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Identifying Developmental Dyscalculia: Perspective of Primary School Teachers

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Developmental Dyscalculia (DD) is a topic of much concern, as Mathematics is a subject that has much applicability in our daily life and which in turn limits educational attainment and affects the income level of a person. Studies indicate that early identification and remediation can overcome DD to a large extend. One way to ensure early identification of DD is to make sure that teachers in the general education stream have adequate knowledge about the condition and have the necessary skills for the identification of these children. The present study aims to understand the primary school teacher's knowledge about DD, the possibility of additional assistance given to these children and its effectiveness by employing a Focus Group Discussion. The results evolved indicated that teachers are aware of the difficulties faced by these children and the remediations they employ are effective to a certain extent.

Keywords: Developmental Dyscalculia, Focus Group Discussion, Identification

Developmental Dyscalculia is a dysfunction of developing neural networks specifically in the numerical domain due to a variety of possible reasons, including genetic vulnerability, deficits in domain-general abilities like visuo-spatial and verbal processing, attention, and working memory, and adverse environmental and psychological conditions like deprivation and anxiety (von Aster & Shalev, 2007). This condition is characterized by persistent difficulties in learning and remembering arithmetic facts (Geary & Hoard, 2001; Ginsburg, 1997; Jordan & Montani, 1997; Jordan, Kaplan & Hanich, 2002), executing calculation procedures (Russell & Ginsberg, 1984), immature problem solving procedures (Geary, 1990; Geary, Bow-Thomas & Yao, 1992) memory retrieval deficits (Barrouillet, Fayol & Lathulie´re, 1997; Geary, 1990; Geary, Hamson & Hoard, 2000) and poor performance in tasks requiring an understanding of basic numerical processing (Landerl, Bevan & Butterworth, 2004; Butterworth, 1999).

Developmental Dyscalculia can be distinguished from other causes of low numeracy by the presence of more fundamental problems in the understanding of simple number concepts such as poor counting or selecting the larger of two numbers (Landerl, Bevan & Butterworth (2004) and an inability to subitize (an ability that underpins the acquisition of counting skills). This suggests that Developmental Dyscalculia is due to a highly specific impairment in the capacity to learn arithmetic (Butterworth, 2005). Akin to the phonological deficit hypothesis of dyslexia, the core deficit in the numerical system is "the number sense" deficit which is the ability to quickly understand, approximate and manipulate numerical quantities, as proposed by Dehaene (2001). Its neural substrate is the Horizontal Intra-Parietal Sulcus (HIPS), a specific region of the parietal cortex which contains a non-verbal representation of numerical quantity analogous to a mental number line (Dehaene, Piazza, Pinel & Cohen, 2003). The condition is found to be quite enduring, often persisting into late adolescence (Shalev, Manor & Gross-Tsur, 2005).

Developmental Dyscalculia can be established in standard III, that is at the age of 8-9 years (Fuchs et al., 2011); but its identifiable features may manifest itself even earlier (Fuchs & Fuchs, 2001; Fuchs et al., 2005; Geary, 2005) as early as 5-7 years. It has an estimated prevalence rate ranging from 5-6.5% of school going population (Geary & Hoard, 2001; Gross-Tsur, Manor & Shalev, 1996; von Aster &

Shalev, 2007). In India, Ramaa and Gowramma (2002) conducted two independent studies for identifying and classifying children with dyscalculia in primary schools and found that when other possible causes of arithmetic failure had been excluded, incidence for dyscalculia came out as 5.98% (15 cases out of 251) in one study and 5.54% (78 out of 1408) in the second study.

Early interventions are seen to produce substantial improvement in Mathematics performance (Dowker & Sigley, 2010; Fuchs et al., 2009; Geary, Bow-Thomas & Yao, 1992). Interventions for numeracy problems though useful at any stage, are most effective when started early on, with prevention research gaining importance in the recent past (Fuchs et al 2005., Griffin & Case, 1996). The treatment of children with DD is complex owing to heterogeneity of symptom presentation, presence of co-morbid conditions and presence of domain general difficulties apart from the specific mathematical deficits (Kaufmann, 2012).

Care should be taken to ensure that the specific components of numeracy in which the child has difficulty should be focused, for treatments to be effective (Dowker & Sigley, 2010). The types of interventions used include targeted mathematics interventions, behavioural & psychological interventions, pharmacological interventions, non-invasive brain stimulations or a combination of the aforesaid (Furlong, McLoughlin, McGilloway, Geary & Butterworth (2015). Often these children require Tier 2 (interventions in small groups) & Tier 3 (intensive one-on-one interventions) level interventions (Fuchs, Fuchs & Craddock et al., 2008).

General education teachers have an important role to play in identifying children with low numeracy issues, as they are often the first people to notice children who are falling back in classroom mathematics. The role of teachers in early intervention begins largely from differential identification of these children from the classroom situation and extends to parental counselling and giving extra drill or coaching for these children. Specifically, primary school teachers have a major part to play in this exercise due to their access to children in the early years. Children in any classroom vary in academic skills. It has been observed that primary teachers are left with the task of teaching students with diverse academic ability and achievement levels by adapting the lessons to suit all of them without compromising on the time frame (Corrno, 2008). In this context, the ability to adapt to regular teaching methods incorporating the needs of the academically less skilled group would require not only thorough subject matter knowledge, but also skill in identifying early enough the symptoms of conditions like DD. However, in an earlier study, Konantambigi and Shetty (2008) have observed that Indian teachers get a good insight into the learning problems of children.

According to the census report of 2011, Kerala, with a 94% literacy rate, stands in the first position in literacy in India, (Emerging Kerala, 2012). The schools in Kerala maintain good standards in terms of infrastructure and faculty. The primary school teachers are trained graduates having sufficient exposure to the current methods of teaching.

In view of the aforesaid facts, the present investigators felt that it may be worthwhile to find out the level of understanding of primary school Mathematics teachers regarding the condition, Developmental Dyscalculia and the remedial methods they currently employ.

Focus Group Discussion was felt to be the best suited method for the purpose. This study was done as a part of a larger research project funded by the Department of Science & Technology, Govt. of India, which focuses on early identification and intervention of children with Developmental Dyscalculia (6-7 years & 8-9 years), which has been cleared by the Institutional Ethical Committee for Research of ICCONS.

Objective:

The present study was aimed to formulate an idea of the understanding of Developmental Dyscalculia among primary school Mathematics teachers. The areas covered under the discussion were the methods of identifying children with DD and the kind of extra attention and remedial teaching they give these children and its effectiveness.

Method

Participants:

The inclusion criterion was set as minimum 5 years or more of teaching Mathematics in primary section classes. The participants in the present study belonged to six different schools; three urban and three rural, who were allotted to two different focus groups. Even though the appropriate number of a focus group is stipulated to be 8-12 participants, in the present scenario none of the schools individually had eight or more teachers teaching mathematics in the primary section. So, taking one of the bigger rural schools into consideration, the first group (FGD1) included a total of five participants (excluding one teacher with less than 5 years of teaching experience) who had an average of 12 years' experience in teaching Mathematics in primary section (classes 1 to 4) in the CBSE curriculum. Being a new form of exercise, getting the teachers at ease and making them understand the requirement of the investigator involved a lengthy process even though the results elicited were fruitful.

The second group (FGD2) included 15 participants from five different CBSE schools, coming under the same management (three teachers from each school; three urban and two rural); having an average teaching experience of 9.25 years in primary school Mathematics, who participated in all four sessions of the Focus Group Discussion. Since none of the individual schools had more than 3-4 Mathematics teachers in primary section (a number too little for an FGD), the experimenter included the teachers from all the five schools together making a 15-participant group. As a result, more diverse and spontaneous statements ensued from this group.

All participants (FGD1 and FGD2) were female candidates hailing from the district of Trivandrum, Kerala. The discussion leader contacted the principals of the respective schools to select the participants viz Mathematics teachers of primary schools in each of the schools.

Tools

1. Consent forms
2. Initial ice-breaker questions
3. Core, open ended questions for discussion
4. Recording Sheets
5. Audio-Recorder

Technique:

Focus Group Discussion (Laimputtong, 2011) and the Delphi method (Hasson, Keeney & McKenna, 2000) were used to investigate the teaching practices employed by primary school teachers. Focus group discussions (FGDs) are structured discussions with a group of subject experts (primary school teachers in Mathematics with sufficient experience) involved in the topic in which certain roles (e.g., a discussion leader, a time keeper and a secretary) and rules (e.g., only on-topic contributions) are specified and adhered to.

The Delphi Survey is a group facilitation technique which is an iterative multi-stage process designed to transform opinion to group consensus (Hasson, Keeney & McKenna (2000). With this method consensus building is attained by using a series of questionnaires to collect data from a panel of selected subjects by employing multiple iterations or repeated feedbacks to develop a consensus regarding a specific topic (Hsu & Sandford, 2007). The feedback process happens in a series of rounds with the experimenter issuing a statement of the position of the whole group and the participant's own position in a questionnaire form, which is worked on by each participant and returned. This summation of comments not only makes each participant aware of the range of opinions emerged and the reasons behind them, but also helps them to re-asses their initial judgements about the information given in previous iterations (Ludwig, 1994; Hsu & Sandford, 2007).

Another option is gathering qualitative data through focus groups or interviews, which is used to inform the first quantitative round of Delphi, which is the method employed in this study. This technique entails the repeated administration of the statements elicited from the focus group to achieve consensus among

experts. After the first round of administration, those items on which consensus is not reached is taken up for a discussion. Again, the statements elicited are presented to the experts involved in the discussion for consensus. This procedure is repeated until consensus (specified with a consensus criterion) is reached (Prast, Van de Wiejer-Bergsma, Kroesbergen & Van Luit, 2015).

This technique was considered appropriate for this study, as it satisfies one of the research purposes for which it is entitled to be used as per Delbecq, Van de Ven, and Gustafson (1975) viz., employing an FGD to seek out information (on the current level of awareness/understanding among primary to school teachers about Developmental Dyscalculia and the nature of assistance given to them, if any) which may generate a consensus among the respondent groups (who are primary school teachers belonging to six different schools of Trivandrum district).

Procedure

The sessions were monitored by the principal investigator as the discussion leader, JRF as time keeper and the RA as secretary. The discussions in both, FGD 1 & FGD 2 were carried out in two sessions of two hours each on adjacent days. The discussion leader was seated at the centre of the group (See figure 1 & Figure 2) and the time keeper, who was also taking the audio recordings of the proceedings, was strategically positioned near the group to make sure all the information stated were correctly recorded. The whole session was audio-taped, so that no detail of the discussion was missed at the time of consolidation of consensus report. The Secretary remained unobtrusive and took notes of the proceedings.

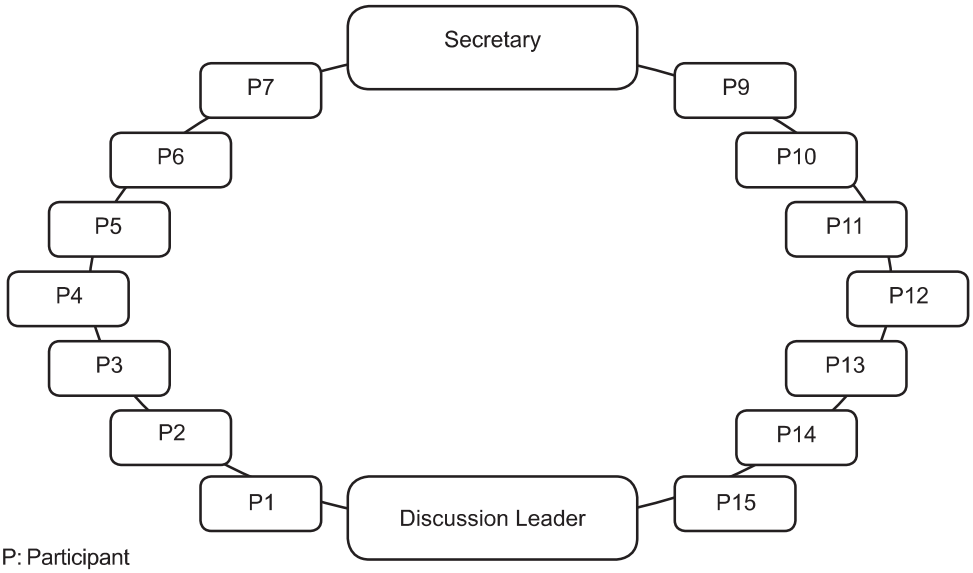
Consent forms stating the purpose of the discussion as well as the condition of confidentiality were distributed to the teachers. They were given time to go through the form, clarify doubts, if any, and make an informed choice on whether they want to participate or not. After collecting the consent forms (Appendix 1) and making sure that all the forms were read and signed, a brief introduction on the project and the aim of the focused group discussion were given by the discussion leader.

After an initial set of ice breaker questions the discussion moved on to the core questions (See Table: 1). The initial ice breaking questions were:

What do you like most about your profession?

What is your favourite subject to teach?

Why do you like it over the others?



P: Participant

Figure 1: Seating arrangement of FGD2

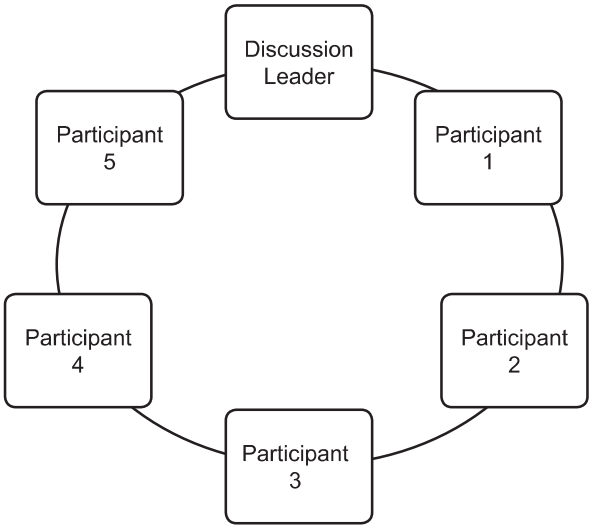


Figure 2: Seating arrangement of FGD 1

How important do you think this subject is in contributing to a child's academics and daily life, and why?

All the teachers mentioned Mathematics as their favourite subject and the liking to teach, interact with young children and associated activities (Mathematics club) to be the highlights of their profession. The importance of Mathematics in a person's daily life was stressed by the teachers. Qualities like punctuality, memorizing ability; problem solving, concentration, enhanced thinking and reasoning ability were mentioned as the by-products of learning Mathematics. Overall, the ice breaker questions pointed towards the like mindedness of the participants of the group.

Following this, the discussion moved on to the core questions (See Table 1), which were open-ended questions to lead the discussion, which included an appraisal of the knowledge of teachers about DD, existing methods of identification of DD from their classrooms and currently employed methods of remediation in classrooms. As the discussion progressed, the participants were encouraged to voice all their ideas, including those they consider as negligible, as freely as possible.

The pattern of participation by teachers in the first FGD group was uniform, with all four contributing equally. In the second FGD group too, majority of them were quite enthusiastic to contribute, but more initiative was found to be taken by participant numbers, 2, 4, 6, 8, 10, 11, 12 & 14. Care was taken by the discussion leader to ensure that each question elicited responses/ opinions from all the members participating in the discussion by re-iterating that each person's opinion counted, leaving no chance for side-lining any of the members.

Consensus procedure: The statements elicited from the Focus Group Discussion were compiled using the live recordings of all the focus groups which were transcribed verbatim. This, along with the Secretary's notes of the FGD's were used to code the data. The coding was done initially based on the protocol of core questions prepared and sub themes which arose later in the discussion were coded as they emerged.

This summation was presented to the participants in the third session. The teachers were requested to rate the statements on a five-point scale (strongly disagree [1], disagree [2], neutral [3], agree [4] & strongly agree [5]). Based on the outcome of this rating, the items in the questionnaire were grouped into agreed, disagreed, and neutral categories, with the intention of taking the neutral items and those

having below 60% consensus to the next round of discussion. In case of both the FGD 1 & 2, all the teachers who had participated in the first two sessions filled up the Questionnaire 1 A & 1 B (Appendix 2) and it was analyzed quantitatively in terms of % of agreement to each statement. This was done to formulate a consensus of degree of agreement, if any among the respondents/ groups of teachers, in the major aspects regarding the topics covered in FGD.

In the fourth and last round of discussion the teachers were informed of the consensus that they have reached through the previous sessions.

Results

The core questions and the number of statements elicited from the two groups are presented in Table 1. The questions were discussed one at a time and the next question was taken up only after all areas relating to the question was exhaustively discussed.

Table 1: The core questions of Focus Group Discussion and the statements that were elicited through discussion

Core questions	Statements elicited	
	FGD1	FGD2
What are the general problems seen among children with DD?	6	10
How do you identify children with difficulty in Math?	3	4
Do children doing well in classes 1 & 2 fall back in class 4; if so Why?	4	2
What kind of assistance or help do you give in school?	3	6
Does it yield results?	2	2
What else can be done to improve the performance of these children?	5	2

At the culmination of the discussion 23 statements evolved in the FGD1 and 26 statements in FGD2 on identification of children with mathematical difficulties, was additional support provided to them, time constraints and suggestions.

The 23 items generated in FGD1 and the 26 items generated in FGD2 were prepared in the form of a questionnaire and presented to the teachers to rate each statement in terms of degree of agreement, disagreement or neutrality, using the Delphi method, in session three. The rated statements were returned to the investigators and a re-grouping of the statements was done to find out how many statements reached the consensus criteria of 60% agreement/disagreement. The result of this analysis revealed 100% agreement in all statements, which may be due to similar knowledge levels on the topic among each group.

The final list of comments relating to the core questions under discussion is presented in Table 2. The increase in number of participants in the second group seems to have facilitated diverse outputs in the case of identification of children with DD and the possible remediation they are subjected to by the general education teachers.

Discussion

The objective of the present study was to formulate an idea based on the understanding of Developmental Dyscalculia among primary school Mathematics teachers which included methods they use for identification, remedial teaching provided and their effectiveness. All the statements indicated in Table 2, received 100% consensus from the teachers of the respective focus groups. The agreement can be attributed to the general awareness about the characteristics of children having DD among the sample of primary school teachers involved in the present study.

The exercise has helped the experimenter in ascertaining that the statements compiled from different members in the group are acceptable to each member and the techniques they employ to identify children with DD, their method of helping these children and the evaluation of the children's understanding is similar within each group. Interestingly, the statements received from the two groups differed widely from each other; which may be due to the difference in exposure to in-service training programs received by the two groups.

The initial question was addressed to gauge the understanding of the teachers regarding

Table 2: The responses received from each group on the questions discussed

Q. No	FGD1	FGD2
1	Problem in retaining learned/ taught concepts. Careless mistakes. Jumping into premature conclusions. Copying from peers even on topics they know well. Difficulty in understanding due to lack of attention in a minority, at least. Lack of monitoring and guidance from home is a major factor in low attainment in Math.	Lack of attention Slow writing Difficulty in sequencing, omissions & substitutions (writing) Spatial errors (6 as 9, 16 as 61 etc) Errors in counting Errors in calculation Errors in identifying greater and lesser numbers Error in skip counting Errors in place value Difficulty in understanding shapes & sizes
2	Random selection of children and making them do on the board Teachers go around the class to make sure all are doing their work, they pick backward ones. Class tests.	Oral questions in class (randomly asked) Exercises done in class Home work Class tests
3	In higher classes the pictorial representations come down Content increases Numbers get bigger/larger Shapes are easier to understand	Content increases Teaching with concrete objects not possible due to lack of time
4	Make them do problems in class Make them writing answers on board Devote some additional time to clarify doubts in staff room	Remedial teaching is given for counting & operations after informing parents Objects are used initially to teach the concept This is followed by pictures Later with numbers Remedial classes are given once a week for each class for a period of 30 mins in the evening
5	Yes Don't get enough time.	Remedial classes are effective, but the retention level differs. Out of 6, 4 improves Difficult if the number of children is more, individual attention is important.
6	Teaching with concrete objects Activities in groups Use of posters Lesser strength in class Timely parental attention, when intimated by teachers	Individual training at the pace of the child would help.

Developmental Dyscalculia. In response to this question both specific Mathematics related deficits observed commonly in low achieving groups as well as general cognitive and behavioural difficulties seen in children with DD were identified by the groups. The responses

of the first group were based on observable behavioural difficulties perceived among the children with DD; such as difficulties in retaining learned/ taught concepts, careless mistakes, jumping into premature conclusions, copying from peers even on topics they know well and difficulty in understanding due to lack of attention in a minority. Besides the above mentioned, FGD 1 group strongly aired the view that lack of proper attention at home was concomitant to low achievement in Mathematics among children.

The responses from FGD 2 group were more specific to features of DD since they were deficits specific to Mathematics. The characteristics identified included lack of attention, slow writing, difficulty in sequencing, omissions and substitutions (writing), spatial errors (6 as 9, 16 as 61, etc.), errors in counting, errors in calculation, errors in identifying greater and lesser numbers, error in skip counting, errors in place value and difficulty in understanding shapes and sizes. The experience of these teachers and their exposure to refresher courses might have made the teachers of this group competent to understand the specific difficulties faced by children with Developmental Dyscalculia. This finding is supported by Campbell, Gillmore & Cuskally (2003) who found that success of inclusive classrooms depends on the teacher's knowledge of the unique needs of students, reiterating the importance of in-service training for teachers in Specific Learning Disorders.

Over the course of the discussion both groups voiced the opinion that though they understand the difference between DD & those with low achievement symptom wise and in terms of persistence of mathematical difficulties, they pick students with mathematical difficulties in terms of class room performance in the subject or mathematical errors made by the students in class or in their worksheets, and is not based on underlying reason of that underachievement. However, persistence of the problem despite repeated corrections/drill & practice often leaves them puzzled. Hence, it was decided to reframe the second question as difficulty in math and not DD.

For the second question pertaining to how children having difficulty in Math can be identified, all the participants reported that children who are likely to have Developmental Dyscalculia could be identified through their performance in class, homework and consistency of errors in periodic class evaluations. This suggested that the predominant method relied upon by teachers is observation of the child's class work. This also meant that teachers are more competent in identifying children with DD than parents since teachers know exactly how an average child in a particular class would perform. This finding is supported by Karande, Mehta & Kulkarni (2007) who found that parental knowledge of their children with SLD is inadequate in our country, based on a clinic centred study.

Normally, children with DD are identified at the end of two years of schooling. On probing the teachers regarding whether they had come across children who were doing well in class 1 and 2 finding it hard to cope when they reach class 4, both the groups responded affirmatively. Reportedly, the teachers believed that the difficulty is aggravated by the increase in content, sharp reduction of pictorial representation in textbooks, and the lack of time to explain the concepts in detail with the help of concrete objects and visual aids. This information leads to an important suggestion that pictorial representation of Mathematical concepts has a very prominent role in making children understand concepts better and may be used in text books throughout the primary level classes.

Regarding the remedial measures currently followed by the teachers, FGD 1 stated that they give more attention to such children in class by making them do the problem on the board or write the answers suggested on the board and clear the doubts of these children by asking them to come and meet the teachers in the staff room. The teachers in the second FGD had a more systematic plan of action which again revealed greater exposure and experience in dealing with children who are low in performance in Mathematics. They reported that they would request the parents of such children to stay back after school hours for 30 minutes, once a week. The teachers then teach these children individually using concrete objects, semi concrete aids and then moving on the abstract level of numbers to make the child understand.

Remedial efforts currently followed were reported to be effective to a certain extent, by both the groups. But, both the groups felt that lack of time was a serious concern. The second group further added that about 33% of the students did not retain the concepts taught, which might be due to the limited frequency of remediation, provided by teachers within their time constraints. Here again, the low improvement percentage could also be due to the presence of students with dyscalculia among this low achievement and resistant group. Another difficulty they encountered was the presence of more number of children who needed help through remedial sessions than a teacher can personally attend at a given time.

With respect to suggestions for improvement, the first group felt that the use of objects, activities, posters, and lesser strength of children in each class would help in effective teaching of Mathematics. This finding is supported by Griffin, (2004), who strongly advocates that providing children who lack number sense, the opportunity to explore concept using concrete activities and discussing them in a social context enables them to pick up number sense. The first group also emphasized the need for prompt parental attention when intimated from school. The second group thought that the best way was to give individual attention and bringing the child at par with the class, instead of trying to slow the pace of the whole class, which is supported by Sebba and Sachdev's (1997) finding of flexible inclusive classroom education based on collaborative team planning, to be an effective option for SLD's.

Conclusions

The study was intended to get an idea about the level of understanding of primary school Mathematics teachers about Developmental Dyscalculia. General education teachers in Mathematics at the primary school level have a good understanding of the difficulties faced by children with Developmental Dyscalculia. Teachers were able to identify students who have difficulty in mathematics based on general behavioural features or typical characteristics of DD thus distinguishing them their normally performing counter parts. Primarily, they identify children who are likely to have Developmental Dyscalculia through the performance of students in class and based on consistency of errors in periodic class evaluations. The tendency for children doing well in lower classes to fall behind when they graduate to class 4 is observed and is attributed to an increase in content, and to an abrupt reduction in pictorial representation in textbooks and the lesser time, which can be devoted by teachers to explain the concepts in detail with the help of concrete aids. The help offered by teachers to such children range from extra practice in class or clarification of doubts giving additional time in staff rooms and additional coaching using concrete objects, at a frequency of half an hour per week.

Concepts taught through remedial teaching were not retained by one third of the students owing to the limited frequency of sessions allowed by the existing time constraints of teachers. It can also be attributed to the inability of teachers to separate children with Developmental Dyscalculia, from among those who are low achievers in Mathematics, so that appropriate measures can be taken. Suggestions for effective remediation as voiced by teachers included use of visual aids and use of concrete objects when introducing concepts, slowing the pace of teaching so that conceptual understanding is firmly set in, and prompt parental attention to the feedback by teachers.

Implications:

The experience of the general education of teachers points out that they primarily identify children with DD through classroom mathematics performance and behavioural features, this awareness level being a function of the exposure received through training programs. Hence training programs with specific focus on identification and remediation methods for primary school mathematics teachers will lead to early identification, appropriate referrals and effective classroom remediation by teachers. It is necessary that text books may devote adequate pictorial representation and teachers should be given the opportunity and time to explain concepts with concrete aids. In terms of remedial efforts by teachers it would be useful to slow down the pace of teaching, use

more of visual and concrete aids while concepts are introduced and ensure that parents give prompt attention when difficulties are pin-pointed by classroom Mathematics teachers, to receive timely & specific remedial efforts.

Limitations:

This work was done on a small sample of teachers belonging to six schools of CBSE syllabus, from Trivandrum District in Kerala. Similar work can be taken up on larger sample of schools and teachers to ensure generalisation.

References

Barrouillet, P., Fayol, M., & Lathulie`re, E. (1997). Selecting between competitors in multiplication tasks: An explanation of the errors produced by adolescents with learning disabilities. *International Journal of Behavioural Development, 21*, 253–275.

Campbell, J., Gilmore, L., & Cuskelly, M. (2003). Changing student teachers' attitudes towards disability and inclusion. *Journal of Intellectual & Developmental Disability, 28*(4), 369-379.

Corno, L.Y.N. (2008). On teaching adaptively. *Educational Psychologist, 43*(3), 161-173.

Delbecq, A. L., Van de Ven, A. H., & Gustafson, D. H. (1975). *Group techniques for program planning.* Glenview, IL: Scott, Foresman, and Co.

Dowker, A., & Sigley, G. (2010). Targeted interventions for children with arithmetical difficulties. *British Journal of Educational Psychology, 2*(7), 65-81.

Emerging Kerala (2012). In Wikipedia. Retrieved from http://www.emergingkerala2012.org/about-us.php

Fuchs, L. S., Compton, D. L., Fuchs, D., Hollenbeck, K. N., Hamlett, C. L., & Seethaler, P. M. (2011). Two-stage screening for Math problem-solving difficulty using dynamic assessment of algebraic learning. *Journal of learning disabilities, 44*(4), 372-380. doi: 10.1177/0022219411407867.

Fuchs, L. S., Compton, D. L., Fuchs, D., Paulsen, K., Bryant, J. D., & Hamlett, C. L. (2005). The prevention, identification, and cognitive determinants of Math difficulty. *Journal of Educational Psychology, 97*(3), 493 - 513.

Fuchs, L. S., Fuchs, D., Hosp, M. K., & Jenkins, J. R. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific studies of reading, 5*(3), 239-256.

Fuchs, L. S., Powell, S. R., Seethaler, P. M., Cirino, P. T., Fletcher, J. M., Fuchs, D., & Zumeta, R. O. (2009). Remediating number combination and word problem deficits among students with Mathematics difficulties: A randomized control trial. *Journal of Educational Psychology, 101*(3), 561 - 576.

Fuchs, L. S., Fuchs, D., Craddock, C., Hollenbeck, K. N., Hamlett, C. L., Schatschneider, C. (2008). Effects of Small-Group Tutoring with and without Validated Classroom Instruction on At-Risk Students' Math Problem Solving: Are Two Tiers of Prevention Better Than One? *Journal of Educational Psychology, 100*(3), 491-509.

Furlong, M., McLoughlin, F., McGilloway, S., Geary, D. & Butterworth, B. (2015) Interventions to improve mathematical performances of children with mathematical difficulties (MLD). *Cochrane Database of Systematic Reviews, 10*, 1-31.

Geary, & Hoard (2001). Numerical and arithmetical deficits in learning-disabled children: Relation to dyscalculia and dyslexia. *Aphasiology, 15*(7), 635-647.

Geary, D. C. (1990). A componential analysis of an early learning deficit in Mathematics. *Journal of Experimental Child Psychology, 49*, 363–383.

Geary, D. C. (2005). *The origin of mind: Evolution of brain, cognition, and general intelligence.* American Psychological Association.

Geary, D. C., Bow-Thomas, C. C., & Yao, Y. (1992). Counting knowledge and skill in cognitive addition: A comparison of normal and Mathematically disabled children. *Journal of Experimental Child Psychology, 54*(3), 372-391.

Geary, D. C., Hamson, C. O., & Hoard, M. K. (2000). Numerical and arithmetical cognition: A longitudinal study of process and concept deficits in children with learning disability. *Journal of Experimental Child Psychology, 77*(3), 236-263.

Ginsburg, H.P. (1997). *Entering the child's mind: The clinical interview in psychological research and practice*. NY: Cambridge University Press.

Griffin, S. & Case, R. (1996). Evaluating the breadth and depth of training effects when central conceptual structures are taught. *Society for Research in Child Development Monographs, 59*, 90-113.

Griffin, S., (2004). Educational Leadership. *Improvement Achievement in Math and Science 61*(5), 39-42.

Gross-Tsur, V., Manor, O. and Shalev, R. S. (1996), Developmental dyscalculia: prevalence and

demographic features. *Developmental Medicine & Child Neurology, 38*, 25–33. doi: 10.1111/j.1469-8749.1996.tb15029.x

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing, 32*(4), 1008-1015.

Hsu, C., and Sandford, B.A. (2007). The Delphi Technique: Making Sense of Consensus. *Practical Assessment. Research & Evaluation, 12*(10), 1-8.

Jordan, N. C., Kaplan, D., & Hanich, L. B. (2002). Achievement growth in children with learning difficulties in Mathematics: Findings of a two-year longitudinal study. *Journal of Educational Psychology, 94*(3), 586–597.

Jordan, N. C. & Montani, T. O. (1997). Cognitive arithmetic and problem solving: a comparison of children with specific and general Mathematics difficulties. *Journal of Learning Disability, 30*(6), 624-634.

Karande, S., Mehta, V., Kulkarni, M. (2007). Impact of an education program on parental knowledge of specific learning disability. *Indian Journal of Medical Sciences. 61*(2), 398-406.

Kaufmann, L., & von Aster, M. (2012). The Diagnosis and Management of Dyscalculia. *Deutsches Ärzteblatt International, 109*(45), 767–778. http://doi.org/10.3238/arztebl.2012.0767

Konantambigi, Rajani M. and Shetty, MaMatha. (2008). Teacher identification of learning problems: Comparison with a screening device and learning disabilities test. In, K. Thapa, G. M. Van Der Aalsvoort and J. Pandey (Eds). *Perspectives on Learning Disabilities in India: Current practices and prospects*. NewDelhi: Sage

Laimputtong, P. (2011). *Focus Group Methodology: Priniciples and Practice*. Sage Publications: London.

Landerl, K., Bevan, A., & Butterworth, B. (2004). Developmental dyscalculia and basic numerical capacities: A study of 8–9-year-old students. *Cognition, 93*(2), 99-125.

Ludwig, B. G. (1994). I*nternationalizing Extension: An exploration of the characteristics evident in a state university extension system that achieves internationalization*. (Unpublished doctoral dissertation), The Ohio State University, Columbus.

Prast, E. J., Van de Weijer-Bergsma, Kroesbergen & Van Luit (2015). Readiness-based differentiation in primary school Mathematics: Expert recommendations and teacher self-assessment. *Frontline Learning Research, 3*(2), 90-116.

Ramaa, S. &, Gowramma, I. P. (2002). A systematic procedure for identifying and classifying children with dyscalculia among primary school children in India. *Dyslexia, 8*(2), 67-85.

Russell, R. L., & Ginsburg, H. P. (1984). Cognitive analysis of children's Mathematical difficulties. *Cognition and Instruction, 1*, 217–244.

Sebba, J. and Sachdev, D. (1997). *What Works in Inclusive Education? Ilford: Barnardo's Publications.* Retrieved from http://www.barnados.org.uk/resources.

Von Aster, M. G., & Shalev, R. S. (2007). Number development and developmental dyscalculia. *Developmental Medicine & Child Neurology, 49*(11), 868-873.

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Appendix: 1

Consent to Participate in Focus Group Discussion

You are invited to participate in a Focus Group Discussion targeted to understand the perception of primary or elementary general school education of Mathematics teachers of CBSE syllabus, on children with Specific Learning Disorder in Mathematics i.e., Developmental Dyscalculia, as part of a research project titled, "Early Identification and Intervention in Developmental Dyscalculia", funded by the Department of Science and Technology (CSRI), Government of India.

Name: _____ Date: _____ Time: _____

Number of years of teaching: _____ Classes taught: _____

Gender: _____ Age: _____ Average number of hours taught per day: _____

Subjects taught (other than Maths) & number of hours per day: _____

The aim of the discussion is to familiarise with the methods followed by teachers in identifying children with Developmental Dyscalculia/specific learning difficulties in Mathematics, help they provide in school & its effectiveness. The information learned in the focused group will be used to aid in the design of (alternate methods) an intervention package for children with Developmental Dyscalculia in the age group of 6-7 and 8-9 years.

You can choose whether or not to participate in the focus group and stop at any time. The focus group will be tape recorded and your responses will remain anonymous and no names will be mentioned in the report. There are no right or wrong answers to focus group questions. We want to hear many different viewpoints and would like to hear from everyone. Please do not hesitate even when your responses may not be in agreement with the rest of the group. In respect for each other we ask that only one individual speak at a time in the group and that responses made by all the participants be kept confidential.

I understand the above information and agree to participate fully under the conditions stated.

Signed: _____

Date: _____

Signature of the PI/Moderator: _____

Appendix: 2 Q 1A

FGD-1 Focus Group Discussion: Phase 2 Consensus

Dear teachers,

The following are the conclusions we arrived at from our discussion on the perception of primary or elementary school general education teachers of mathematics, on children with learning difficulties in Mathematics of CBSE syllabus i.e., Developmental Dyscalculia/ Low Achievement in Mathematics; based on our discussion on 25th and 26th May 2016. We have compiled the information we have collected according to our understanding. Please go through the statements given below and mark your agreement or disagreement to each statement on a 5-point scale; Stronglydisagree[1], Disagree [2], Neutral [3], Agree [4], Strongly agree [5]. Extend of agreement or disagreement to each statement is as follows.

Core Questions:

1. What are the general problems seen among children with difficulty in Maths?

Common problems noticed among low achievers in math are:

- Problem in retaining learned/ taught concepts. 100%
- Careless mistakes. 100%
- Jumping into premature conclusions. 100%
- Copying from peers even on topics they know well. 100%
- Difficulty in understanding due to lack of attention in a minority, at least. 100%
- Lack of monitoring and guidance from home is a major factor in low attainment in math. 100%

2. How do you identify children with difficulty in Math?

- Random selection of children and making them do Math on the board. 100%
- Teachers go around the class to make sure all are doing their work, and then pick the backward ones. 100%
- Class tests. 100%

3. Do children doing well in classes 1 & 2 fall back in class 4; if so Why?

- As they go to higher classes the pictorial representations come down. 100%
- Content increases. 100%
- Numbers get bigger/larger. 100%
- Shapes are easier to understand. 100%

4. What kind of assistance or help do you give in school?

- Make them do problems in class. 100%
- Make them write answers on board. 100%
- Devote some additional time to clarify doubts in staff room. 100%

5. Does it yield results?

- Yes. 100%
- Don't get enough time. 100%

6. What else can be done to improve the performance of these children?

- Teaching with concrete objects. 100%

- Activities in groups. 100%
- Use of posters. 100%

Appendix: 2 Q 1B

FGD-2

Focus Group Discussion: Phase 2 Consensus

Dear teachers,

The following are the conclusions we arrived at from our discussion on the perception of primary or elementary school general education teachers of mathematics, on children with learning difficulties in Mathematics of CBSE syllabus i.e., Developmental Dyscalculia/ Low Achievement in Maths; based on our discussion on 30th and 31st May 2016. We have compiled the information and have composed it according to our understanding. Please go through the statements given below and mark your agreement or disagreement to each statement on a 5-point scale; Strongly disagree [1], Disagree [2], Neutral [3], Agree [4], Strongly agree [5]. Extend of agreement or disagreement to each statement is as follows.

Core Questions:

1.What are the general problems seen among children with difficulty in Maths?

Common problems noticed among low achievers in math are:

- Lack of attention. 100%
- Slow writing. 100%
- Difficulty in sequencing, omissions & substitutions (writing). 100%
- Spatial errors (6 as 9, 16 as 61 etc). 100%
- Errors in counting. 100%
- Errors in calculation. 100%
- Errors in identifying greater and lesser numbers. 100%
- Error in skip counting. 100%
- Errors in place value. 100%
- Difficulty in understanding shapes & sizes. 100%

2. How do you identify children with difficulty in Math?

- Oral questions in class (randomly asked). 100%
- Exercises done in class. 100%
- Home work. 100%
- Class tests. 100%

3. Do children doing well in classes 1 & 2 fall back in class 4; if so Why?

- Content increases. 100%
- Teaching with concrete objects not possible due to lack of time. 100%

4. What kind of assistance or help do you give in school?

- Remedial teaching is given for counting & operations after informing parents. 100%
- Objects are used initially to teach the concept. 100%
- This is followed by pictures. 100%

- Later with numbers. 100%
- Remedial classes are given once a week for each class for a period of 30 mins in the evening. 100%

5. Does it yield results?

- Remedial classes are effective, but the retention level differs. Out of 6, 4 children improve. 100%
- Difficult if the number of children is more, individual attention is important. 100%

6. What else can be done to improve the performance of these children?

- Individual training at the pace of the child would help. 100%