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Specific Difficulties Exhibited by Children with Mathematical Disability (CWMD) in Arithmetic Learning Fractions at Elementary Level.

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Abstract

Competence with fractions is foundational to acquire more advanced mathematical skills. However, achieving competency with fractions is challenging for many students, especially for those with mathematics learning difficulties who often lack foundational skill with whole numbers. Difficulties exhibited in fractions prevent the child from enjoying the world of numbers. Thus in the present study the authors try to know the percentage of children with mathematical Disabilities of Grade VI and VII exhibiting difficulties in various criterion measures pertaining to Fraction. These participants were considered as Masters, Partial Achievers and Non-Masters based on the different criterion measures. The Major findings are discussed in the article.

Keywords: Specific Difficulties in Arithmetic and Mathematical Disability, Difficulties in Learning Fractions.

Introduction

Although many children encounter difficulties with mathematics in elementary school, much less research has been conducted in this area (Ginsburg, 1997). Thus weaknesses in the area of mathematics can impede educational opportunities for students (Rivera-Batiz, 1992). Children with mathematics difficulties often have problems in several areas of mathematical cognition. These include the ability to solve relatively complex story problems and retrieval of number facts (Jordan & Hanich, 2000; Russell & Ginsburg, 1984). fractions have been one of the most difficult mathematical skills to master, for children with and with-out difficulties (Behr, Wachsmuth, Post, & Lesh, 1984; Hiebert, 1985; McLeod & Armstrong, 1982; Ni, 2001). Struggling learners in mathematics (students with learning disabilities [LD], mathematics learning disability (MLD), low-achievement in mathematics, and at-risk for failure in mathematics) are at an even greater disadvantage, as their performance in mathematics has

traditionally lagged at least two grade levels below their peers (Wagner & Blackorby, 1996).

The National Mathematics Advisory Panel (NMAP, 2008 fractions have been one of the most difficult mathematical skills to master, for children with and with- out difficulties (Behr, Wachsmuth, Post, & Lesh, 1984; Hiebert, 1985; McLeod & Armstrong, 1982; Ni, 2001).

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Accumulating data from the National Assessment of Educational Progress (NAEP) also provide evidence for students' difficulties with fractions. According to the 2017 NAEP, only 32% of fourth graders correctly identified which fractions were greater than, less than, or equal to a benchmark fraction, ½ . In 2009 NAEP, only 25% of fourth graders correctly identified a fraction closest to ½.

Norton and Boyce (2013) and Siegler, Thompson and Schneider (2011) argued that fraction is very difficult to teach, most cognitively challenging and most essential for advanced mathematics.

Traditionally, difficulty with fractions has been attributed to fundamental differences between whole numbers and fractions. This can lead to whole-number bias, which refers to students' overgeneralization of whole number knowledge to fractions (DeWolf & Vosniadou, 2015; Ni & Zhou, 2005). This finding confirms the observation of Hackenberg and Lee (2015) that teaching fraction effectively requires using correct language and technical terms.

The present study intends to identify the specific difficulties in fractions faced by CwMD, the objective of analyzing the difficulties faced by CwMD in Mathematics Diagnostic test.

Need and importance of the study

Math concepts such as fractions that students do not master in the early grades can go on to confuse them later on and to cause them a great deal of math anxiety. Fractions are often the first hurdle experienced by school learners while learning mathematics as it is one of the operation beyond basic skills of addition, subtraction, multiplication and division (Chinnappan 2006).The new research shows that students need to intuitively understand concepts rather than just to memorize language or symbols, as such rote memorization does not lead to long-term understanding. Many math teachers do not realize that the language of math can be confusing to students and that students must understand the concepts behind the language. They tend to learn addition and subtraction of fractions earlier and multiplication and especially division of fractions later. Fractions forms a building block for other mathematical skills and it is important that learners feel comfortable and confident in understanding of fractions. Researchers argue that children generally perform badly in fractions and that the knowledge of fractions is crucial for success (Booth, Newton & Twiss-Garrity 2014). Competence with fractions is foundational to acquiring more advanced mathematical skills. However, achieving competency with fractions is challenging for many students, especially for those with mathematics learning difficulties who often lack foundational skill with whole numbers. Teaching fractions is also challenging for many teachers as they often experience gaps in their own fractions knowledge. Jessica Namkung Lynn Fuchs

Objectives of the Study

1. To analyze the difficulties experienced by Children with Mathematical Disability (CwMD) of Grades -VI, VII in various criterion measures of the following components of Arithmetic in Grades V-VII:

a) Addition of fractions
b) Subtraction of fractions
c) Multiplication of fractions
d) Division of fractions

Methodology

The methodology related to the participants, tools and techniques method of collection and analysis of data are discussed in this section.

Participants

In order to achieve the objectives of the study the participants, CwMD were selected from seven Government and Private Aided schools with Kannada as Medium of Instruction from Mysore City by applying a set of Exclusionary and Inclusionary Criteria. The details of the participants are given below in the Table-1

Table -1
Details of the participants

Type of School	**Total No of children in Grades VI and VII in the selected school.**			**Number of children Identified as CwMD in Grades VI and VII**		**Number of children included in the study**
	Grade	**No of Children**				
Government	VI	134	**234**	11	**17**	6
Private Aided	VI	100		6		3
Government	VII	147	**259**	9	**18**	6
Private Aided	VII	112		9		6
		Total Strength 493		**Total 35**		**21**

It can be viewed from the above Table that an alarming 7% incidence of CwMD in upper primary school children,

Assessment Instruments and Method of Collection of Data

The data was collected by administering Mathematics Diagnostic Test developed by the investigator.

Brief Description of the Tools

The Mathematics Diagnostics Test developed by Nair Prithi Govindhan, 2015 was used in the study. The test intends to assess the performance level of children in mathematics studying in the Grade –V. The test intends to diagnose specific difficulties exhibited and errors committed by the children of Grade V. The test covers almost all the areas of mathematics of Grade V.

The Mathematics Diagnostic Tests for the Grade –VI and VII were developed by the investigator to know the performance level of children in mathematics studying in the grade VI and VII. The test intends to diagnose the errors committed and specific difficulties exhibited by children in solving the mathematical operations. The test covers almost all the areas of Arithmetic, Algebra and Geometry in mathematics of the grades VI and VII of Karnataka state board Text book of Kannada medium.

Collection of the Data

The data was collected by administering the tests to 21 children of Grades VI and VII who were identified as children with Mathematical Disability. The total tests were administered in small groups of 2 to 3 children in two sessions of about 60 min in order to avoid the fatigue factor. The children were given sufficient time.

The scoring was done with reference to each of the criterion measures of the total tests. However, in the article the data related to Fractions of all the 3 Grades are discussed.

Method of Analysis of Data

The data was analyzed qualitatively. The score obtained by the each child based on the criterion measures was converted into percentage For the purpose of analyzing the specific difficulties in each of the criterion measures relating to Fractions the children were categorized as Masters (M)(Scored 80% and above), Partial Achievers (PA) (Scored 79% and below) and as Non-Achievers (NA) (Scored 0) .

Table 2:

Percentage of Children with Mathematical Disabilities (CMD) who were considered as - Masters, Partial Achievers and Non-Masters in different criterion measures pertaining to Fractions of Mathematics Diagnostic Test of grade – V (N=21).

SI. No	Criterion Measures Grade V	Max. Score	M	PA	NA
1	Find the sum of the given fractions	4	40.47	40.13	19.4
2	Writing the decimal form of the fraction (With 10 and 100 as denominator)	1	40.47	40.13	19.4
3	Selecting the correct equivalent fractions	4	34.52	51.2	14.28
4	Selecting the correct equivalent fractions	4	32.14	53.58	14.28
5	Write the missing fractions	1	28.58	0	71.42
6	Find the product of the given measurement	2	23.8	47.63	28.57
7	Find the quotient for the given fractions	2	21.42	59.54	19.04

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Table 3:

Percentage of Children with Mathematical Disabilities (CMD) who were considered as - Masters, Partial Achievers and Non-Masters in different criterion measures pertaining to Fractions of Mathematics Diagnostic Test of grade – VI (N=21)

SI. No	Criterion Measures Grade VI	Max. Score	M	PA	NA
1	Writing the Prime Number	2	0	0	100
2	Writing the product of Prime Number	2	0	0	100
3	Writing the missing fraction	2	0	0	100
4	Match the following numbers with the correct factor	4	10.71	32.15	57.14
5	Finding the greatest common factors	2	0	0	100
6	Finding the LCM and HCF by factor method	2	0	0	100
7	Writing the improper fraction to Mixed fraction	2	0	0	100
8	Writing the mixed fraction to improper fraction	2	0	0	100
9	Selecting the correct equivalent fraction	2	0	0	100
10	Fill in the missing fraction	2	0	0	100

11	Using the > or < sign in fraction	2	0	0	100
12	Find the sum of the given fractions	2	0	0	100
13	Addition of fractions (having same denominator)	2	0	0	100
14	Subtraction of fractions (Having same denominator)	4	17.85	53.58	28.57
15	Problem-Solving	2	0	0	100

Table 4

Percentage of Children with Mathematical Disabilities (CMD) who were considered as - Masters, Partial Achievers and Non-Masters in different criterion measures pertaining to Fractions in Pre-Test of Mathematics Diagnostic Test of grade (VII) (N=12).

Sl.No	Criterion Measure	Max. Score	Percentage of Masters	Percentage of Partial Achievers	Percentage of Non-Masters
1	Stating whether the given statement is True or False	3	100	0	0
2	Reducing the fractions to the lowest form	2	33.33	0	66.67
3	Addition of fraction	2	0	41.67	58.33
4	Writing the mixed fraction into inverse form	2	0	50	50
5	Identifying Positive and negative fractions	2	8.33	8.34	83.33
6	Classifying into proper, improper and mixed fraction	2	0	0	100
7	Reducing the fractions into lowest form	2	0	0	100
8	Converting the improper fraction to mixed fraction	2	0	0	100
9	Subtraction of fraction	2	0	0	100
10	Fundamental operations related to fractions	4	0	0	100
11	Problem Solving (Word Problem)	2	0	0	100
12	Dividing the whole number by the fraction (Simplification)	2	0	0	100
13	Multiplying fraction by fraction	2	0	0	100
14	Dividing the fraction by fraction	2	0	0	100
15	Writing in inverse fraction	2	0	0	100

Major Findings of the study

From the analysis of the data the following observations were made

a. In almost all the criterion measures of Fractions considerable percentage of children experienced difficulties.
b. Majority of the participants were found to be partial achievers in attempting the items from the criterion measures pertaining to Fractions of Grade V, the percentage of mastery and non-mastery were less.
c. All participants showed difficulty in almost all the criterion measures pertaining to Fractions of Grade VI with 100% of Non-Mastery, except two of the criterion measures which showed 57.14% of Non-Mastery in matching the numbers with the correct factors and 53.58% of partial achievers in subtracting the fractions having the same denominator.
d. Participants exhibited difficulty in all most all the criterion measures pertaining to Fractions of Grade VII with 100% of Non-Mastery, except in three criterion measures of fractions where 100% of mastery is noticed while stating whether the given statement, exhibiting non-mastery with 58.33% in addition of fraction and 83.33% of non-mastery in identifying Positive and negative fractions.

Fractions have been one of the most difficult mathematical skills to master, for children with and without difficulties **(**Behr, Wachsmuth, Post, & Lesh, 1984; Hiebert, 1985; McLeod & Armstrong, 1982; Ni, 2001).

The performance in mathematics has traditionally lagged at least two grade levels below their peers (Wagner & Blackorby, 1996). The National Mathematics Advisory Panel (NMAP, 2008).

The observations made in the present study supports the findings of the previous studies.

Conclusion

On the basis of the observations made in the study it can be understood Children with Mathematical Disability in the upper primary schools face serious difficulties. The Remedial instructional programmes have to be planned and tried out with systematic research. On the basis of such evidence based programmes teachers have to be trained.

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