

Effectiveness of Metacognitive and Neurocognitive Intervention Strategies in Enhancing Mathematical Performance of Grade 08 Students

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Abstract

Mathematics is utmost important for the daily life of the people. It is one of the significant subjects which improve the abilities and skills in a variety of calculations. Learning mathematical skills at the secondary level is highly emphasized because it will help the cognitive skills of the children. This is an experimental study using single group pretest treatment post test design. The major objectives of the study were to diagnose the mathematical performance of Grade 08 students who are identified to be improved, and to assess the efficacy of Metacognitive and Neurocognitive Intervention strategies in enhancing mathematical performance of Grade 08 students. For this study, a sample of 35 Grade 08 Students studying at AK/Al-Muneera Girls High Schools, Addalaichenai who were identified poor in proficiency in mathematic ability was selected by using purposive sampling technique. Data were collected using Mathametic Achievement Tests (Diagnostic Test, Pretest, Post test, and Progressive Test) and Observation Sheet: The findings of the study have revealed that Metacognitive and Neurocognitive Intervention Strategies were effective in enhancing mathematical achievement of students.

Keywords: Metacognitive and Neurocognitive Intervention Strategies; Grade 08 students; Mathametic Achievement Tests.

Introduction

Mathematics is one of the significant subjects which support learning of the abilities and skills. Learning mathematical skills at the secondary level help the cognitive skills of the children. The methods of learning the proficiency of mathematics highly depends on the techniques of learning in the classroom. Effective teaching depends upon the application of innovative strategies which support

the learning teaching process to a great extent.

Metacognitive and Neurocognitive Strategies

Metacognition is simply an awareness and understanding of one's own thought processes such as study skills, memory capabilities, and the ability to monitor learning. Metacognitive knowledge helps to understand own cognitive processes and the understanding of how to regulate those processes to maximize learning. In teaching learning process, the metacognitive knowledge will be of very use not only to the teachers, but also to the students. Both students and teachers can adopt the metacognitive knowledge of the students in designing the learning activities to optimize their learning outcomes.

Similarly, neurocognition is simply any form of cognition that is associated with the functioning of one or more specific areas of the brain. Its functions are the cognitive functions that are closely linked to the function of particular areas, neural pathways,

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or cortical networks in the brain substrate layers of neurological matrix at the cellular molecular level (Dan, 2013). In other words, it shows how ones brain functions when it comes to learning teaching process. The knowledge about neurocognition also helps both teachers and students to design their learning activities to maximize the learning outcomes.

In combining both metacognitive and neurocognitive strategies in the teaching learning process is an innovative attempt in the approach to developing the mathematical ability of the secondary students. In designing the learning activities and implementing them in the classroom using metacognitive and neurocognitive approaches, suitable tasks are important.

Need for the Study

Mathematic proficiency is important for the cognitive development of the students and economic gatekeeper that provides a key basis for achieving other academic and career skills. The strategies of knowing of one's own thinking process and how his brain functions will ease the leaning teaching process, particularly the difficult subjects, like mathematics. Insecondary schools in Sri Lanka, several instructional methods and strategies have been used for teaching secondary class students, especially for improving mathematic proficiency. These methods were reported be relatively not that effective (Jazeel, 2017).

A review of related literature revealed that though there are some studies found in the line of teaching language using Metacognitive and Neurocognitive approaches abroad, there is little researches found to focus mathematical teaching of Grade 08 students in Sri Lankan context. Therefore, this study "Effectiveness of Metacognitive and Neurocognitive Intervention Strategies in Enhancing Mathematical Proficiency of Grade 08 Students" was planned.

Objectives of the Study

1. The objectives of the study are To diagnose the students who are to be improved in mathematics in Grade 08 class
2. To design and Implement Metacognitive and Neurocognitive Intervention Package among the students
3. To assess the effectiveness of the Metacognitive and Neurocognitive Intervention strategies in enhancing mathematic skills among the students

Methodology

In this study, an experimental method was adopted with pretest treatment post test design.

Population of the Study

The population of the study constitutes all the students studying in Grade 08 students in AK/Al-Muneera Girls High School, Addalaichenai

Sample of the Study

A sample of 35 Grade 08 students who were identified poor in mathematics was selected by using purposive sampling technique.

Tools for the Study

The following tools were used for the study:

1. *Diagnostic Mathematic Achievement Test*: This test is for identifying the specific difficulties in mathematic skills faced by students reading in Grade 08 and selecting the sample of 35 bottom level performers for the study
2. *Metacognitive and Neurocognitive Strategies Validation Scale*: This lickert type Scales is developed by the investigator for validating the Metacognitive and Neurocognitive Intervention Package developed by the investigator
3. *Pre- and post tests*: (Parallel Achievement Tests). These achievement type mathematic tests are constructed for finding the levels of students and for assessing the effectiveness of Metacognitive and Neurocognitive Intervention strategies.
4. *Observation Sheet*: This sheet is developed by the investigator to identify the activeness and the attitudes of the students while doing activities during the experimentation

Intervention Strategy

For implementing Metacognitive and Neurocognitive Intervention strategies, a Metacognitive and Neurocognitive Intervention Package was developed by the investigator which contains series of mathematical tasks which can be implemented by using metacognitive and neurocognitive strategies. The package was validated by the experts using Metacognitive and Neurocognitive Strategies Validation Scale developed by the investigator

Conducting the experiment

Before the implementation of the package, a validated pre-test was administered for assessing the competency level of the sample in Mathematics.

Then, the validated Metacognitive and Neurocognitive Intervention Package was implemented for a period of 06 months. The modules in the package were implemented one after the other. After completing the implementation of the package, a post test was administered assessing the competency level of the sample in the mathematics. The scores obtained by the sample of the study were analyzed by employing the following statistical techniques, Test of Significance - 't' test

Results

Research Hypothesis -1

Metacognitive and Neurocognitive Intervention strategies will significantly enhance the attainment of mathematical proficiency of the students

From the table 1 it may be inferred that, since the value obtained 3.42 is more than the table value 2.85 the difference in performance between the Pre-Test and post test is significant at 0.01 level. Thus, the hypothesis of the study has been confirmed. Thus, Metacognitive and Neurocognitive Intervention strategies have enhanced the attainment of mathematics of the preschool students.

Table 1:

Sl. No.	Performance Test	N	Mean	Standard Deviation	't' value	Level of Significance
1	Pre-Test	35	14.2	4.18	3.42	Significant at 0.01 level
2	Post-Test	35	46.7	6.43		

Findings of the Study

- Metacognitive and Neurocognitive Intervention strategies have enhanced the attainment of preschool students
- Metacognitive and Neurocognitive Intervention strategies have improved the, confidence, activeness and interest among students to do activities. The techniques were user friendly

Discussion

It is revealed from the analyses of the findings that *Metacognitive and Neurocognitive Intervention strategies*. The findings of the present study strengthen the results of the previous researches. Bäckman (2012) found in the similar study conducted in Malaysia schools that the use of peer works improved the mathematical skills. This study also revealed that the students should be given appropriate activities to improve their mathematical problem solving skills. The mathematic activities should be student-centered and easier. However, the metacognitive strategies are rarely used in schools in Sri Lanka and that there needs more researches to test the ability of improving language, aesthetic, creative skills of the students.

The results of the study carried out by Dan (2013) revealed that the teaching using different cognitive and neurocognitive methods were more effective than conventional methods. Similarly, Shulman (1986) concluded that approaches of giving peer assignments were more effective than conventional methods in developing language and mathematics for slow learners. The present study has supported this result. However, according to Pramling and Pramling (2008) emphasized in their studies that cognitive and neurocognitive approaches are more useful for the students with learning difficulties and the over use of this techniques discourage the students learning themselves. This arguments need to be proved with more studies using the cognitive and neurocognitive approaches. As far as the present study is concerned, what both opined was contradictory to the results of the study.

By and large, the various previous studies have strengthened the findings of the present study and vice-versa. Hence, this is an important attempt in search of an appropriate method for teaching mathematics in schools

Conclusion

The following conclusions have been made from the analyses of the data collected. It is concluded that

the Metacognitive and Neurocognitive Intervention strategies are very effective methods in teaching mathematics among students. The students are very active and interested and seem to be confident in this doing their mathematical activities

By using strategies difficulties in mathematics can be minimized. The mathematics of all the students can be enhanced further irrespective of the bottom performers.

The using of metacognitive and neurocognitive strategies instead of conventional teaching methods can activate the brains of the students and make the students learn the difficult concepts in mathematics easily.

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