

A review study on Attention Deficit Hyperactivity Disorder (ADHD) and Dyscalculia in school going students

Mrigakshi Sarma *

* Department of Education, Tezpur University, India

ABSTRACT

The Study aimed to find the Influence of Attention Deficit Hyperactivity Disorder among the Dyscalculia School Students. The study identifies the students with Attention Deficit Hyperactivity Disorder and Dyscalculia from Xth Standard. It finds out the significant difference in Dyscalculia and Attention Deficit Hyperactivity Disorder among the dyscalculia students with respect to different component levels. The study review about different studies conducted around the world amongst ADHS and Dyscalculia students. It was observed that ADHD started at early stage in children which was initially ignored by the parents. The parents and teachers must support and help the students suffering from ADHD to improve their self-esteem, confidence and motivate them to excel in life. In dyscalculia the students faced problem in solving and doing mathematics. Many students who are suffering from ADHD are also facing problem in solving mathematics. It was observed that if parents, teachers, friend and other people help these people with interactive learning, the students can recover well.

Keywords: Dyscalculia, Attention Deficit Hyperactivity Disorder, Inattention, Impulsivity and Hyperactivity

1. INTRODUCTION

The Attention deficit hyperactivity disorder (ADHD) is a brain disorder majorly found in children and teens and can be continued lifelong if not treated. It affect individual's mental stillness, lack of focus and behavioural control. Most of the children are diagnosed with ADHD disorder globally. The disorder house in when the students get admitted to school, they find difficulty in paying attention [1]. The children facing ADHD experience educational failure,

problems in communicating the actions, lack of confidence and social activity, and failure in relationships. All this problems risks them in adulthood such as depression, anxiety etc. [2].

Many a time's parents ignore the disorder in early years suspecting as normal behaviour. They feel that their kid is showing enthusiastic behaviour and not willing to adapt the new school environment [3]. It is important for parents to discuss with their child disorder, and seek for possible treatment at early stage. In

studies it is revealed that when parents discovered about the ADHD disorder in their child they first refuse to accept the problem, many grieved over, busted into anger, felt depressed and emotional [4]. While other parents blamed their partner, relatives and teachers for the development of the ADHD disorder [5].

Dyscalculia refers to “mathematics learning disability” found in kids from early age or can be developed later with mental blockade. It is also known as “mathematics disorder” or “mathematics dyslexia.” In this the child struggles with numbers and mathematical problems. The students tend to be confused with problem based questions. This develops anxiety and low self-esteem over the time. Dyscalculics can be due to ADHD, thus the kid cannot focus on words, number and any type of mathematic based problem. This type of situations leads to pain and fear in children’s mind which shatters their image and confidence [6].

The literature of several researchers who have studied the issue of Attention Deficit and Hyperactivity Disorder (ADHD) and Dyscalculia will be reviewed. It will guide the researcher in the most efficient ways as to deal with ADHD and Dyscalculia. It may also help the parents who struggle with particular challenges at home with their children.

2. THE ADHD IN STUDENTS AND ITS STUDIES

Animated Learning Package of Mathematical Concepts for Students with Attention Deficit Hyperactive Disorder (Govindaraj, 2017) [7] the study focused on developing a tool to identify students with Attention Deficit Hyperactivity

Disorder (ADHD) in school. The study was research conducted with Animated Learning Package for students and its effect on their learning skills. The study develops a tool to identify students with Attention Deficit Hyperactivity Disorder (ADHD). The study helps in identifying 102 students with Attention Deficit Hyperactivity Disorder with different levels. The students were exposed to animated learning package which surprisingly shows interesting results. The students with high level of Attention Deficit Hyperactivity Disorder turned into moderate level and rest of the students reduced their ADHD behaviour and fall under low level after the course. The research suggests that, it is important for both teachers and parents to teach the kids with their ability of learning and help them cure the disorder [8-9].

The Impact of Attention Deficit Hyperactivity Disorder (ADHD) in Adulthood: A Qualitative Study (Watters et.al, 2017) [10]. The study provides a deeper insight into the experiences of adults with ADHD in Western Ireland. This qualitative research screened symptoms of ADHD patients. The individuals facing ADHD faced poor concentration, distractibility and inattention in their adulthood. Inattention and lack of concentration resulted in difficulties with basic tasks and loss the multi-tasking ability [11]. The patients sometimes were hyperactive, low on self-esteem and less social [12]. Becoming aware of the stigma associated with ADHD can help clinicians improve the individual treatment plans to meet the needs of their patient. It also explores patient’s attitudes towards receiving a formal diagnosis.

Educational Practitioners’ Beliefs and Conceptualisation about the Cause of ADHD

(Russell et al., 2016) [13] the study focused on exploring the educational practitioners concepts and their beliefs about the causes of symptoms of ADHD. Their beliefs fell into two categories: biological and environmental. They conceptualised the causes of ADHD in lay-theoretical models: a model whereby biological predisposition is the root of the cause of the child's symptoms and a "True" ADHD model that considered symptoms of ADHD in many cases were due to adverse environmental effects. Differential beliefs about the causes of ADHD may lead to practitioners blaming parents for a child's behaviour and discounting ADHD as a valid condition [14].

Identification of Children with Attention Deficit Hyperactivity Disorder (ADHD) and their Cognitive Profile (Mahewash, 2015) [15] the study focused on identifying children with ADHD from 2nd to 8th standard on the basis of teachers' and psychiatrists' perception. All children identified with ADHD (100%) by the teachers and psychiatrists having average IQ were considered for the study. From the study it was found that, highest number of children was identified in the co-education school. Early detection of ADHD would lead to early treatment of the disorder in children and help in solving the day to day problem that those children have to face. It was also found that there was a difference between the teacher's perception of ADHD in children and actual occurrences of ADHD.

Diagnosed Attention Deficit Hyperactivity Disorder and Learning Disability: United States (Pastor and Reuben, 2006) [16] the study estimate the prevalence of diagnosed attention deficit hyperactivity disorder (ADHD) and

learning disability (LD) in children from U.S. The report is based on data from the National Health Interview Survey (NHIS), an ongoing national household survey of the civilian population of the United States. The results revealed that about 5% of children had ADHD without LD, 5% had LD without ADHD, and 4% had both conditions. Boys were more likely to have each of the diagnoses (ADHD without LD, LD without ADHD, and both conditions) than the girls. Children of 12–17 years were more likely to have these problems. Children with each of the diagnoses were more likely to have other health conditions. Children with ADHD were more likely to have contact with a mental health professional, use prescription medication, and have frequent health care visits. Children with Learning Disabilities were more likely to use special education services.

The study conducted on Learning Disorders and ADHD in Omani School children revealed Learning Disabilities Diagnostic Inventory (LDDI) and the twenty eight item version of the Conner's Teacher Rating Scale. It was completed by classroom teachers to determine the existence of LD and ADHD symptoms in 321 children in grades one to four. Among the cohort, thirty per cent were reported to have symptoms of ADHD, including conduct problems (20%), hyperactivity (20%) and inattentive-passive behaviours (40%) [17].

There are studies which observed that the trained teachers using cooperative learning procedures with children in their classroom can influence the social skills of children with ADHD symptoms and their acceptance by their peers [18]. ADHD children's symptoms, social skills, and cooperative behaviour were assessed by

means of a teacher's questionnaire, and the social preferences of the children in their class were collected. Changes emerged in teachers' assessments of the children's cooperative behaviour in the experimental classes. Improvements in the sociometric status of children with ADHD symptoms were only seen in the cooperative learning classes.

Some studies provide data on the co-morbidity rates of specific learning difficulties and ADHD symptoms. ADHD symptoms were assessed via parents' ratings. The results showed that only five per cent of both the control group and the group with solely mathematical difficulties fulfilled the criteria of an ADHD subtype according to the DSM-IV based on parents' ratings [19]. In contrast, this was the case in even twenty per cent of the children with difficulties in reading/writing and of those with low IQ. Compared to girls, boys in the control group had a 150 per cent higher risk for matching the criteria of one of the ADHD subtypes in parents' ratings, whereas boys with learning difficulties and those with low IQ had an even 200 per cent to 600 per cent higher risk for it. The relationship between learning difficulties and ADHD symptoms can be found predominantly in the inattentive type. Moreover the some studies show higher co-morbidity may be the result of including students with writing disorders, not just reading and/or mathematics disabilities [20]. Proposed DSM-5 criteria for both disorders will likely affect co-morbidity rates; however, it is unclear whether such rates will increase or decrease. Regardless of the specific impact of DSM revisions, academic skill and/or performance deficits should be assessed for students with ADHD as part of screening,

comprehensive evaluation, and treatment monitoring. Comprehensive intervention services for students with co-morbid ADHD and LD will require empirically supported treatment strategies that address both disorders and that are implemented across school and home settings.

ADHD is secondary disorders in a child and this can have serious implications for the child's overall development. Studies find that teachers detect far more students with ADHD than the number expected from the norms based on the standardized ADHD rating scale. Multiple regression analyses indicated that the teachers' beliefs about a child's peer relations and the quality of teacher-child relationships predicted teachers' ratings on the ADHD scale more than other factors did [21]. In some studies it was found that the ADHD rates were elevated in individuals with childhood-onset Obsessive Compulsive Disorder (OCD). There was a strong association between ADHD and clinically significant hoarding behaviour. This association is consistent with recent studies suggesting that individuals with hoarding may exhibit substantial executive functioning impairments and/or abnormalities, including attention problems [22].

The relationship between attention, executive functions and reading domain abilities in attention deficit hyperactivity disorder and reading disorder is important to be observed. The combination of cognitive deficits in the subgroup of children with both ADHD and RD and the relationship between accuracy in word decoding and executive functions shown for the ADHD groups point to a distinct clinical profile of the co-morbid condition. Attention and EF

should be considered in the diagnosis of RD and in the remediation protocol [23].

Some studies determined the combined subtype of attention-deficit/hyperactivity disorder (ADHD) have impairments in cognitive functioning and motor skills. The specific effect of the co-morbidity of LD was also investigated [24]. In general, the test results of children with ADHD/C were poorer than those of the control group but better than the results of children with a combined ADHD/C+LD diagnosis (with the exception of motor skills). The predictive accuracy of the testing battery tasks in children with ADHD/C and ADHD/C+LD was examined. The results of a standard procedure of discriminant function analyses revealed that the measures correctly classified 73.6 per cent of the children.

The temporal mechanism of attention deficit in children with ADHD was also determined by some researchers and concluded that attaining to control blinking (magnitude and time incidents) and closing gates of attention can reduce the various academic and attention related impairments in children with ADHD. Moreover, some children with ADHD appeared to have a blink largely normal in magnitude but temporally displaced toward a later time. The authors hypothesize that a slower closing of the attention gate may mediate this specific attention impairment in children with ADHD [25]. The relationship between Learning Disabilities and ADHD must be examined before providing any treatment to the children. It is observed that students with learning disabilities were also identified as having ADHD and were being treated with stimulant medication [26-27]. The findings revealed that, children with

attention deficit and a co-morbid learning disability had greater memory deficits. However in one study it was observed that children with both ADHD and learning disabilities performed better on the attention tasks than children with only ADHD [28].

3. DYSCALCULIA AND ITS CASE STUDY

Mathematics anxiety and Prevention Strategies: (Mandal & Saha, 2019) [29] the study focused on finding the mathematics anxiety amongst secondary school students on basis of gender. They used the standardized Mathematics Anxiety Scale [30] to make analysis of mathematics anxiety amongst the secondary students. was used in this research. The study revealed that there are significant difference in mathematics anxiety and performance in mathematics between boys and girls. Boys scored better than girls and show less mathematics anxiety as compared to girls. It was observed that the students which practised daily or used easier techniques were performing much better. The reason for boys' better performance can be their continuous practise and reasoning behaviour than girls [31]. The study even indicates that there was no significant difference in mathematics anxiety and performance amongst the urban and rural areas secondary students. Although, the rural area students scored better marks in mathematics than the urban area students.

A survey of the mathematical problems (dyscalculia) confronting primary school pupils in Buea Municipality in the south west region of Cameroon (Nfon, 2016) [32] the study focused confronting the dyscalculia and ADHD problems

in primary school students from government school. The government primary schools was chosen because it provide more representative picture of the social, economic, political, and religious diversities. The study it was found that students with difficulties in sequencing and organising detailed information often have difficulties remembering specific facts and formulas for completing mathematics calculations [33]. It was also found that. Dyscalculia students lack self-confidence and practice avoidance strategies which are often manifested in their behaviour. The computation of mathematical facts continues to be a problem with dyscalculia pupils as they have weak, inexact numbers system. These type of students must be provided special care and supported in all possible condition to boost their confidence.

Study of Dyscalculia Primary School Children in Salem District and Evaluation of Applicability of Innovative Strategies as Remedial Measures (Nagavalli, 2015) [34], the study focused on identifying dyscalculia students. The students were examined with output in numerical difficulty, sequential difficulty, language difficulty, cognition, motor difficulty, visual and spatial difficulty and multiple tasking. The teachers and the dyscalculia children were interviewed informally on the difficulties they face while teaching-learning mathematics [35]. The study found that about fifty students had learning difficulties in mathematics and were identified as dyscalculia students. The students felt that the remediation intervention programme were effective and efficient. The remediation intervention programme through activities, real objects, concrete objects, representational through visual images, through

role play, graphic organizers, derived fact strategy, vocabulary model, co-operative learning helped them to learn the concept easier.

ANGST: Examining Students' Fears in Mathematics (Paray, 2014) [36] the study focused on identifying the profile of high school students according to sex, age and year to observe the fear of the students in Mathematics. The study revealed that, the respondents possess moderate fear on: being called in maths class to solve problems on the board, reading and interpreting graphs and charts, solving manually complex equations without using calculator, working on an abstract mathematical problem. The students even feared about maths class, thinking about an upcoming maths test one hour before, receiving a homework assignment for many difficult problems due to the next class meeting, realizing they have to take a certain number of maths classes before graduating in high school.

Teaching addition to children with dyscalculia through CAI (Singh and Agarwal, 2011) [37]: The study assess the main-effect of group in teaching addition to children with dyscalculia. From the study it was found that CAI is superior to traditional method while teaching addition of fractions to children with dyscalculia. The boys and girls with dyscalculia were equally benefited from CAI.

Mathematics Anxiety in Children with Developmental Dyscalculia (Rubinsten, *et. al.*, 2010) [38]: The study investigates the effects of math anxiety on numerical processing in children with specific deficits in the acquisition of math skills by using a novel affective priming

task as an indirect measure. From the study it was found that, participants with Developmental Dyscalculia responded faster to targets that were preceded by both negative primes and maths related primes. A reversed pattern was present in the control group.

Developmental Dyscalculia (Ruth and Shalev, 2004) [39]: The study focused on the natural history of developmental dyscalculia and factors that contributes to the persistence. The findings of the study showed that the factors significantly associated with persistence of dyscalculia were severity of the arithmetic disorder and arithmetic problems in siblings of the probands. Factors that were not associated with persistence included socio-economic status, gender, the presence of another learning disability and educational interventions. Studies reveal that the factors related to the children with learning disabilities in mathematics were the poor instruction, parents' adverse behaviour to them, and teacher's negligence in the class. It was suggested that the quality of teaching strategies and quality of instruction in the schools must be improved [40].

4. ADHD AND DYSCALCULIA

The ADHD highly affect the students learning and thinking process, which sometime lead to mathematical anxiety. The study with Clinical and psycho educational profile of children with specific learning disability and co-occurring attention-deficit hyperactivity disorder was observed [40]. Almost ten per cent of school going children had specific learning disability (SLD) in the form of dyslexia, dysgraphia and/or dyscalculia. Attention-deficit hyperactivity disorder (ADHD) occurs as a co-morbidity in

about twenty per cent of these children fifty consecutively diagnosed children (thirty four boys, sixteen girls) were included in the study. SLD was diagnosed on the basis of psycho educational testing. Diagnosis of ADHD was made by DSM-IV-revised criteria. There were no differentiating features between the two gender groups. Their academic problems were difficulties in writing (ninety six per cent), inattentiveness (ninety six per cent), and difficulties in mathematics (seventy four per cent), hyperactivity (sixty eight per cent) and difficulties in reading (sixty per cent). All children had poor school performance, fifteen (thirty per cent) had already experienced class retention and twenty (forty per cent) had developed aggressive or withdrawn behaviour. Children with SLD and co-occurring ADHD need to be identified at an early age to prevent poor school performance and behavioural problems.

ADD/ADHD: Effects on Mathematics and Mathematical Computations (Brooks et al., 2007) [41] aimed to determine the methods educational practitioners find worth when teaching ADD/ADHD students mathematical computation and concepts. From the research it was found that the educational practitioners agree upon numerous educational processes in order to teach mathematics to students with ADD/ADHD. The research also discovered that 86% of the educational practitioners do not believe that their classroom environment is conducive to students with ADD/ADHD learning mathematics. Changing or improving the classroom environment can be as simple as changing seats or allowing the students to use mathematical tools (i.e. compass, ruler, and calculator), smart boards etc. Moreover studies

shows that when students with ADHD are exposed to Computer Assisted Instruction on the Mathematics Performance and Classroom Behaviour performed well as compared to normal teaching method [42]. Their mathematics achievement improves and their on-task behaviour increase during the CAI sessions relative to independent seatwork conditions. It was also found that, students and teachers consider CAI to be an acceptable intervention for some students with ADHD who are having difficulty with mathematics.

The students facing problem with ADHD and dyscalculia can be due to familial reasons. Studies conducted to find the relation between the two. The study show that, among the 464 probands included in the analysis, the prevalence of dyscalculia in children with ADHD was significantly higher than among controls. It was also found that, significantly increased rates of ADHD in the relatives of probands with ADHD with and without dyscalculia compared to the relatives of control probands. Also, there was a significantly increased rate of ADHD in relatives of ADHD + Dyscalculia probands compared to relatives of dyscalculia probands [44-45].

5. CONCLUSION

The purpose of the reviewing the previous studies is to understand the different aspect made by different scholars at different levels or areas. It enables the researcher to learn from previous research topic. This chapter so far dealt with the need of review, studies carried out both in India and abroad in the areas of Dyscalculia and Attention Deficit hyperactivity Disorder. Review of related literature also outline the gaps in previous research work and help to refine,

refocus or even change the topic of research area. A literature review is an evaluation report of information found in the literature related to the selected area of study. The reviews describe, summarise, evaluate and clarify the literature.

In the present study the investigator has reviewed many studies related to the variables of the study. Many studies conducted to study the natural history of developmental dyscalculia and also to identify tile factors that contributes to the persistence. One study was conducted to investigate the attention performance of children with ADHD, children with LD, and children with no psychiatric diagnoses on various neuropsychological tests of attention. The present study is different from the studies that have been already done in terms of area, population and sample. From the above review of literature the investigator could not find studies which studied the impact of Attention Deficit Hyperactivity Disorder among the Dyscalculic school students with respect to gender. This motivated the investigator to select the topic of this nature.

6. CONFLICT OF INTEREST

NA

7. SOURCE/S OF FUNDING

No source of funding

8. REFERENCES

1. Tan, M., & Appleton, R. (2005). Attention deficit and hyperactivity disorder, methylphenidate, and epilepsy. *Archives of disease in childhood*, **90(1)**, 57-59.
2. Thapar, A., Holmes, J., Poulton, K., & Harrington, R. (1999). Genetic basis of

- attention deficit and hyperactivity. *The british journal of psychiatry*, **174(2)**, 105-111.
3. McIntyre, R., & Hennessy, E. (2012). 'He's just enthusiastic. Is that such a bad thing?' Experiences of parents of children with Attention Deficit Hyperactivity Disorder. *Emotional and behavioural difficulties*, **17(1)**, 65-82.
 4. Taylor, M., O'Donoghue, T., & Houghton, S. (2006). To medicate or not to medicate? The decision-making process of Western Australian parents following their child's diagnosis with an attention deficit hyperactivity disorder. *International Journal of Disability, Development and Education*, **53(1)**, 111-128.
 5. Frigerio, A., Montali, L., & Fine, M. (2013). Attention deficit/hyperactivity disorder blame game: A study on the positioning of professionals, teachers and parents. *Health*, **17I(6)**, 584-604.
 6. Harbor-Peters, V. F. A. (2001). Unmasking some aversive aspects of schools mathematics and strategies for averting them. Inaugural lecture, 5.
 7. Govindaraj, S. (2017). Animated learning package of mathematical concepts for students with attention deficit hyperactive disorder.
 8. Daniels, L. M., Terpstra, J., Addicott, K., Slator, B. M., Schwert, D. P., Saini-Eidukat, B., ... & White, A. R. (2006). Effects of Teaching science through immersive virtual environments. In *Web-based intelligent e-learning systems: Technologies and applications*, pp. 271-290. IGI Global.
 9. Sujathamalini, J., Ananthi, G., & Kanmani, S. (2013). A Study on the Attitude of Teacher Trainees Towards Inclusive education. *Indian Journal of Research. PARIPEX*, **3 (5)**
 10. Watters, C., Adamis, D., McNicholas, F., & Gavin, B. (2018). The impact of attention deficit hyperactivity disorder (ADHD) in adulthood: a qualitative study. *Ir J Psychol Med*, **35(3)**, 173-179.
 11. Agarwal R, Goldneberg M, Perry R, IsHak WW (2012). The quality of life of adults with attention deficit hyperactivity disorder: a systematic review. *Innovations in Clinical Neuroscience*, **9**, 10-21.
 12. McCarthy S, Wilton L, Murray M, Hodgkins P, Asherson P, Wong I (2013). Management of adult attention deficit hyperactivity disorder in UK primary care: a survey of general practitioners. *Health and Quality of Life Outcomes*, **11**, 22.
 13. Russell, A. E., Moore, D. A., & Ford, T. (2016). Educational practitioners' beliefs and conceptualisation about the cause of ADHD: A qualitative study. *Emotional and Behavioural Difficulties*, **21(1)**, 101-118.
 14. Harborne, A., Wolpert, M., & Clare, L. (2004). Making sense of ADHD: a battle for understanding? Parents' views of their children being diagnosed with ADHD. *Clinical Child Psychology and Psychiatry*, **9(3)**, 327-339.
 15. Hasan, M. Identification of children with attention deficit hyperactivity disorder ADHD and their cognitive profile
 16. Pastor, P. N., & Reuben, C. A. (2008). Diagnosed Attention Deficit Hyperactivity Disorder and Learning Disability: United

- States, 2004-2006. Data from the National Health Interview Survey. Vital and Health Statistics. Series 10, Number 237. *Centers for Disease Control and Prevention*. 1600 Clifton Road, Atlanta, GA 30333.
17. Al-Mamari, W. S., Emam, M. M., Al-Futaisi, A. M., & Kazem, A. M. (2015). Comorbidity of learning disorders and attention deficit hyperactivity disorder in a sample of Omani schoolchildren. *Sultan Qaboos University Medical Journal*, **15(4)**, e528.
18. Capodiecici, A., Lachina, S., & Cornoldi, C. (2018). Handwriting difficulties in children with attention deficit hyperactivity disorder (ADHD). *Research in Developmental Disabilities*, **74**, 41-49.
19. Maehler, C., & Schuchardt, K. (2016). Working memory in children with specific learning disorders and/or attention deficits. *Learning and Individual Differences*, **49**, 341-347.
20. DuPaul, G. J., Gormley, M. J., & Laracy, S. D. (2013). Comorbidity of LD and ADHD: Implications of DSM-5 for assessment and treatment. *Journal of learning disabilities*, **46(1)**, 43-51.
21. Kypriotaki, M., & Manolitsis, G. (2010). Teachers' evaluations for the detection of primary-school children with attention deficit hyperactivity disorder. *European Journal of Special Needs Education*, **25(3)**, 269-281.
22. Sheppard, B., Chavira, D., Azzam, A., Grados, M. A., Umaña, P., Garrido, H., & Mathews, C. A. (2010). ADHD prevalence and association with hoarding behaviors in childhood-onset OCD. *Depression and anxiety*, **27(7)**, 667-674.
23. Bental, B., & Tirosh, E. (2007). The relationship between attention, executive functions and reading domain abilities in attention deficit hyperactivity disorder and reading disorder: A comparative study. *Journal of Child Psychology and Psychiatry*, **48(5)**, 455-463.
24. Jakobson, A., & Kikas, E. (2007). Cognitive functioning in children with and without attention-deficit/hyperactivity disorder with and without comorbid learning disabilities. *Journal of Learning Disabilities*, **40(3)**, 194-202.
25. Li, C. S. R., Lin, W. H., Chang, H. L., & Hung, Y. W. (2004). A psychophysical measure of attention deficit in children with attention-deficit/hyperactivity disorder. *Journal of Abnormal Psychology*, **113(2)**, 228.
26. Snider, V. E., Busch, T., & Arrowood, L. (2003). Teacher knowledge of stimulant medication and ADHD. *Remedial and Special Education*, **24(1)**, 46-56.
27. Comings, D. E., Gonzalez, N., Wu, S., Gade, R., Muhleman, D., Saucier, G., ... & MacMurray, J. P. (1999). Studies of the 48 bp repeat polymorphism of the DRD4 gene in impulsive, compulsive, addictive behaviors: Tourette syndrome, ADHD, pathological gambling, and substance abuse. *American journal of medical genetics*, **88(4)**, 358-368.
28. Hewitt, J. K., Rutter, M., Simonoff, E., Pickles, A., Loeber, R., Heath, A. C., ... & Eaves, L. J. (1997). Genetics and developmental psychopathology: 1. Phenotypic assessment in the Virginia twin study of adolescent behavioral

- development. *Journal of Child Psychology and Psychiatry*, **38(8)**, 943-963.
29. Mandal, A.K. & Saha, B. (2019) Mathematics Anxiety and Prevention Strategies: An Attempt to Improvement of Mathematics Performance of Secondary School Students in West Bengal, A multidisciplinary *Online Journal of Netaji Subhas Open University*, **2 (1)**: 1-7
30. Mahmood, S., & Khatoon, T. (2011). Development and validation of the mathematics anxiety scale for secondary and senior secondary school students. *British Journal of Arts and Social Sciences*, **2(2)**, 169-179.
31. Akin, A., &Kurbanoglu, (2011). The relationship between mathematics anxiety, mathematics attitudes, and self-efficacy: A structural equation model. *Studia Psychologica*, **53**, 263-273
32. Nfon, N. F. (2016). a Survey of the Mathematical Problems (Dyscalculia) Confronting Primary School Pupils in Buea Municipality in the South West Region of Cameroon. *International Journal of Education and Research*, **4(4)**, 437-450.
33. Badian, N. A. (1983). Arithmetic and nonverbal learning. *Progress in learning disabilities*, **5**, 235-264.
34. Nagavalli, T. (2015). A Study of Dyscalculic Primary School Children from Salem District and Evaluation of Applicability of Innovative Strategies as Remedial Measures. *Indian Educational*, **53(2)**, 34.
35. Tall, D., & Razali, M. R. (1993). Diagnosing students' difficulties in learning mathematics. *International Journal of Mathematical Education in Science and Technology*, **24(2)**, 209-222.
36. Paray, D. S. ANGST: Examining Students' Fears in Mathematics. *Age*, **15(17)**, 52.
37. Singh, Y. P., & Agarwal, A. TEACHING ADDITION TO CHILDREN WITH DYSCALCULIA THROUGH CAI.
38. Rubinsten, O., & Tannock, R. (2010). Mathematics anxiety in children with developmental dyscalculia. *Behavioral and Brain functions*, **6(1)**, 1-13.
39. Shalev, R. S. (2004). Developmental dyscalculia. *Journal of child neurology*, **19(10)**, 765-771.
40. Pandit, R P. (2000). "A model for the identification of learning disabilities in Mathematics Shukshak Jownal. 3, Kathmandu: Mahendra Ratna Campus, 11-17
41. Karande, S., Satam, N., Kulkarni, M., Sholapurwala, R., Chitre, A., & Shah, N. (2007). Clinical and psychoeducational profile of children with specific learning disability and co-occurring attention-deficit hyperactivity disorder. *Indian journal of medical sciences*, **61(12)**, 639-647.
42. Levin, F. R., Evans, S. M., Brooks, D. J., & Garawi, F. (2007). Treatment of cocaine dependent treatment seekers with adult ADHD: double-blind comparison of methylphenidate and placebo. *Drug and alcohol dependence*, **87(1)**, 20-29.
43. Mautone, J. A., DuPaul, G. J., & Jitendra, A. K. (2005). The effects of computer-assisted instruction on the mathematics performance and classroom behavior of

children with ADHD. *Journal of Attention Disorders*, **9(1)**, 301-312.

44. Monuteaux, M. C., Faraone, S. V., Herzig, K., Navsaria, N., & Biederman, J. (2005). ADHD and dyscalculia: Evidence for independent familial transmission. *Journal of learning disabilities*, **38(1)**, 86-93.
45. Crittenden, P. M., & Kulbotton, G. R. (2007). Familial contributions to ADHD: An attachment perspective. *Tidsskrift for Norsk Psykologforening*, **44(10)**, 1220-1229.