Effectiveness of Peer Scaffolding Techniques in Enhancing Mathematical Achievements among Preschool Children in Addalaichenai Education Division of Sri Lanka
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Abstract

Learning of mathematical skills at preschool level is significant for the cognitive development of children. The major objective of the study was to assess the effectiveness of Peer Scaffolding Techniques in enhancing mathematical performance of preschool children. This was an experimental study and a sample of 15 preschool children studying at House of English identified poor in proficiency in mathematic ability was selected by using purposive sampling technique. Data were collected using Tools for Assessment in Early Mathematics (TEAM), Observation Sheet and Early Numerical Tasks: The findings revealed that Peer Scaffolding Techniques was effective in enhancing mathematical achievement of preschool children.

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One type of scaffolding technique is the process scaffolding. It breaks a complex task down into smaller, more manageable parts that slowly increase in cognitive complexity to form a cohesive whole (University of Waterloo and Schroeder, 2012). By breaking down major assignments into several components, it can focus on the skills of students or the knowledge of students require to successfully complete the larger assignment, and support them in a way where student engagement is increased, rather than assigning a single assignment that might be initially confusing and overwhelming. This process allows students to see the bigger picture, and allows the teacher to empower students to work towards it independently.

Another type of scaffolding technique is critical thinking scaffolding where students develop critical thinking skills with the support they receive. The critical thinking scaffolding assigns work in a way that allow students to move gradually from lower order critical thinking skills to more complex, higher order critical thinking skills. Lower order level assignments may consist of abstracts, summaries, or descriptions, to reinforce skills such as remembering and understanding concepts. Higher level skills such as applying, analyzing, evaluating, and creating, can be reinforced through assignments storytelling, mind-mapping, according to the level of the students (Ibid).

In peer scaffolding techniques, the students are motivated to get the help of their peers who are very close and familiar to them. These approaches clearly deviate from mundane peer work or group work. In scaffolding techniques, both process scaffolding and critical thinking scaffolding are involved so that the students can master their skills and ability of completing challenging mathematical tasks easily and freely without any compulsion. In these strategies, the students are assigned to do the activities which are supported and scaffolded by their peers in learning teaching process. The practices of scaffolding even promote the affective domain of the preschool students in addition to their developments of cognitive and psychomotor domains.

**Need and significance of the Study**

Mathematic proficiency is a requirement for the cognitive development of the preschool students and an economic gatekeeper that provides a key basis for achieving other academic and career skills. Hence, teaching of mathematics highly influence on teaching of other subjects including mathematics in the primary and post primary classes.

Further, the Mathematic ability is influencing in the development of the multi-literacy and multi-competencies of the students studying at preschool classes. Better teaching of mathematics at primary and preschool level can lay a good foundation for the development of mult-talents of the students.

In present preschools, several instructional methods and strategies are used for teaching preschools children, especially for improving mathematic proficiency. These methods are rather conventional and reported be relatively not that effective (Jazeel, 2017). The new and innovative child friendly instructional techniques are important for teaching preschools, especially for teaching them mathematical ability.

The scaffolding instructional techniques are found to be effective in teaching in secondary and primary class students in some other countries. However, these techniques are not known and used in teaching preschool classes in Sri Lankan preschools. This requires the testing of peer scaffolding techniques in Sri Lankan context for preschool children and if found effective, can be prescribed as a suitable instructional strategy for teaching mathematics. A review of related literature also revealed there are few studies about using of peer scaffolding techniques. Even these studies have not focused on teaching mathematics at preschool levels. This study was planned to fill this gap.
Objectives
1. To diagnose the mathematical performance of preschool students who are identified to be improved.
2. To design and implement Peer Scaffolding Techniques among preschool children
3. To assess the effectiveness of the Peer Scaffolding Techniques in enhancing mathematical performance of preschool children

Hypothesis
1. There is a significant difference between the pretest score and posttest score of the subject in early mathematical skills

Method
Participants
A sample of 15 preschool children studying at House of English who were identified poor in proficiency in mathematic ability was selected for this study by using purposive sampling technique. Though all the children who were studying in the class were treated with intervention strategy, only the scores of the sample were subjected to statistical analysis.

Instruments
1. Tools for Assessment in Early Mathematics (TEAM): The tool developed by Clements Sarama and Willie (2011) was moderated with experts opinion to suit the local context and measure mathematical ability of preschool students in terms of their age. For establishing the reliability of the tool, test – retest method was used. The correlation coefficient was .86. The pilot run was done among 10 children studying at Batticaloa Nursery School and moderated considering the opinions of the experts. This instrument has both content and face validity.

   This tool was used to identify the students who were to be improved in their mathematical proficiency, to find out the levels of their performance before and after the intervention.

2. Observation Sheet: Children under study were observed using this sheet by the investigator while doing the numerical tasks coupled with peer scaffolding techniques. The sheet was validated with expert’s opinion.

3. Early Numerical Tasks: This is the numerical tasks the children performed as intervention blended with peer scaffolding techniques. These Tasks included verbal counting, one-to-one counting, cardinality, counting subsets, set comparison, subitizing, numeral comparison, set comparison, number order, set-to-numerals, story problems, and number combinations

Intervention Strategy
In this study, Peer Scaffolding Strategies, which the different techniques of assigning peer to support the student to do the activities in Early Numerical Tasks, are intervened.

Procedure
After obtaining the informed consents of the guardians of the children and the management of House of English, the sample was treated with peer scaffolding techniques to perform the designed numerical tasks. The teacher of the class was trained by the investigator on how to use the peer scaffolding techniques and the numerical tasks. Before after the intervention, the mathematical proficiency level of the children were identified using Tools for Assessment in Early Mathematics and the scores obtained were tabled for statistical analysis. The observation sheet was used to observe the interest, activeness of the children while doing the specified tasks on numeracy.

Results
For assessing the effectiveness of peer scaffolding techniques in enhancing mathematical achievements of preschool children, the hypothesis of the study, “there exists significant difference between the pretest score and posttest score of the subjects in the performance of
mathematical skills” was tested. For this, the mean scores of pretest and posttest and standard deviations needed to calculated ‘t’ value is presented in table 1.

Table 1

<table>
<thead>
<tr>
<th>Performance Test</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>‘t’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>15</td>
<td>17.2</td>
<td>5.17</td>
<td>12.49**</td>
</tr>
<tr>
<td>Post-Test</td>
<td>15</td>
<td>49.7</td>
<td>10.43</td>
<td></td>
</tr>
</tbody>
</table>

**p< .01

Table 1 shows mean, standard deviation, and the ‘t’ value of the performance of mathematics in pretest score and posttest score of preschool children. The mean of pretest score and standard deviations are 17.2 and 5.17 separately. Similarly, the mean of posttest score and their standard deviation are 49.7 and 10.43 respectively since the ‘t’ value obtained 12.49 is more than the table value 2.89 the difference in performance between the pre-test and post-test is significant at 0.01 level. This indicates that the hypothesis of the study has been confirmed. Thus, the Peer Scaffolding Techniques has enhanced the attainment of preschool students.

From the data gathered from observation of the classroom, it was found that the preschool children who were under treatment of Peer Scaffolding Techniques, showed improved confidence, activeness and interest in doing the early numerical tasks. They were collaborative, friendly and helping each other which simplified teaching learning process in the class.

Discussion

The findings of the present study strengthen the results of the previous researches. Backman (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 mathematical activities should be student-centered and easier. However, the peer scaffolding techniques is rarely used in preschools and that there needs more researches to test their ability of improving language, aesthetic, creative skills.

The results of the study carried out by Runesson, and Marton (2002) showed that the scaffolding instructions 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 Runesson, (2006) the uses of peer approach is very low and many teachers are still using the conventional methods. He says this peer work approach need more researches focusing primary, secondary and advanced level classes.

By and large, the various previous studies have strengthened the findings of the present study and vice-versa.

Conclusion

The objective of the study was to find out the effectiveness of peer scaffolding techniques in enhancing mathematical performance of preschool children using experimental method. It is concluded that the peer scaffolding techniques are effective methods in teaching mathematics among preschool students. This finding implies that preschool teachers should be encouraged to employ the effective and innovative techniques of peer scaffolding in teaching for the development of their mathematical ability. Though these new techniques have been used for the preschool students with poor mathematical achievement, the average and higher
level of preschool children in mathematics also can be taught using the new techniques. As group work and peer scaffolding technique are quite different, the preschool teachers should be educated the new techniques and their usability.

Preschool students are very active and interested in doing mathematical activities when peer scaffolding techniques are used by their teachers. This indicates that the preschool students can get freedom and confidence in working with difficult mathematical sums when their peers provide support in learning mathematics.

Both of the major findings imply that by using these new strategies, difficulties in learning mathematics can be minimized. The mathematics of all the students can be enhanced. The strategy of mingling these strategies with suitable technology instead of conventional teaching methods can even further help the students learn the difficult concepts in mathematics and motivate the students to do more classroom activities.

References