

## DIRECT INSTRUCTION IN REMEDIAL MATH INSTRUCTIONS

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### ABSTRACT

**The study investigated whether direct instruction, applied as a main instructional strategy, with a focused curriculum, could help students quickly improve their basic math skills. Nineteen students (7 to 16 years old) with math problems received individualized treatment for three weeks. Pretest, treatment, posttest was the basic design. Results indicated that after the treatment, the students made significant gains in their math basic skills, with an average gain of approximately 2.0 in Grade Equivalent score. The findings suggested that the integrated direct instruction approach, when used appropriately, can be both effective and efficient in helping students improve their basic math.**

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**R**esearch literature indicates that math problems emerge in the early years and are common at all age levels (Mercer & Mercer, 1993). Children with math deficiencies face not only academic problems but also practical problems every day. For these children, math problems often result in school failures and living problems. Daily living also requires numerous math skills, such as planning time, measuring a variety of things, making estimations, shopping, and so forth.

Researchers and educators have been searching for effective ways to help these children improve their math skills. The direct instruction strategy has been considered effective in teaching math basic skills, factual knowledge and concept name identification (Jones & Cooper, 1987). Pendarvis and Howley (1988) identified four major elements that had been shown to contribute to students, improved performance: (a) the emphasis on acquisition of concepts; (b) the use of mediators, including verbal, visual, and semantic mediators to enhance students' schema development; (c) the use of active learning and direct instruction techniques; and (d) the development of cognitive skills. In this article, direct instruction was identified to have contributed to students' improved performance.

Current research literature provides evidence on the effectiveness of direct instruction in teaching various basic math skills to diverse student bodies. The effect of direct instruction in raising the mastery of math related language-concepts for beginning first graders was investigated by Lambert and Pearson (1986). It was found that with direct instruction of language concepts, the experimental group did better on the posttest than the control group on 7 of 13 concepts.

A concentrated, direct instruction in reading and math program was provided to 27,944 students receiving Chapter 1 basic services in Maine (Maine State Department of Education, 1992). Some of these students also received support services such as counseling, guidance, and transportation. Pre and posttests for assessing students' basic and advanced skills in reading and math showed academic gains in normal curve equivalent (NCE) units. Average gains in Fiscal Year 1991 and 1992 ranged from 1.9 to 7.77 NCEs.

Direct instruction has also been applied to teaching middle grade low-achieving migrant students who were two to four years behind their peers. A 19-day curriculum consisting of 80 to 95 hours of direct instruction was implemented with this group of children in California. The pre and posttest results showed student growth in all four areas: attitudes toward math and science, metric system skills, observation skills, and skills in the use of scientific method (Ochoa, 1994).

In a comparison study investigating effects of token reinforcement, cognitive behavior modification and direct instruction, 94 students with learning disabilities received a treatment (one hour per day) for four weeks. Significant gain was found in achievement test scores for the token reinforcement and direct instruction groups (Ross & Braden, 1991).

Based on their 10-year research program, Kitz and Nash (1995) found that the most effective means of helping dyslexic college students was a well-planned curriculum and high quality instruction. A structured curriculum was the most effective means of helping them learn basic and fundamental algebra skills. Their practices included direct instruction, standard lesson designs, mastery learning, use of manipulative materials in problem solving, and training in math expressions.

In searching for a way to improve math and reading basic skills of correctional pretrial detainees, Winters, Mathew, Booker, and Fleegeer (1993) found that a system that integrated TABE assessment and evaluation, computer-assisted instruction, direct instruction, and an individualized curriculum was the most appropriate instructional program for meeting the educational needs of adult offenders. It appears that this combined approach works effectively in helping learners from diverse background improve math skills.

The purpose of the study was to investigate whether direct instruction, applied as a main instructional strategy, with a focused curriculum, could help students with math problems quickly improve their basic skills in math.

## **Method**

The study was designed to help students with severe math deficiencies: They were one to four grades below their actual grade level in math. None of these children was identified for special education services at the time of receiving treatment in this project. A faculty member (project director) in special education in a college located in the Appalachia Mountains area organized the project as a free summer program.

### Term Definition

Direct instruction is defined as an instructional sequence that includes demonstration, controlled practice with prompts and feedback, and independent practice with feedback (Mercer, 1997). This strategy comprises all six features defined by the researchers at the University of Oregon (Mercer, 1997). Basic math skills in this study refers to numeration concepts, computation procedures, knowledge and use of multiplication table, application of the skills to problem solving.

### Participants

Participants of the project were 19 students (10 boys, 9 girls, 7 to 16 years old). All the students were referred by their parent(s) because they were having real troubles in math. They

were students of the rural schools located in the Appalachia Mountains area. These students were from middle/lower middle class, Caucasian families. The participating teachers were the preservice teachers (fourth and fifth year) majoring in the college's special education program who volunteered to help a child improve his/her math skills over a 5-week period.

### Treatment

The program utilized a one-on-one approach—one teacher helping one student throughout the whole process. In this program, each student received focused treatment (mainly instructions) in the problem areas she/he exhibited: numeration concept, various computation procedures, multiplication table and its applications, and so forth.

Direct instruction was used as the main instructional strategy in the study. In addition, the teachers used the following methods: review, clarification, repeated instruction, drill and practice, continuous monitoring of the child's progress, continuous adjustment of teaching method, and curriculum content and so forth. The teachers also tried to maintain a rapport with the student she/he taught throughout the project. Positive reinforcement was applied in the process such as using tangibles and praise, and so forth.

The instructional materials used in the program were selected by each teacher based on the assessment results. The materials were selected based on the present achievement level and problem areas identified in each student.

### Design and Procedure

The duration of the project was five weeks. The first week was used for teacher training—preparing the participating teachers on how to assess a child's present achievement level in math, how to develop an instructional plan (including selection of instructional materials) for a student, and how to use direct instruction as a main instructional strategy to help a student improve the problem areas. The teacher training lasted for two hours (completed in one day). Two days were used for assessing the group of students. One day was spent by each teacher to develop the instructional plan. The next three weeks were for treatment. The fifth week was used for posttesting, the teachers preparing a brief report for the parents, and summarizing the project. The basic design of the study took the form of pretest, treatment, and posttest.

Each teacher developed an instructional plan for one student. Each plan was examined by the project director before it was implemented. During the treatment period, each teacher received feedback from the project director on how to apply the teaching methods appropriately and how to adjust the instructional content she/her was teaching. Necessary adjustments to the teaching methods and instructional content were made by each teacher to ensure the effective learning of each student.

Each student received mostly one hour treatment each session, sometimes 30 minutes a session. They all received four hours (minimum) of treatment per week. Most of them received 12 hours of individualized treatment. However, four students received five to six hours of treatment per week, because four teachers volunteered to spend more time working with them. The treatment was provided during the three weeks. Each teacher also recorded what occurred during each treatment session as a monitoring procedure.

### Instrument

Each student was administered the math subtest of the wide Range Achievement Test-R (WRAT-R) for pre and posttest. A test made by each teacher was also given to each student. This was to check on whether the problems a student exhibited on the pretest were identical to what the teacher found on the teacher-made test. Test items on the teacher-made tests were designed by each teacher according to the problems shown by each student on the WRAT-R test. It was to check on whether the student really had such problems.

After a three-week focused treatment, a posttest was administered to each student. Every student in the project made notable progress. A summary report was provided by the teachers to the parents of each student, and suggestions were made to them on the necessity of providing continued help to the student. Main findings follow.

### **Results**

A Dependent *t*-test was conducted on the raw scores of the pre and posttest scores of this group of students. Results indicated that significant gains were found with the posttest results. The comparison yielded a *t*-value at 22.75, with  $p < .000$ , two-tailed.

The average Grade Equivalent (GE) scores of the two testings showed: The average GE score for the pretest was 3.58, and that for the posttest was 5.53.

### **Discussion**

It is to be clear that other treatment methods were also integrated in this study, with direct instruction being the main one. The secondary treatment also played an important role in the program. Thus the direct instruction approach used in this study needs to be considered as an integrated approach, not an isolated teaching method. The approach has the following features: direct instruction being the main instructional strategy, teachers being trained with a curriculum design (appropriate for each child), the instructions being structured and focused, feedback to the teachers on adjusting instructional methods and content. The same approach was applied to helping students with severe reading problems and similar results were found (Din, 1998). The direct instruction strategy applied in this study should be considered as part of the program. A highly controlled curriculum was also integrated. Without a curriculum that matched the students' knowledge and skill levels and focused instructions, it is unlikely that the students could gain so much in such a short time. This approach (direct instruction with a curriculum design) is similar to the definition of Kameenui, Jitendra, and Darch (1995) for "Direct Instruction."

Even though the participating teachers in this project were fourth and fifth year college students, it is possible to train parent volunteers with college or high school level education background in this approach to help children improve their basic skills in math. It would be interesting to replicate such a program on a more extensive basis to see whether similar results can be generated.

The actual instructions provided to the students included application skills training. Nevertheless, WRAT-R does not measure problem solving skills or application skills. No information of improvement in this area is available.

### **Conclusion**

In this study, direct instruction, applied as a main instructional strategy, with a focused curriculum (an integrated approach) was employed to help students with severe math deficiencies. Results indicated that the students made notable gains in basic math skills after receiving the treatment for three weeks. The findings suggested that the integrated direct instruction approach, when used appropriately, can be both effective and efficient in helping students improve their basic math skills.

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