

The needs and significance to design and develop a Dyscalculia checklist

*Keperluan dan kepentingan untuk mereka bentuk dan membangunkan
senarai semak Diskalkulia*

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Abstract

Dyscalculia occupies four to six percent among the population of our pupils. It is as common as dyslexia but it is a learning disability in mathematics instead of reading. However, the dyscalculic pupils are hardly detected and identified due to the lack of awareness and checklist for adults in order to detect them. The purpose of this study is to discuss about the needs and significance to design and develop a checklist for dyscalculic pupils. The results show that the needs to develop a dyscalculia checklist are prevalence of dyscalculic pupils, lack of awareness among teachers and parents, and the need of standardized dyscalculia checklist to be officially applied in our country's education system. If a dyscalculia checklist is being developed, it will bring significance to Ministry of Education, teachers and parents, dyscalculic pupils, and researchers. As a conclusion, the needs to design and develop a checklist for dyscalculia has been identified based on literature reviews. The implication of this paper is that a dyscalculia checklist will be developed by the researchers in order to detect the dyscalculic pupils among the population.

Keywords: Dyscalculia, Checklist, Special Education, Learning Disability, Mathematics.

Abstrak

Diskalkulia menyumbang antara empat hingga enam peratus dalam kalangan murid-murid. Diskalkulia adalah sama biasa seperti disleksia namun ia merupakan satu masalah pembelajaran Matematik tetapi bukan membaca. Walaubagaimanapun, murid-murid diskalkulia adalah sukar dikesan dan dikenal pasti disebabkan kekurangan kesedaran dan senarai semak bagi orang dewasa untuk mengesan mereka. Tujuan kajian ini adalah untuk membincangkan tentang keperluan dan kepentingan untuk mereka bentuk dan membangunkan satu senarai semak diskalkulia bagi murid-murid diskalkulia. Dapatan kajian menunjukkan bahawa satu senarai semak diskalkulia perlu diwujudkan kerana kelaziman murid-murid diskalkulia, kekurangan kesedaran dalam kalangan guru dan ibu bapa, dan keperluan untuk satu senarai semak diskalkulia yang seragam untuk diaplikasikan secara rasmi dalam sistem pendidikan negara kita. Jika satu senarai semak diskalkulia dibangunkan, maka ia akan memberi manfaat kepada Kementerian Pendidikan Malaysia, guru dan ibu bapa, murid-murid diskalkulia, dan pengkaji. Kesimpulannya, keperluan untuk mereka bentuk dan membangunkan satu senarai semak diskalkulia telah dikenal pasti berdasarkan tinjauan literatur. Implikasi kajian ini adalah satu senarai semak diskalkulia akan dibangunkan oleh pengkaji untuk mengesan murid-murid diskalkulia dalam kalangan populasi.

Kata Kunci: Diskalkulia, Senarai Semak, Pendidikan Khas, Masalah Pembelajaran, Matematik.

INTRODUCTION

Mathematics is a compulsory subject in primary and secondary school curriculum. It is important and needed in our everyday life (Yoong & Ahmad, 2019). It is undeniable that Mathematics is important in our daily life (Jamian & Taha, 2020). However, some pupils might face difficulties or disabilities in learning mathematics (Yoong & Ahmad, 2018). This is happening especially among the dyscalculic pupils who are having learning disability in Mathematics.

There are six categories of special needs pupils, which include pupils with; (1) visual impairment; (2) hearing impairment; (3) speech difficulties; (4) physical disabilities; (5) multiple disabilities; and (6) learning disabilities such as autism, Down's Syndrome, attention deficit hyperactivity disorder, and dyslexia (Ministry of Education Malaysia, 2013). Dyscalculia is categorised as one the learning disabilities. It is a learning disability in mathematics, identical to dyslexia which is a learning disability in reading.

The purpose of this paper is to identify the needs to develop a dyscalculia checklist and the significance of the dyscalculia checklist. Two research questions are:

- (1) What are the needs to design and develop a dyscalculia checklist?
- (2) What are the significance of the dyscalculia checklist?

LITERATURE REVIEW

Literature reviews based on the concepts were made to give a clearer picture of the concepts to be discussed in this paper. In this session, the researchers will discuss about the literature review of special education, dyscalculia, and checklist.

Special Education

Special education in Malaysia is a continuous effort to create individuals that are skilful, oriented, capable, faithful, independent, able to plan and manage daily living, and are aware of self- potential as balanced and productive individuals and members of the society in line with the National Educational Philosophy (Musa & Ahmad, 2019). The special education curriculum depends on three main principles; (1) comprehensive and integrated education; (2) good and meaningful learning; and (3) lifelong education (Yunus & Ahmad, 2019).

Generally, special education pupils learn at a relatively slow pace, they might need much time to build a basis of mathematics facts before they can proceed with more advanced levels of knowledge (Bakker, van den Heuvel-Panhuizen, & Robitzsch, 2016). Some of these pupils have not included in special educational services. They must be given a proper education suitable with their cognitive development level (Yoong & Ahmad, 2018). As a summary, special education is an education specially designs for the pupils who have special educational needs. Teachers need to be very patient because the pupils in special education are often considerably behind in their learning ability, as compared with their same-aged peers in general education.

Dyscalculia

Dyscalculia is a mathematics difficulty where students struggle to learn or understand mathematics (Alloway & Alloway, 2015). It is a specific learning disability directed to arithmetic. Dyscalculic pupils can be reeducated and reduce the severity of the learning disability, however never totally recovered (Ferraz & Neves, 2015). They should be detect and given proper intervention as early as possible.

Dyscalculic pupils are known to have a delay in their general mathematics achievement level, they also have an additional delay in their rational number understanding compared with their peers (Moser, Vibert, Marco, & Mast, 2017). Research had shown that a child with dyscalculia is a hundred times less likely to receive an official diagnosis of that disorder than a child with dyslexia (Morsanyi, van Bers, McCormack, & McGourty, 2018). In our country, dyscalculia is yet a new term to be discovered and further explored. If compared with dyslexia, the researches in this field are relatively very small. Hence, the researchers will carry out a study to identify the needs and significance to design and develop a dyscalculia checklist.

Checklist

Learning Disabilities Checklist was developed to be administered by teachers and school authorities to assess children's learning difficulties in order to improve their academic functioning. This checklist helps teachers and instructors in identifying Learning Disabilities and structuring remedial teaching practices and programs for children with learning disabilities (Ashraf & Najam, 2014). In Arusha, Tanzania, a screening tool checklist was prepared to identify learners with dyscalculia and facilitate a broader look at the achievement (Yusta, Karugu, Muthee, & Tekle, 2016).

Checklist acts as the first instrument to detect the potential special education children before screening those pupils showing some signs of disabilities. The purpose of checklist is to provide tools for systematically recording observations. Checklist is an assessment tool that set out specific criteria. It can be used in the first step to detect the pupils with learning disabilities. In this study, dyscalculia checklist is defined as an instrument for teachers and parents to detect the dyscalculic pupils

METHODOLOGY

Specifically this study is a review on the needs and significance to design and develop a dyscalculia checklist. The purpose of this study is to investigate the needs to develop a checklist for dyscalculia and the significance on dyscalculia checklist to several parties, such as Ministry of Education, teachers and parents, dyscalculic pupils, and researchers. This study does not involve any participants and the findings will be discussed based on the literature reviews.

FINDINGS

The findings of this study will be discussed based on two research questions. Hence, it is divide into two sections in order to investigate; (1) needs to design and develop a dyscalculia checklist; and (2) significance of a dyscalculia checklist.

1. Needs to Design and Develop a Dyscalculia Checklist

In this session, the needs to design and develop a dyscalculia checklist will be discussed based on three aspects, which are: (1) prevalence of dyscalculia; (2) lack of awareness; and (3) the need of standardized dyscalculia checklist in Malaysia.

i. Prevalence of Dyscalculia

The prevalence of specific learning disorder across the academic domains of reading, writing, and Mathematics is five percent to fifteen percent among school-age children across different languages and cultures. Prevalence in adults is unknown but appears to be approximately four percent (American Psychiatric Association, 2013). There are four to six percent of the pupils among the population are dyscalculic (Bird, 2017).

The presence of dyscalculia may affect Mathematics performance among typical students. This learning difficulty in Mathematics occurs among individuals across the whole IQ range. The estimated prevalence of dyscalculia range is between three and six percent of the population. In Sabah, the researchers found out that 5.5 percent of the primary school students are suffering from dyscalculia (Chin, Pang, Wong, Tan, & Lee, 2014). In another words, it is estimated that one out of twenty pupils in the classroom is dyscalculia. And yet, they have not been identified and continued being left out or labelled among the population. Thus, a dyscalculia checklist has to be designed and developed in order to identify the dyscalculic pupils in the normal classroom.

ii. Lack of Awareness

It is noticeable that the term dyscalculia did not appear even once in Malaysia Education Blueprint 2013-2025. A special education teacher is predicted to have higher scores of knowledge of intervention strategies to address the specific learning disability, but not of knowledge of characteristics or symptoms (Sousa, Dias, & Cadime, 2016). In India, checklist had been developed to screen children with learning disability due to lack of awareness of nature and characteristics of learning problems (Joshi & Vanaja, 2016).

A teacher without dyscalculia knowledge might label dyscalculic pupils as lazy or stupid (Fu & Chin, 2017). These negative perceptions affect their psychological development. Subsequently, they may start to believe that they will never master the mathematical skills as their peers or friends. As this happen day by day, they may even develop a deliberate avoidance of numbers. Dyscalculia is nearly as common as dyscalculia, yet these pupils often left unidentified and undiagnosed even after finishing their school years. Even more, there is also a possibility for misjudging the dyscalculic pupils. As a result, this may lead to the inefficient and improper diagnosis given to them. Hence, Parents and teachers need to be aware if the symptoms or characteristics of dyscalculia are shown upon their children.

iii. The Need of Standardized Dyscalculia Checklist

There is a dyslexia checklist instrument available in Malaysia (Ministry of Education Malaysia, 2011), where the teachers can download this checklist from website of Special Education Department and apply it on their pupils. The constructs of this checklist are (1) spelling, (2) reading, and (3) writing. Although some might say dyscalculia is the same category of learning disability as dyslexia, but there is no any constructs in this checklist relevant to numeracy.

On the other hand, a Malaysian dyscalculia instrument had been developed and used as a screening tool to identify the dyscalculic pupils among primary school pupils (Chin et al., 2014). This screening tool is named as Early Dyscalculia Test (Wong, 2016) but there is yet no standardized dyscalculia checklist officially applied in our country's education system. So, it is clear that a dyscalculia checklist which is suitable in the context of our country had to be designed and developed. Therefore, the researcher will carry out a research entitled design and development of Dyscalculia Checklist Instrument (DCI) for dyscalculic pupils in the primary schools.

2. Significance of a Dyscalculia Checklist

Next, the researchers will discuss about the significance of a dyscalculia checklist. The dyscalculia checklist is needed as it will gives significant benefits to Ministry of Education Malaysia (KPM), teachers and parents, dyscalculic pupils, and researchers.

i. Significance to Ministry of Education

In Malaysia, there is a dyslexia checklist developed by Lee (2008). This dyslexia checklist had been revised by Special Education Department in KPM in year 2011. This instrument acts as a preliminary

test to be implemented among the primary schools pupils in Malaysia (Ministry of Education Malaysia, 2011). However, there is little research being done on dyscalculia in general, and Malaysia in particular (Wong et al., 2014). When comes to dyscalculia, there is still no any standardized dyscalculia checklist in order to detect the dyscalculic pupils. Since it is estimate that one out of twenty of the pupils is dyscalculic, thus it is very important for the researcher to design and develop a dyscalculia checklist that is valid and reliable, so that it can be applied in our country and be used officially by our education ministry.

ii. Significance to Teachers and Parents

Having the sufficient expertise to assist pupils diagnosed with dyscalculia, a disability in learning arithmetic, can be challenging for teachers and parents (Knudsen, 2016). Parental support and collaboration are critical components of any educational environment in which special educational needs and disabilities are place (Hornby & Evans, 2013). In the matter of this, teachers and parents need to cooperate in order to assist the pupils to achieve their optimum learning level. They to be aware if the symptoms or characteristics of dyscalculia occur on their children. By using the dyscalculia checklist, teachers and parents will be able to detect whether their child is dyscalculia or merely poor in mathematics

Regarding to this, teachers and parents should always make sure that the pupils or children are receiving the proper education as they are required to. If a checklist for dyscalculia has been developed and being approved by the KPM, this checklist can be applied to the pupil who poses the symptoms or characteristics of dyscalculia. This is very important as the teachers and parents will be able to make it as guidance to carry out the diagnosis and interventions in improving the weaknesses of the dyscalculic pupils. Hence, design and development of this checklist will definitely bring benefits not only to teachers but also to parents.

iii. Significance to Dyscalculic Pupils

Eventually, this study is also significant for dyscalculic pupils. A dyscalculic pupil is often found no sense of numbers, no ability to estimate even small quantities, and no idea whether an answer to an arithmetic problem is reasonable or not (Bird, 2017). If these dyscalculic pupils are not being identified, they will continue be being left out or labelled (Yoong & Ahmad, 2020). These pupils often perform very poor in their assessment and hence being labelled as stupid or lazy among their peers. Hence, the design and development of a dyscalculia checklist will enables these pupils to be identified as early as possible.

Teaching strategy will be effective if the design of lesson is pupil-centered (Seliaman & Dollah, 2018). With this dycalculia checklist, these pupils can obtain an early intervention which is suitable to their learning level. As a result, the dyscalculic pupils are able to gain their confidence in Msathematics learning and hence they are believed to be able to improve the mathematics assessment results as well.

iv. Significance to Researchers

The researchers in Malaysia had developed a computer play intervention for children with low conceptual understanding in basic mathematics operation using dyscalculia feature approach (Syah, Hamzaid, Murphy & Lim, 2016). However, these researchers stated that it is difficult to determine to what extent the sample satisfied the characteristics dyscalculia. Thus in their study, they were cautious about claiming the subjects to be children with [possible dyscalculia] and settled for the term [children with low understanding in basic mathematics operation] or [children displaying dyscalculia characteristics].

Hence, this shows the urgent need for a dyscalculia checklist to be designed and developed in order to contribute towards the future researchers as an instrument to determine their samples whether they are dyscalculic or not, and also as guidance and reference for other researches relevant to this field.

Besides, this study also contributes towards a more systematic documentation which involved the learning disability of dyscalculia.

DISCUSSION AND CONCLUSION

In a summary, two research questions in this paper have been answered. The first research question is, [what are the needs to design and develop a dyscalculia checklist?]. The first reason to design and develop a dyscalculia checklist is due to the high rates of dyscalculic pupils. There are estimated that one out of twenty pupils are dyscalculic. This is in according to Bird (2017) that stated a prevalence of four to six percent among the population. The second reason to develop a dyscalculia checklist is the lack of awareness about the symptoms and characteristics of dyscalculic pupils.

There is worsening trend for Mathematics subject occurring in primary schools (Jamian & Taha, 2019). If these pupils are not being detected, they will continue to be left out and labelled as stupid and lazy. Last but not least, there is still no standardized dyscalculia checklist in Malaysia that can be used officially by the teachers and parents. Thus, these three reasons explained why there is a need to design and develop a dyscalculia checklist.

Subsequently, if a dyscalculia checklist is being developed, it will bring significance to different parties. Firstly, it will bring significance to Ministry of Education, so that a standardized checklist for dyscalculia is able to be applied in our education system officially. Then, it is also significant to teachers and parents, because they play a crucial part in detecting the at-risk dyscalculic pupils. Next, the dyscalculia checklist will also be significant to dyscalculic pupils to enable them to be identified and given proper intervention as early as possible. Lastly, it will be significant to the future researchers in this field as an instrument to determine their sample of dyscalculic pupils.

In a nutshell, since there are needs to design and develop a dyscalculia checklist and it will bring significance to many aspects, so the researchers will design and develop a checklist for dyscalculia entitled Dyscalculic Checklist Instrument (DCI), in order to detect the at-risk dyscalculic pupils in primary schools.

REFERENCES

- Alloway, T.P. & Alloway, R.G. (2015). *Understanding working memory* (2nd ed.). London: SAGE Publications Ltd.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington: American Psychiatric Association.
- Bakker, M., van den Heuvel-Panhuizen, M. & Robitzsch, A. (2016). Effects of mathematics computer games on special education students' multiplicative reasoning ability. *British Journal of Educational Technology*, 47(4), 633-648.
- Bird, R. (2017). *The dyscalculia toolkit: supporting learning difficulties in maths* (3rd ed.). London: SAGE Publications Ltd.
- Chin, K.E., Pang, V., Wong, K.K., Tan, C.K. & Lee, K.W. (2014). A preliminary study for dyscalculia in Sabah, Malaysia. *The Eurasia Proceedings of Educational & Social Sciences (EPESS)*, 1, 217-225.
- Musa, F.C. & Ahmad, N.A. (2019). Conceptual framework of teacher's competence in teaching and learning of fine motor skills to students with special education needs (learning disabilities). *International Journal of Academic Research in Business & Social Sciences*, 9(11), 1180-1186.
- Ashraf, F. & Najam, N. (2014). Validation of Learning Disabilities Checklist in Public Sector Schools of Pakistan. *Pakistan Journal of Psychological Research*, 29(2), 223-244.
- Ferraz, F. & Never, J. (2015). A brief look into dyscalculia and supportive tools. *The 5th IEEE International Conference on E-Health and Bioengineering*, 15-18.

- Fu, S.H. & Chin, K.E. (2017). An online survey research regarding awareness of dyscalculia among educators in Sandakan district, Sabah. *International Journal of Academic Research in Progressive Education and Development*, 6(2), 1-10.
- Jamian, R. & Taha, H. (2020). Needs analysis of mobile application usability specifications for mathematics year 4: constructs of attitude, interest and basic knowledge. *Jurnal Pendidikan Sains & Matematik Malaysia*, 10(1), 9-15.
- Joshi, N. & Vanaja, C. (2016). Checklist to screen children with reading difficulty for classroom teachers. *Language in India*, 16(1), 185-199.
- Hornby, G. & Evans, W.H. (2013). Including students with significant social, emotional and behavioural difficulties in mainstream school settings. In P. Garner, J. Kauffman & Elliot, J. (Eds.). *The SAGE Handbook of Emotional & Behavioral Difficulties* (2nd ed.). London: SAGE.
- Knudsen, G.S. (2016). *Identifying dyscalculia symptoms related to magnocellular reasoning using smartphones* (Master Thesis). Norway: University of Bergen.
- Ministry of Education Malaysia. (2011). *Instrumen senarai semak disleksia*. Retrieved on 7th May 2020 from <https://www.moe.gov.my/muat-turun/pendidikankhas/program-pemulihan-khas/muat-turun-ppk/instrumen-dan-pentaksiran/2667-manual-instrumen-senarai-semak-disleksia-isd-2011/file>
- Ministry of Education Malaysia. (2013). *Malaysia education blueprint 2013-2025 (preschool to post-secondary education)*. Putrajaya: Kementerian Pendidikan Malaysia.
- Morsanyi, K., McCormack, T. & O'Mahony, E. (2017). The link between deductive reasoning and mathematics. *Thinking & Reasoning*, 24(2), 234-257.
- Moser, I., Vibert, D., Marco, D. & Mast, F.W. (2017). Impaired math achievement in patients with acute vestibular neuritis. *Neuropsychologia*, 107, 1-8.
- Nor Elleeiana Mohd Syah, Nur Azah Hamzaid, Belinda Pinguhan Murphy & Lim, E. (2016). Development of computer play pedagogy intervention for children with low conceptual understanding in basic mathematics operation using the dyscalculia feature approach. *Interactive Learning Environment*, 24(7), 1-20.
- Seliaman, N. & Dolah, M.U. (2018). Pengajaran matematik sekolah rendah menggunakan pendekatan kontekstual: satu kajian kes. *Jurnal Pendidikan Sains dan Matematik Malaysia*, 8(2), 27-34.
- Sousa, P., Dias, P.C. & Cadime, I. (2016). Predictors of primary school teachers' knowledge about developmental dyscalculia. *European Journal of Special Needs Education*, 2(1), 3-10.
- Wong, K.K. (2016). *The development of an early dyscalculia test* (Doctoral's thesis). Universiti Malaysia Sabah, Kota Kinabalu, Malaysia.
- Yusta, N., Karugu, G., Muthee, J. & Tekle, T. (2016). Impact of Instructional Resources on Mathematics Performance of Learners with Dyscalculia in Integrated Primary Schools, Arusha City, Tanzania. *Journal of Education and Practice*, 7(3), 12-18.
- Yoong, Y.S. & Ahmad, N.A. (2018). A conceptual framework for DoCtor WoRM's Module in improving multiplication skills among year four low achievers. *International Journal of Academic Research in Business and Social Sciences*, 8(4), 946-957.
- Yoong, Y.S. & Ahmad, N.A. (2018). Needs analysis of DoCtor WoRM's Module in improving multiplication skills among year four low achievers. *International Journal of Academic Research in Business and Social Sciences*, 8(5), 931-944.
- Yoong, S.M. & Ahmad, N.A. (2019). Development and evaluation of DoCtor WoRM's Module in improving multiplication skills among year four low achievers. *SageSubmissions*. Preprint. <https://doi.org/10.31124/advance.7609058.v1>.
- Yoong, S.M. & Ahmad, N.A. (2020). A conceptual framework to design and develop Dyscalculia Checklist Instrument for dyscalculic pupils. *Solid State Technology*, 63(1s), 495-501.
- Yunus, H. & Ahmad, N.A. (2019). A conceptual framework for META ProBaca Module in improving reading comprehension and reading fluency among dyslexia pupils. *International Journal of Academic Research in Business & Social Sciences*, 9(11), 1187-1200.