific research that demonstrates the general efficacy of Computer-Aided Instruction.

A research report from Northwest Regional Educational Laboratory (NWRel, 1995) is the foundation for this report. It offers a synthesis of research on effective instructional practices. In fact, the stated purpose of the report was to

"identify the characteristics and practices identified by research as associated with improvements in student performance (p. 7)." In this paper, original source research will also be cited as appropriate.

Two important themes emerged in the NWRel synthesis. These themes served as the scientific research-based principles upon which the entire *A*+*LS* instructional programs were developed. These key findings are as follows:

- **Nature of Instruction:** Instruction that is carefully sequenced and direct is the most effective.
- **Computer-based instruction:** Computer-based instruction that works to support teacher presented instruction is effective.

Instructivism

Instructivism, a general approach to education, holds that carefully sequenced and direct instruction is most effective. Instructivism goes by many names including mastery learning, direct instruction, explicit teaching, and applied behavior analysis. Direct Instruction, the commercial program created by Seigfreid Engleman, is the best-known example of a complete implementation of this approach to teaching. Madeline Hunter's highly structured approach to teaching is also an example of Instructivism.

The most extensive scientific research undertaken to evaluate instructional practices was known as Project Follow Through (Beck, Stebbins, and Proper, 1977). This research project was undertaken by the U.S. Department of Education during the Johnson administration. The data was collected by the Stanford Research Institute and analyzed by Abt Associates. The question posed in this research was "what is the most effective way to educate economically and academically impoverished students to avoid the cycle of poverty?"

Project Follow Through evaluated 12 instructional models ranging from the carefully controlled Direct Instruction and Behavior Analysis models to the "child-centered" models of Bank Street and Open Education. Three broad categories of instructional programs were evaluated (Watkins, 1995).

- Basic Skills models based on directly teaching the fundamental skills of reading, arithmetic, spelling, and language.
- Cognitive-Conceptual models that focused on learning-to-learn and problem-solving skills.
- Affective-Cognitive models that emphasized developing positive self-concept and attitude.

This was a long-term study that began in 1967 and ran until 1995 when funding for the project was discontinued. The study was conducted in over 180 schools

nationwide, and the major results were first released in 1977. The following conclusions were formed from the study (Stebbins, et al, 1977):

- Models that emphasize basic skills succeeded better than other models.
- Direct Instruction had higher scores than any other model.
- The model based on applied behavior analysis also scored better than the other models.
- Models that emphasized basic skills had better results on tests of self-concept.

The significant characteristics of these approaches were carefully sequenced lessons for maximally effective learning of big ideas; teaching complex problem solving directly; using strategies for solving problems that are so conspicuous that students learn to use the strategies; and using mediate scaffolding (Kameenui and Carnine, 1998).

Instructional Practices

Project Follow Through was a landmark study that showed the relative effectiveness of the approach to instruction now known as Instructivism. Yet, this study evaluated complete programs, and the extrapolation of their principles must be done with caution. Therefore, AEC also did a broader review of the scientific-based research.

As noted above, the basis of the research review was *Effective Schooling Practices: A Research Synthesis 1995.* The review was written by Kathleen Cotton at the Northwest Regional Education Laboratory as part of its *School Improvement Research Series.* The key research findings of this synthesis for the basis of effective teaching practices were:

- **Teachers carefully orient students to lessons.** They describe objectives, explain the relations of the current lesson to previous learning, they call attention to key concepts, and they provide advanced organizers and study questions. (Block and Burns (76), Bloom (76), Brophy (87), Rosenshine and Stevens (86)).
- **Teachers provide clear and focused instruction.** They give clearly written and verbal directions, emphasize key points and instructions, and check students' understanding. Avoiding digression, they give students plenty of opportunity for guided and independent practice, and select problems well matched to the lesson content so student success rate is high. They provide computer-assisted instructional activities that supplement and are integrated with teacher-directed learning (Bain, Lintz, and Word (89), Brophy (79), Metcalf and Cruickshank (91), Waxman (85)).

- **Teachers routinely provide feedback and reinforcement.** This feedback is given directly by the teacher both in written and verbal forms. They provide computer-assisted instructional activities that give students immediate feedback regarding their learning performance. (Tennenbaum and Goldberg (89), Slavin (79), Kulik and Kulik (87, 88)).
- **Teachers routinely review and re-teach as necessary.** They present materials in alternate ways to ensure mastery by all students. Additionally, teachers select computer-assisted instructional activities that include review and reinforcement components (Slavin, 87), present information in an orderly way (Kallison, 86), use clear and simple language (Land, 87), make extensive use images and examples (Hiebert, 91), and frequently restate essential principles (Maddox and Hoole, 75).

These principles are clearly seen in Applied Behavioral Analysis models of instruction and Direct Instruction. These findings are also substantially similar to those of Project Follow Through.

Computer Aided Instruction

The previous cited studies delineated the qualities of effective instruction. The question, then, is what is the scientific research base for using computers to aid instruction. The research base is strong and forms the foundation for the products of AEC. Once more, this section relies on syntheses of research and meta-studies.

The first major synthesis was again conducted by Northwest Regional Education Laboratory (NWRel, 1992). This synthesis reviewed a wide range of studies and concluded that Computer-Aided Instruction (CAI) has many broad reaching and positive effects on student learning that include:

- A faster learning rate
- Better retention of learning
- Improved attitudes toward learning
- Improved writing when the instruction was part of holistic writing as a process approach
- Associated positive effects such as:
    - Increased internal locus of control
    - Improved school attendance
    - Increased motivation
    - Increased time-on-task
    - Increased cooperation and collaboration with traditional instruction

Stennett (1985), following his extensive review of Computer-Aided Instruction research, concluded the following.

> The single best-supported finding in the research literature is that the use of Computer-Aided Instruction as a supplement to tradition, and teacher-directed instruction produces achievement effects superior to those obtained with traditional instruction alone. Generally this finding holds true for students of different ages and abilities and for learning in different curricular areas.

The North Central Regional Education Laboratory (NCRel) also conducted a research review. Their review could more accurately be considered a meta-study. This study consisted of an analysis of 946 studies and 10 meta-studies. Their conclusions were substantially similar to those of the synthesis by NWRel and Stennett. NCRel found that classrooms in which computers were used to support instruction showed gains in achievement greater than classrooms where computers were not used.

The meta-study of Kulik and Kulik (1989) was the most frequently cited study in the syntheses noted above. It was a meta-analysis of 199 scientific-based research studies. Many conclusions were drawn, but the most pointed of these conclusions were as follows:

- Students generally learned more in classes where they received computer-aided instruction.
- Students learned lessons with less instructional time when they received computer-aided instruction.
- Students liked classes better in which there was computer-aided instruction.

Frank Brown (2000) conducted an extensive study in a large urban public school system in North Carolina. The study compared a group that used computer-aided instruction and a group that did not use computer-aided instruction. The hypothesis tested was that CAI in mathematics would produce superior academic achievement for students who used the program. The hypothesis was confirmed and the conclusion was drawn that CAI is a helpful supplement to regular classroom instruction in basic mathematics and algebra.

The Pacific Regional Education Laboratory (PREL, 2000) conducted a meta-study to evaluate the use of computer-aided instruction for improving reading achievement. The study revealed that computer-aided instruction does have a positive effect on reading achievement.

Finally, Sivin-Kachala and Bialo (2000) conducted an extensive review of the research literature on the effectiveness of using technology in schools. This

review screened over 3,500 published research studies and chose 311 for the review. The conclusions drawn with respect to student achievement were substantially similar to those of the other studies sited with a few important additions:

- Educators are essential elements in the effectiveness of technology.
- Students of teachers with 10+ hours of technology training far exceeded students of teachers who received less than five hours of technology training.

In conclusion, this review of the scientific-based research literature clearly demonstrates that computer-aided instruction helps with student achievement.

Key Applications of the Scientifically-Based Research Findings in the *A*+*nyWhere Learning System* and the *A*+*dvanced Learning System* Instructional Programs

The key for The American Education Corporation is the application of the aforementioned scientific-based research to the *A*+*nyWhere Learning System* and *A*+*dvanced Learning System* instructional programs. AEC decided that its products would be most effective through the combination of research-based instructional practices and computer-aided instruction. In fact, the research of Russell Gersten (1987) showed that the same variables that affect traditional learning affect computer-aided instruction.

The scientific research-base for the products of AEC is two-fold.

- The value of computers to assist in instruction has been well established in scientific research over a 25 to 30 year period.
- Instructional practices generally known as Instructivism result in increased student learning.

The following sections summarize the key findings implemented in the design of *A*+*LS* curriculum content:

Underlying Instructional Approach

The underlying instructional approach of the *A*+*LS* instructional programs is as follows:

- *A*+*LS* instructional programs teach basic, core skills. These skills are modeled and taught directly by teaching with the primary emphasis on fundamental skills and knowledge.
- *A*+*LS* lessons are sequenced carefully for maximally effective learning of “big ideas.”

- *A*+*LS* instructional programs use conspicuous strategies for solving problems, encouraging students to learn to use the strategies.
- *A*+*LS* instructional programs use mediated scaffolding. This means that students are presented problems with a high degree of structure and support from the program. As students become more capable and advance through lessons, the structure is decreased so that they become increasingly independent learners.

Individual Lesson Design

A specific approach to each lesson was developed that was based on the aforementioned scientific-based research. That approach is as follows:

1. Each lesson carefully orients students to what they will learn.
    - Specific steps are taken in each lesson to gain the student's attention.
    - Specific steps are taken to orient the student within the lesson. The most important aspect of this orientation is to help the student connect the idea of the lesson to previous learning.

2. Each lesson provides clear and focused instruction.
    - The text is focused.
    - One concept/idea is presented per page.
    - Each lesson is intended to convey one major concept.

3. Each lesson routinely provides feedback and reinforcement directly to the student.
    - During the lesson, students receive immediate feedback to practice test questions.
    - After the lesson, a progress report is available to the student.

4. The *A*+*LS* instructional programs routinely review and re-teach as necessary.
    - The *A*+*LS* instructional programs provide a means for students to review and repeat lessons. Review and repetition of lessons is under the control of teachers.
    - The *A*+*LS* instructional programs design is to assure student mastery.
    - Tools for students to toggle back and forth from the Study Guide pages are provided.

5. The *A*+*LS* instructional programs are designed so that teachers can readily align the program with what they are teaching in class as well as with state learning objectives. In this way, the program can be used

effectively as a supplement to classroom instruction. The most clearly documented scientific research finding with regard to computer aided instruction is as a supplement to traditional instruction.

Reading is a special case. Considerable research about the nature of reading and what instructional practices are required for children to learn to read effectively was done. The *A*+*LS* reading titles were developed with this research as the foundation. Because of the extensive nature of this background, a separate paper, *The Research Basis for the Reading Programs of the A*+*dvanced Learning System and the A*+*nyWhere Learning System (2002),* was prepared to document the scientific research-base for the *A*+*LS* reading program.

Research Findings with *A+LS* Instructional Program Curriculum

In addition to the scientific-research base for the development of the *A*+*LS* instructional programs, there is an increasing base in research on the efficacy of these programs. The majority of the research to date is *ex post facto* research, which is based on data collected "after the fact." It generally looks at the impact on student achievement after introducing *A*+*LS* instructional program curriculum as an educational intervention. This data provides an impetus to engage in scientific research. Findings of this nature come from reports of current users of the *A*+*LS* instructional program curriculum who have submitted their results to AEC.

The Echols County School System in Georgia reports that *A*+*LS* curriculum has been used for remediation of students who did not pass the state's required exit exam. Following a program of instruction with *A*+*LS* curriculum, 97% of students using *A*+*LS* curriculum lessons for remediation passed the state exit exam. The implication was that this is a much higher pass rate than previously experienced at the school.

The Ben Hill County School System in Georgia reports a similar experience where students are regularly testing out of remedial classes after a nine-week period of instruction with *A*+*LS* curriculum. Again, this school reports that this is a significant improvement over prior methods of instruction.

The Kissimmee Middle School in Florida reported an increase of 11 to 14 percentile points on the Stanford Achievement Test for the school average after implementing *A*+*LS* curriculum for two years.

Hanna Fowler, principal, at J.A. Maxwell Elementary School in Thomson, Georgia, conducted a comprehensive observational study (Fowler, 2002). This observational study was Ms. Fowler's dissertation in partial fulfillment of the requirements of her doctoral degree. This study was a report of a comprehensive school reform program that occurred over a four-year period. The *A*+*LS*

curriculum was an integral part of the reform program. It should be noted that the other instructional programs implemented as part of the reform effort also followed an Instructivist model and by their nature would implement the instructional practice cited in this paper. The effect on student achievement at J.A. Maxwell Elementary School was dramatic. The scores on the ITBS reading subtests gained an average of 23 percentile points over three years. Once again, observational data suggests that *A*+*LS* curriculum is an important contributor to improved academic achievement.

A scientific study investigating *A*+*LS* curriculum as an instructional intervention for algebra with high school students was conducted. This study was conducted by John Ash (2001) in partial fulfillment of degree requirements. It investigated whether *A*+*LS* curriculum as a supplementary intervention in mathematics instruction would increase student achievement. The study found that students who used *A+LS* curriculum performed significantly better than students who did not use *A*+*LS* curriculum. This scientific research study showed *A*+*LS* curriculum to be an effective educational intervention.

Many more school case studies can be cited with data of a similar nature. This *ex post facto* and observational data strongly suggests that additional scientific research would further support the fact that the increased performance can be attributed to the *A*+*LS* instructional program.

Future Directions

This paper shows the strong scientific research-base for the design of the *A*+*LS* instructional programs. Furthermore, this paper presents observational data that suggests additional scientific research would further demonstrate the efficacy of the *A+LS* instructional programs. The additional research projects are currently underway:

AEC will assure that the scientific-based research conducted will determine the efficacy of the *A*+*LS* instructional programs.

- The research design will determine for which students the *A*+*LS* instructional programs are effective.
- The research design will determine under what conditions the *A*+*LS* instructional programs are effective.
- The research design will determine what variables are influenced by the use of the *A*+*LS* instructional programs. The investigated variables will include; student achievement as measured by grades; independent measures of achievement such as scores on norm-referenced tests. Additional variables may include attendance and graduation rates.

This paper was written to provide the reader with an understanding of the scientific research-base upon which the *A*+*LS* instructional programs were developed. It also indicates the future direction of AEC with regard to scientific research to establish the effectiveness of these programs. For additional questions about this paper, please contact Dr. Tom Trautman, Vice President of Curriculum Development at 800-222-2811, Ext. 150 or by e-mail at tomt@amered.com.

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