ABSTRACT

Many studies have demonstrated the efficacy of Direct Instruction in various academic fields. The main characteristic of this approach is emphasis on a perfectly straightforward, successive Instruction with quick steps and empirical experiences which is taught by the teacher. Direct Instruction means breaking the complex task into its constituent components, and also training and organizing these components. This study aims at examining the efficacy of Direct Instruction approach (DISTAR) on improvement of mathematics in students with learning disabilities. In the present study, A-B single subject design was used with follow-up phase. In order to arrive at the goal of the study, researchers selected three students at age range of 8 to 10 in the city of Ferdows. Wechsler intelligence scale for children was used to measure the variables in order to determine intellectual ability of children and also identify the students with learning disabilities, and teacher-made tests were used as a baseline to evaluate input behaviour of students in math. Teacher-made test was implemented as pre-test and post-test, and follow-up phase was run after 14, 21, 25 days sequentially, and the scores of each three stages were recorded on a diagram and its graph was drawn. The results showed that all three tests in intervention phase of experimental operation in comparison to baseline, had considerable improvements, and maintained a fairly high degree of learning in follow-up phase.

Keywords: Direct Instruction, Learning Disabilities, Dyscalculia, Students.

1. INTRODUCTION

Inability in learning is a problem which affects the inability of child in receiving, processing, analyzing or storing information. This inability can make reading, writing, spelling or solving mathematics questions difficult for the child (Gresten, Jordan and Flojo, 2005).

Students with learning disabilities learn very slowly, while other students have better educational status and feel less humiliated and they don’t have aversion to school and lessons. The parents of students with learning disabilities are often ignorant of the causes of this inability, and this arises more problems and by exposing pressures on their child, they multiply the difficulties (Kakavand&Ahadi, 2009).

Direct Instruction with a behavioural approach has special characteristics (clear goals, precise organization, short steps, presentation of easy to difficult subjects, advanced-organizer, organized and guided practices, repetitive evaluation), which is implemented as an affective and adequate approach in helping students with learning disabilities. Bursuck and Damer (2007) define the components of Direct Instruction as ‘Direct Instruction is an explicit teaching, Direct teaching of skills and methods, organized and systematic...’
training during teaching, which clearly selects a set of skills and then, organizes useful skills in a logical manner for Instruction.

This approach requires more plans which are provided by teachers, and if applied effectively, it can be used extensively for transferring skills from the learned subjects to new ones (Strickland & MacCinni, 2010).

In the research's review of literature on the effectiveness of Direct Instruction, Suzan, Barbara and John (2005), Adams and Carnine (2003) revealed that in comparison to other educational programs, Direct Instruction is more effective in the improvement of learners with special learning disabilities. Watkins and Slowcam (2004), Carnine, Silbert, Kame and Traver (2004), have found that, with regard to the results of experimental studies, Direct Instruction is more approved and supported than any other training program. Thus, Direct Instruction is undoubtedly the most useful educational program for students who are at risk of educational failure or on the other hand, those who need special trainings. Many researches have been done on the efficacy of this approach in general and special training, and each research represents the success of this approach. Harshkamp and Suhre (2006), showed the effects of computerized Direct Instruction programs in comparison to structural computer program on high school math, which results approved the Direct Instruction more noticeably. Herbst (2005) also assessed the efficacy of Direct Instruction in mathematics of students with behavioral-emotional problems, and found that this approach can overcome the mathematic problems of these students.

The efficacy of Direct Instruction is approved on reading and mathematics of 55 students with cerebral palsy in 14.5 to 16.5 range of age and average IQ of 71.25 (Humphries, Neufeld, Johnson, Engels and MacKay, 2005). Herbst (2005), evaluated the effectiveness of Direct Instruction on math of 10 students with emotional-behavioral problems, and concluded that this approach is suitable for overcoming mathematic problems.

In a study Kroesbergen and Van Luit (2005) compared Direct Instruction with guided training in mathematics on 69 students with mild mental retardation, and found that the efficacy of Direct Instruction is higher than guided training. Kroesbergen, also, conducted a meta-analysis study from 58 studies on the intervention of mathematics in students with peculiar need at elementary level, and revealed that Direct Instruction and self-examination are more effective than mediating strategies, and suggested that Direct Instruction in math skills enjoys from strongest research supports.

In case of Direct Instruction, few studies have been conducted so far in Iran, from which one can address the followings. Pirzadi et.al (2011), evaluated the effect of Direct Instruction on phonological awareness in reading skill which was conducted on students with learning disabilities. Their results showed that Direct Instruction can have positive effect on improving academic achievements.

Karimi (2010), compared the effectiveness of three training approaches, which were Direct Instruction, phonological awareness and combined teaching, and involved in reducing the spelling problems of elementary students and also editing plans. The results of this study showed that Direct Instruction, phonological awareness and combined teaching approaches, are all pretty effective and useful in solving spelling problems of elementary students.

In another study, Sharifi Ardani (2010), evaluated the effects of Direct Instruction approach on learning math concepts (addition, subtraction, multiplication and division) in students with math disabilities. The results suggested that Direct Instruction approach is positively effective in children's learning math concepts.

Most of the researches have shown the efficacy of Direct Instruction in various academic fields. Among these, Grussen (2004) suggested the improvement of high-risk students in reading, language and mathematics because of using Direct Instruction. Kroesbergen (2003) also conducted a meta-analysis study from 58 studies on the intervention of mathematics in students at elementary level with learning disabilities, and found that Direct Instruction is the most suitable approach for basic mathematical skills. Since these students need step-by-step and Direct training, task analysis and organized Instruction, Direct Instruction approach is a proper approach in training these students (Kroesbergen &Van Luit, 2005). Direct Instruction means breaking a complex task into its constituent components, and then training and organizing these components (Stine, Silbert and Carnine, 1997). The main characteristics of this approach are emphasis on completely Direct, successive with quick steps training along with empirical experiences, which are taught by the teacher (Hallahan & Kaffman, 2003).

Although many studies on the Direct Instruction have been done outside of Iran, this paper tries to find a useful approach for teaching math to these students (with math disabilities) through conducting a research with the title of evaluating the efficacy of Direct Instruction on mathematical performance of students with learning disabilities; with respect to different cultural and economical characteristics of Iran, this approach has not been examined for students with math disabilities, and this paper intends to address this gap.
The present study intended to examine the following hypotheses:
Mathematical performance in students with math disabilities improves through using DirectInstruction.
The effects of DirectInstruction on improvement of math performance is different between two sexes.
This study aims at examining the effects of DirectInstruction (DISTAR) on improvement of mathematics in students with learning disabilities.

2.METHODOLOGY

In the present study, A-B single subject design was used with a follow-up phase. In order to arrive at the goal of the study, researchers selected three students at age range of 8 to 10 in the city of Ferdows.

2.1.MEASURES

Wechsler intelligence scale for children and teacher-made tests was used to measure the variables.
a) Wechsler intelligence scale: this scale was made by Wechsler in 1969 to measure children's IQ. On the contrary to similar single scales, it is not based on age levels, but consists of sub-tests, whose provisions are arranged according to difficulty. Each sub-test evaluates different capabilities, and presents the collection of the whole intelligence. WISC scale, was revised and standardized after 25 years after compilation in 1974, and the revised Wechsler intelligence scale for children was named (WISC-R). This test includes 12 subtest, 2 tests of which has a reserving aspect, and 6 tests are verbal and 6 tests are nonverbal. In order to determine the reliability of the scale, reliability of re-assessment of tests and IQs and chanson reliability coefficient of tests of (WISC-R) scale were examined, and it was found that the test is highly reliable. In order to evaluate the reliability of re-assessment, 120 children, who were examined before, at 6-12 range of age were selected, and they were examined twice over 4 to 6 weeks. The reliability coefficient of the tests was variable between 0.44 to 0.94, except for two cases in which the reliability coefficient of the test of adapting symptoms and account was lower than these values. In order to evaluate the chanson reliability of the scale, verbal and nonverbal tests except for memory figures test, which is made of two distinct components, and symptoms matching test which is a speed test, other tests are divided into even and odd sections and correlation coefficient of both sections was determined. 252 were randomly selected from among 7 different age groups, and they were examined in 11 Spearman Brown tests between even and odd scores. The chanson reliability coefficient of tests is at 6-11 age groups, which is significant in all cases. These variables are variable from 0.98 for feedback terms and reinforcement up to 0.42 for account.
b) teacher-made test: this test is designed based on the content of math book of third and forth level of elementary school for normal students. Content validity of test was determined by examining and comparing test and book contents. Test validity was also confirmed by some experts and experienced specialists. Teacher-made test consists of 20 questions for each concept, which was provided to students as pre-test and post-test, and each question had a score, and total score were twenty.

3.FINDINGS

The results showed that all three tests in intervention phase of experimental operation in comparison to baseline, had considerable improvements, and maintained a fairly high degree of learning in follow-up phase.
Table 1: improvement of subjects in pretest and post-test with follow-up test in short

<table>
<thead>
<tr>
<th>raw</th>
<th>lessons</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Concept of reading time</td>
<td>25%</td>
<td>90%</td>
<td>0.75</td>
</tr>
<tr>
<td>subject</td>
<td>Concept of mass</td>
<td>20%</td>
<td>80%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>Concept of division</td>
<td>25%</td>
<td>85%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>Measuring line segment</td>
<td>5%</td>
<td>90%</td>
<td>80%</td>
</tr>
<tr>
<td>Second</td>
<td>Concept of doubling</td>
<td>30%</td>
<td>95%</td>
<td>85%</td>
</tr>
<tr>
<td>subject</td>
<td>Isosceles and Equilateral</td>
<td>15%</td>
<td>85%</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>triangles</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Concept of diameter</td>
<td>25%</td>
<td>90%</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>equality of multiplication</td>
<td>0</td>
<td>85%</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>and addition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td>Division with remaining</td>
<td>0.31</td>
<td>85%</td>
<td>70%</td>
</tr>
<tr>
<td>subject</td>
<td>test on correctness of</td>
<td>15%</td>
<td>85%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>division</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Division with transfer</td>
<td>0</td>
<td>80%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>parallelogram</td>
<td>30%</td>
<td>90%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Figure 1: subject A at third level of elementary school

Lessons guide
1- Reading time.
2- Concept of mass.
3- Concept of division.
4- Measuring line segment.

Subject A in teacher-made pre-test gained 5 score from 20 in case of the concept of reading, and correctly answered 20% of questions, and this value indicated 90% of increase in post-test. After 2 weeks in the follow-up phase, the subject gained the score of 15 and correctly answered to 75% of questions. In case of the concept of mass, it correctly answered 20% of questions in pre-test, while it increased to 80% in post-test. In case of the concept of division, the subject had 25% improvement, but in post-test correctly answered 85% of questions with Direct Instruction, and in the follow-up test, it correctly answered 70% of questions after 18 days.
Lessons guide:
1- Concept of doubling
2- Isosceles and Equilateral triangles
3- Concept of diameter
4- Equality of multiplication and addition

Subject B in teacher-made pre-test correctly answered 30% of questions in case of the concept of doubling, which was increased to 90% after teaching in post-test phase. The subject got score 25 in follow-up level after 21 days, and answered 85% of questions correctly. In case of introducing Isosceles and Equilateral triangles, the subject correctly answered 15% of questions in pre-test, while it increased up to 85% in post-test. In case of the concept of diameter, the subject had 25% progress, but in post-test phase it could correctly answer 90% of questions with DirectInstruction, and correctly answered 60% of questions in follow-up phase after 18 days.

Lessons guide
1- Division with remaining
2- Testing the correctness of division
3- Division with transfer
4- Parallelogram
Subject C in teacher-made pre-test on the concept of division with remaining correctly answered 35% of questions, which increased to 80% in post-test phase. After 25 days in follow-up phase, it gained score 14 and correctly answered 70% of questions. It could only correctly answer 15% of questions in pre-test on testing the correctness of division, and in follow-up phase it could correctly answer 70% of questions. In pre-test, it couldn't answer any question in case of the concept of division with transfer, while it increased to 80% in post-test. In follow-up phase, 65% of questions were answered correctly. In case of introducing parallelogram, the subject had 30% progress, but in post-test stage it could correctly answer 90% of questions with DirectInstruction, and in follow-up test it correctly answered 75% of questions.

4. DISCUSSION AND CONCLUSION

With regard to the methodology of the present study, it can be concluded that DirectInstruction is effective in improving the students with math disabilities, and the results of this study is compatible with those of Maccini et al. (2006), Kroesbergen (2003), Centeno (2005), Flores and Keylor (2006), Pirzadi et al. (2011). In a study (2005), Centeno showed the efficacy of DirectInstruction on reducing the interruptions in the progress of reading skills in elementary school students. Flores and Keylor (2006), evaluated the effects of DirectInstruction on the successful performance in the topic of fraction in students who are at risk of academic failure at secondary school, and the results revealed that the participation of students in this program caused improvements in their skill. The results of the study which was conducted by Maccini et al. (2006) indicated that one of the effective training approaches for students at high school with emotional and learning disabilities, is DirectInstruction. Pirzadi et al. (2011), examined the effects of DirectInstruction on phonological awareness in reading skill of students with learning disabilities. Their results showed that DirectInstruction is effective in academic improvement of students.

The efficacy of this approach in children with cerebral palsy (Humphries et al., 2005), risky (Grussen, 2004), normal but weak (Bar-cole, 2004 & Centeno, 2005) and normal students (Stones, Slavin & Famish, 1991 & Standish, 2005) was high. Since this approach differs from therapy-training intervention (Direct approach), this approach is recommended to psychologists, consultants, teachers, parents and educational administrators applying this approach to improve learning abilities of math in students.

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