AsTEN JOURNAL OF TEACHER EDUCATION
VOLUME 8

Effectiveness of Basic Arithmetic Skills Module among Pupils with Dyscalculia Symptoms

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ABSTRACT

Mathematics is fundamental in the educational system, yet many pupils lack the required skills in the subject. Intervention is crucial for pupils with dyscalculia symptoms. This study evaluates the effectiveness of the Basic Arithmetic Skills (BAS) Module among pupils with dyscalculia symptoms. This is a quantitative study with a quasi-experimental design. One hundred twenty pupils aged between 7 and 14 years, who exhibited dyscalculia symptoms were involved in this study. They were divided into two (2) groups: the control group with 59 pupils and the treatment group with 61 pupils. The results showed that the BAS Module significantly improved the basic arithmetic skills among pupils with dyscalculia symptoms regardless of gender and age. In conclusion, the BAS Module effectively improved the basic arithmetic skills among pupils with dyscalculia symptoms in primary schools. The study emphasizes the importance of tailored instructional materials and the role of teachers in delivering interventions that cater to pupils' different cognitive development levels. It is recommended that the BAS Module be applied to pupils with dyscalculia to improve their basic arithmetic skills, particularly in addition, subtraction, multiplication, and division.

ARTICLE INFORMATION

Article History
Received: March 7, 2024
Revised: November 6, 2024
Accepted: November 7, 2024

Editor-in-Chief
Watsatree Diteeyont, PhD

Managing Editor
Marie Paz E. Morales, PhD

Yoong, S. M., Anal, A., Ocampo, J. M., & Dela Peña, S. M. (2024). Effectiveness of Basic Arithmetic Skills Module among Pupils with Dyscalculia Symptoms. *AsTEN Journal of Teacher Education, 8*. 106-122.

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Keywords: dyscalculia, mathematics, module, quasi-experimental, specific learning disorder

Introduction

According to the Sustainable Development Goals Report 2022, too many children lack the fundamentals of numeracy and are struggling with the crisis in learning (United Nations, 2022). This shows an urgent need for policymakers, educators, and teachers to do something so that no child is left behind in the educational system, especially for atypical pupils. In 2023, there are 116,044 registered atypical pupils in the country, excluding those unregistered. Among these pupils are 17,271 who are registered in the category of specific learning disability, which includes dyslexia, dyscalculia, and dysgraphia (Ministry of Education Malaysia, 2024).

Ensuring that all pupils receive sufficient and suitable instruction, particularly those with disabilities, is a global concern. Although mathematics is fundamental in the educational system, many pupils lack the required skills in this subject. It is especially important for those who exhibit symptoms of dyscalculia. Effective teaching and learning techniques and strategies are needed to support pupils with symptoms of dyscalculia. According to Kunwar and Sharma (2020), the number of pupils with dyscalculia symptoms might be one of the causes of low proficiency in mathematics.

Focused on effective pedagogical approaches, this study implements the BAS Module to innovate existing instructional methods for pupils with dyscalculia symptoms. This study aims to evaluate the effectiveness of the BAS Module in enhancing the basic arithmetic skills of pupils who exhibit symptoms of dyscalculia. In addition to assessing overall skill development, this study explores how the module's effectiveness may vary across different genders and ages.

Literature Review

Dyscalculia is a learning disability that hinders pupils with average intelligence and age-appropriate education from acquiring math abilities (Ustun et al., 2021). It is a learning challenge that pupils encounter, such as trouble grasping or understanding fundamental addition, subtraction, multiplication, and division mathematical concepts (Pudjoatmodjo et al., 2022). Math disability, developmental dyscalculia, mathematics learning difficulties, numeracy deficit, disorder in mathematics, and specific disorder of arithmetic skills are some of the terms and criteria for dyscalculia that are used by different authorities (Yoong & Ahmad, 2020).

Previous research on dyscalculia intervention is limited, especially in Malaysia (Aquil & Ariffin, 2020). In other countries, the intervention for dyscalculia included the number line training with boardgames (Sari & Olkun, 2024), colored bead Montessori intervention (Damri et al., 2023), a process-based executive function intervention (Nazari et al., 2022), a skill-based intervention and an assistive tool named Mathelete (Ashwini, 2022; Dhingra et al., 2022). However, in Malaysia, there was one recent intervention for dyscalculia pupils, named Reconnecting Learning (Chin & Fu, 2021).

Table 1

Current Interventions for Pupils with Dyscalculia

No.	Source	Intervention	Country	Content	Methodology
1	Sari and Olkun (2024)	Number Line Training with Board Games	Turkey	Number Sense	Experimental Design
2	Damri et al. (2023)	Colored Bead Montessori	Indonesia	Numeracy Ability	Single-subject Research Approach
3	Ashwini (2022)	Skilled Intervention	India	Fraction	Experimental Design
4	Dhingra et al. (2022)	Mathelete	India	Early Numeracy	Experiment
5	Nazari et al. (2022)	Process-based Executive Function Intervention	Iran	Factual and Procedural Arithmetic Knowledge	Semi-experimental Design
6	Ziadat (2022)	Sketchnote Technique	Jordan	Word Solving Problem	Three Groups Experimental Design
7	Chin and Fu (2021)	Reconnecting Learning	Malaysia	Counting Ability	Interview, Observation
8	Devisri and Tharani (2021)	Mathematical Intervention Strategies	Chennai	Mathematical Creative Thinking Ability	Pre-experimental Design
9	Islamyati et al. (2021)	Kantong Bilangan	Indonesia	Place Value	Single Subject Research
10	Iji et al. (2020)	Cooperative Learning as an Intervention Strategy	Nigeria	Numbers and Numeration	Quasi-experimental Design
11	Kohn et al. (2020)	Computer-based Learning Program	Germany	Arithmetic Operations and Number Line Estimation	Experimental Design
12	Lu et al. (2020)	Abacus Course	China	Arithmetic Computation	Experiment

Also, there were mathematical intervention strategies identified (Devisri & Tharani, 2021) such as a Sketchnote technique (Ziadat, 2022), a teaching aid named Kantong Bilangan (Islamyati et al., 2021), an intervention strategy using cooperative learning (Iji et al., 2020), a computer-based learning program named Calcularis 2.0 (Kohn et al., 2020), and the abacus course (Lu et al., 2020). However, Malaysia has had very limited dyscalculia intervention in the past five years. In addition, there was no learning module specifically designed to improve the basic arithmetic skills among pupils with dyscalculia.

Studies show that 11.4% of primary school pupils have not mastered basic arithmetic skills (Jabeen et al., 2021). Although the four (4) fundamental arithmetic skills are the main challenges faced by pupils with dyscalculia symptoms, the existing interventions did not fill the gap to fulfill the requirements of these pupils. Most of the interventions for arithmetic only focus on addition and subtraction skills. According to Boz and Erden (2021), this is insufficient since pupils with dyscalculia symptoms frequently struggle with multiplication and division problems, where basic arithmetic skills are essential for their success in mathematics. Hence,

it is necessary to develop a module that is suitable for pupils of all ages with dyscalculia symptoms in primary schools.

Framework of the study

The study was anchored on Piaget's Cognitive Development Theory (1936), which asserts that pupils between 7 and 12 years old are in the concrete operational stage, heading towards the formal operational stage. During this stage, they learn from simple visual techniques, which are applied to various materials using dots, circles, squares, and lines.

This was substantiated in the Triple-code Model, which consists of three (3) types of codes: analog magnitude representations, visual Arabic number form, and auditory verbal word frame. Some of the elements within this model are subitizing, estimating, comparison, approximation calculation, parity, counting, addition, and so on (Dehaene, 1992).

Another underpinning framework was the Framework for Diagnosing Dyscalculia, which emphasizes that perceptions of objects and actions on objects are two main supporting parts of basic arithmetic skills. Meanwhile, elements such as simple reaction time, short-term memory, number sense, dot enumeration, number comparison, and arithmetic are also interconnected (Wong et al., 2020). The foregoing techniques were carefully designed for every lesson of the BAS Module.

Citing the errors of pupils concerning the reversibility concept to solve arithmetic problems, the learners who have dyscalculia symptoms need a much longer time to produce better academic or non-academic outcomes. They cannot easily adhere to the cognitive development pattern proposed by Piaget (Maf'ulah et al., 2016). It is therefore emphasized that fun and interesting activities, such as modules inspired by Kudus' local wisdom, can be used to cultivate the mathematical creative thinking skills of the learners stated above (Purwaningrum et al., 2021). To some extent, students who have learning deficits in numeration and numbers were recommended to use pictorial models (Tagle et al., 2016). Hence, an intervention through a module that includes all four (4) basic arithmetic skills can be introduced specifically among these pupils.

Research Questions

This study aimed to determine the effect of the BAS Module on arithmetic skills among pupils with dyscalculia symptoms. This study specifically answered the following questions: 1) Is there a significant difference between the treatment group's pre-test and post-test means?; 2) Is there a significant difference between the treatment and control groups' post-test means?; 3) Is there a significant difference between the means of improvement for male and female pupils?; and (4) Is there a significant difference between the means of improvement for pupils of different ages?

Participants

Purposive sampling was employed to select the participants. The participants of the study were selected based on the following criteria: (1) having the symptoms of dyscalculia, (2) recommended by their Mathematics teacher, (3) studying in primary school, (4) aged between 7 to 14 years old, (5) facing difficulties in basic arithmetic skills, (6) basic arithmetic skills' level was under their chronological age, and (7) these

symptoms were persistent for more than six months.

After the written informed consent of parents or guardians was obtained, 120 pupils with dyscalculia symptoms from 29 schools participated in the study. These pupils were assigned into two groups randomly: 61 pupils from 14 schools composed the Treatment group, and 59 pupils from 15 schools formed the Control group. Mathematics teachers in the treatment group were required to monitor the activities that participants had completed in the Module Checklist.

Methodology

Research Design

The study utilized a quasi-experimental design. There are several types of quasi-experiments, for example (1) pre-experimental designs, (a) one-group pre-test–post-test, (b) one-group post-tests only design, (c) non-equivalent post-test only design, (2) pre-test–post-test non-equivalent group design; and (3) one-group time series (Cohen et al., 2018). In this study, the design of pre-test–post-test with control group was applied as it is the most used quasi-experimental design in educational research.

Instruments

The following research instruments were used to gather the needed data and information relevant to the study.

Arithmetic Skills Test

The tests were developed to serve as pre-tests and post-tests. All the items in the pre-test and post-test were open-ended questions. Two types of validity of the Arithmetic Skills Test are face validity and content validity. The face validity coefficient was 0.91, whereas its content validity coefficient was 0.84.

For the pupils aged 7 to 9 years old, only two (2) skills were tested, namely addition and subtraction. The sub-skills for addition were single-digit addition, two-digit addition without regrouping, and two-digit addition with regrouping. On the other hand, the subskills for subtraction were single-digit subtraction, two-digit subtraction without regrouping, and two-digit subtraction with regrouping.

There were five (5) items for single-digit addition, five (5) items for two-digit addition without regrouping, five (5) items for two-digit addition with regrouping, five (5) items for single-digit subtraction, five (5) items for two-digit subtraction without regrouping, and five (5) items for two-digit subtraction with regrouping. Hence, the first set of tests was composed of 30 items.

On the other hand, for the pupils aged 10 years old and above, four (4) basic arithmetic skills, including addition, subtraction, multiplication, and division, were tested. In addition to the 30 items mentioned above, there were another 10 items for multiplication and 10 items for division, or an additional 20 items. Overall, there were 50 items in the test.

Test Scoring

For a two-skills test composed of 30 items, a score of two (2) was given for each item: a score of one (1) for the correct Mathematics sentence and another score of one (1) for the correct algorithm. The total score was 60, and

the formula used was score/ 60 x 100%. The scores were rounded off to the nearest percentage without decimal value. There were an additional 20 items needed to complete the four-skills test. Since a score of two (2) was given to each item with the correct Mathematics sentence and algorithm, there was a total score of 100.

Basic Arithmetic Skills (BAS) Module

This module consists of five (5) materials, which are the Teacher's Manual, the Pupil's Exercise Book, number sense interactive games, PowerPoint games, and instructional videos. Every teacher in the treatment group received a Teacher's Manual, while the pupils in this group received a Pupil's Exercise Book. Number sense interactive games were used as the activities in set inductions at the beginning of every lesson. The pupils were engaged in PowerPoint games to revise what they had learned in the lesson. In addition, instructional videos were pre-recorded so that teachers and pupils are able to watch them again for the explanation of every technique.

Face validity, content validity, and activities suitability of the BAS Module were measured based on experts' consensus (Arip, 2010). The results showed the following: the face validity coefficient was 0.87, the content validity coefficient was 0.88, and the activities suitability was 0.85. All these findings were above 0.70. Hence, the BAS Module achieved good validity. The reliability of the BAS Module was computed using the arithmetic skills test, which also acts as a pre-test and post-test in this study. Test-retest reliability was carried out using Pearson Correlation analysis, where $p<0.001$ and $r=0.602$, which showed a significant reliability.

The main skills in the lessons are addition, subtraction, multiplication, and division. At the same time, the sub-skills are single-digit addition, two-digit addition without regrouping, two-digit addition with regrouping, single-digit subtraction, two-digit subtraction without borrowing, two-digit subtraction with borrowing, single-digit multiplication, and basic division operation. Table 2 shows the topics, activities, and sub-skills in the BAS Module.

Table 2

Topics, Activities, and Sub-skills in BAS Module

Topic	Activities	Sub-skills
Addition	Dots-Cards Down Dots Speedline	Single-Digit Addition Two-Digits Addition without Regrouping Two-Digits Addition with Regrouping
Subtraction	Dots-Cards Up Dots Speedline	Single-Digit Subtraction Two-Digits Subtraction without Borrowing Two-Digits Subtraction with Borrowing
Multiplication	Dys-Cross Dys-Squares Dys-Lines	Mathematics Sentence Algorithm
Division	Dys-Cross Dys-Dots Dys-Arrays	Mathematics Sentence Algorithm

Data Gathering Procedure

The Ministry of Education Malaysia (MOE) granted the researchers formal authorization to conduct research with teachers and students in schools, and the State Education Departments (SED) subsequently approved the study. Approval of human research ethics committee from the Universiti Pendidikan Sultan Idris (UPSI) was attained. To ensure the study participants' voluntary involvement and

compliance with confidentiality requirements, the written informed consent of parents or guardians was obtained for the pupils with dyscalculia symptoms before the data collection.

Upon approval of the request, the list of materials needed for the study was immediately prepared. The process of data gathering involved three (3) stages: Pre-Experimental Stage, Experimental Stage, and Post-Experimental Stage. During the pre-experiment stage, the pupils went through a pre-test to ensure that the two (2) groups were equivalent before the intervention took place. A pre-test was administered to the pupils a week before the actual implementation of the study. This was done to identify how the pupils think before the discussion of the topics.

In the experiment stage, an intervention was carried out. The BAS Module consisted of five (5) materials: the Teacher's Manual, the Pupil's Exercise Book, number sense interactive games, PowerPoint games, and instructional videos. These five materials are complementary to each other.

After three (3) months of intervention using the BAS Module, a post-test was administered for both groups of pupils. The items in the post-test were parallel to the items in the pre-test. The items were not the same to prevent the pupils from memorizing the answers. Using parallel items would ensure that the same skills were tested for the pupils.

Data Analysis Procedure

The study utilized different statistical tools. First, the dependent t-test was utilized to determine the significant difference between the treatment group's pre-test and post-test means. Second, the independent t-test was carried out to test the treatment and control groups' post-test means. Third, the Mann-Whitney U Test was conducted to test the means of improvement for male and female pupils. Finally, the one-way ANOVA was performed to test the means of improvement for pupils of different ages (Diekhoff, 1996).

Findings and Discussions

The findings of this study were discussed in four (4) ways to determine the effectiveness of the BAS Module among pupils with dyscalculia symptoms. The four (4) aspects are (1) improvement of the treatment group, (2) effectiveness between different groups, (3) effectiveness between different genders, and (4) effectiveness between different ages.

1. Improvement of Treatment Group

It can be seen from Table 3 that the pre-test and post-test of the participants have significant differences. The significant improvement in basic arithmetic skills among pupils with dyscalculia symptoms underscores the efficacy of the BAS Module. According to Leifler (2020), teachers

Table 3

Results of the Dependent t-Test for the Comparison of the Treatment Group's Pre-test and Post-test Mean Scores

Test	N	M	SD	SEM	T	df	*p*
Pre-	61	26.69	22.513	2.575	-6.194	60	$p<0.05$
Post-	61	42.64	26.058				

need to understand pupils' specific learning needs and characteristics. This is also supported by Watkins et al. (2019), who state that teachers must implement evidence-based interventions for pupils with different learning needs. These findings show the importance of understanding their pupils' understanding, unique needs and current performance level (Marsh et al., 2021) in implementing targeted interventions tailored to the specific difficulties faced by pupils with dyscalculia.

The BAS Module included five (5) primary materials: a Pupil's Activity Book, a Teacher's Manual, PowerPoint games, number sense interactive games, and instructional videos. This aligns with Soltanlou et al. (2022), which mentioned that interventions specifically for pupils with dyscalculia are needed instead of general interventions for typical developing pupils.

The significant improvement in basic arithmetic skills among pupils with dyscalculia symptoms underscores the efficacy of the BAS Module. This is in line with Dehaene's Triple-code Model, where the improvement in post-test scores could suggest that the module helps strengthen the different representational systems in pupils with dyscalculia symptoms, who typically struggle to connect quantities with their numerical and verbal representations.

2. Effectiveness between Different Groups

Table 4 shows that the means of the post-test of the treatment and control groups of differ significantly. These results support that virtual manipulatives that are applied in this module can offer the scaffolding of pupils' learning (Bouck, Satsangi, & Park, 2018) thus underscoring the potential of tailored instructional approaches in fostering academic progress. There is a significant need for educational interventions and better teacher understanding of dyscalculia (Yoong et al., 2021). This aligns with Espina et al. (2022) that diagnosing and identifying a dyscalculia issue is useless if preventive and mitigation strategies are not implemented. Hence, the BAS Module, with its 30 lesson plans and 12 different techniques, is essential to enhance arithmetic skills for pupils with dyscalculia symptoms.

The findings suggest that appropriate interventions can significantly improve outcomes for these pupils, indicating urgent policy

Table 4

Results of the Independent t-Test for the Comparison of the Treatment and Control Groups' Post-test Mean Scores

	Levene's Test for Equality of Variances		***t*-test for Equality of Means**						
								95% Confidence Interval of the Difference	
	F	***p***	**t**	**df**	***p* (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**Lower**	**Upper**
Equal variances assumed	3.938	$p<0.05$	-3.225	118	$p<0.05$	-14.436	4.476	-23.300	-5.572

implications both locally and internationally. They emphasize the necessity of targeted interventions to ensure all pupils' academic success and promote a more inclusive learning environment worldwide.

3. Effectiveness between Different Genders

Comparing the effectiveness of the BAS Module among different genders is important. Previous research indicated that boys and girls may exhibit different learning patterns and preferences in subjects like mathematics. For instance, some studies have suggested that boys may excel in certain mathematical areas due to differences in spatial reasoning, while girls may perform better in verbal problem-solving tasks. Investigating gender differences helps educators understand if these patterns hold true for all interventions or if certain modules favor one gender over the other.

Table 5

Results of the Mann-Whitney U Test Ranks for Effectiveness of BAS Module based on Gender

Gender	N	Mean Rank	Sum of Ranks
Male	40	30.38	1215.00
Female	21	32.19	676.00
Total	61		

A Mann-Whitney U Test was conducted to compare the effectiveness of the BAS Module between genders. There were 40 male (65.6 %), and 21 female (34.4 %) pupils tested to check if there would be a difference in mathematical skills between genders. Table 5 shows the Mann-Whitney U Test ranks for the effectiveness of the BAS Module based on gender. Based on this finding, the effectiveness of the BAS Module does not differ significantly across pupils of different genders. The results demonstrate that teacher researchers should be alert to gender differences in school-related mathematical skills (Rasanen et al., 2021).

In this study, the BAS Module effectively enhances basic arithmetic skills in primary school pupils who exhibit symptoms of dyscalculia. Moreover, there is no significant difference in the BAS Module's efficacy according to gender. Wong's Framework for Diagnosing Dyscalculia supports the use of the BAS Module, which caters to individual learning difficulties rather than gender demographic factors. The findings suggest that gender alone may not be a determining factor in the efficacy of the BAS Module for basic arithmetic skills. Instead, educators should focus on a broader range of factors and continue to develop universally effective interventions, ensuring that all students, regardless of gender, can improve their skills and excel academically.

4. Effectiveness between Different Ages

Comparing the effectiveness of the BAS Module between different ages is important as children at different ages are at varying developmental stages, both cognitively and emotionally. Investigating age differences helps researchers identify if the BAS Module worked significantly better for certain age groups. To find out if pupils with dyscalculia symptoms of different ages improved at a significantly different rate, a one-way ANOVA was performed.

Table 6 indicates that there is no statistically significant difference in post-test scores between different age groups. Both the variability within groups and between groups are considered, and the results suggest that the BAS Module does not have a significantly different effectiveness on the age among pupils

Table 6

Results of the One-way ANOVA for Post-test in Treatment Group According to Ages

	Sum of Squares	*df*	Mean Square	F	*p*
Within Groups	38456.342	55	699.206		
Between Groups	2283.724	5	456.745	.653	$p>.05$
Total	40740.066	60			

with dyscalculia symptoms. This result shows that virtual manipulatives allow pupils to engage with two-dimensional representations of concrete objects in a digital format, which helps them understand and apply mathematical concepts (Satsangi et al., 2018). In other words, all the pupils with dyscalculia symptoms in primary schools, regardless of age, improved after utilizing the BAS Module.

The result aligns with the study that mentioned teachers should utilize explicit instruction, guide pupils through various steps, and provide repeated practice for the pupils' age-appropriate support (Bouck, Working, & Bone, 2018; Bouck et al., 2020). Pupils with dyscalculia often struggle with poor number sense, impacting their arithmetic learning (Yoong et al., 2022), and leading to feelings of depression and social difficulties (Diswantika et al., 2019). The BAS Module positively affects these pupils' mathematical abilities, which is important because age-appropriate interventions support numerical skills and positively impact their social and emotional well-being (Vigna et al., 2022).

This study underscores the necessity of recognizing the varied cognitive development levels among pupils with dyscalculia symptoms. Despite having lower cognitive development levels in mathematical skills than their peers, these pupils should not be neglected. Mammarella et al. (2021) highlighted that cognitive levels in dyscalculia can vary due to factors like age, comorbidity, and severity of learning difficulty. Therefore, educational strategies should include engaging activities such as interactive games to maintain the pupils' interest and participation in learning.

In short, the findings suggest that the module is designed to address the needs of the different ages in primary schools. This highlights the importance of designing interventions that can be applied across different ages without the need for extensive modification. An intervention like the BAS Module, which uses tools such as games, virtual manipulatives and systematic guidance, can offer a flexible solution for teachers working with pupils of different ages. Future interventions could build on this age-inclusive approach. Moreover, continued exploration of individual differences and external factors could further improve the efficacy of such interventions.

Implications

Pupils with dyscalculia symptoms performed better when their teaching and learning processes were planned systematically. Educational strategies should include engaging activities such as interactive games to maintain the pupils'

interest and participation in learning. Most pupils with dyscalculia symptoms remain undiagnosed, often negatively labelled as stupid or lazy. This issue happened due to the lack of standardized instruments and critical data on dyscalculia. Appropriate interventions can significantly improve outcomes for these pupils, indicating urgent policy implications, both locally and internationally.

Efforts for policy changes to support pupils with special educational needs contribute to the global discourse on inclusive education, emphasizing the necessity of targeted interventions to ensure all pupils' academic success and promote a more inclusive learning environment worldwide. A deeper understanding of the underlying mechanisms of arithmetic learning difficulties and the factors that influence their interventions are important in promoting a reevaluation of existing theoretical models in dyscalculia research.

This study implies that a broader range of approaches in dyscalculia research beyond psychological and neurocognitive focuses is necessary. The BAS Module, with its thirty lesson plans and twelve different techniques, could be integrated into classroom technologies and create digital versions that are easy for teachers to implement. The training materials for teachers and funds for resources should be outlined. The BAS Module could be integrated into existing curricula as part of remedial math lessons, special education programs, or supplemental materials.

Conclusion

Based on the findings, it is evident that the implementation of the BAS Module resulted in significant improvements in basic arithmetic skills among the pupils. This study revealed that age and gender did not significantly impact the degree of improvement, indicating that the BAS Module may be equally beneficial across different age groups and genders. These findings hold significant implications for educators, policymakers, and researchers, highlighting the importance of the potential universality of effective instructional approaches in supporting pupils with dyscalculia.

The lack of significant age and gender differences in the observed improvement challenges conventional assumptions about the differential impact of interventions based on demographic characteristics. Pupils with dyscalculia symptoms remain undiagnosed and are often negatively labelled as stupid or lazy. This happens due to the lack of standardized instruments and critical data on dyscalculia. More advocacy for policy accommodations is imperative to support pupils with special educational needs.

These findings contribute to the theoretical understanding of dyscalculia by challenging assumptions about the differential impact of interventions based on age and gender. From the perspective of Piaget's theory, the BAS Module appears to provide learning experiences that effectively support cognitive development at the concrete operational stage. Dehaene's Triple-code Model also finds relevance in explaining how the module likely engages various numerical processing systems, enabling pupils with dyscalculia to overcome their difficulties. Wong's Framework further supports the BAS Module's targeted approach to address specific symptoms of dyscalculia, suggesting that effective intervention depends on tailoring strategies to pupils' learning needs rather than demographic characteristics.

The pre-test and post-test design used in the study does not measure the long-term effects of the intervention. Future research should consider longitudinal designs to assess the impact of the BAS Module on the basic arithmetic skills of pupils with dyscalculia symptoms. Additionally, qualitative research approaches, such as interviews or observations, could provide richer insights into participants' experiences with the intervention. The BAS Module could be scaled up to be implemented in broader educational contexts by integrating the module into classroom technologies and creating digital versions that are easy to implement. In short, this study makes significant contributions to both theory and practice in the field of dyscalculia interventions.

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Statements and Declarations

The authors report that there are no competing interests to declare. They give their highest gratitude to the Ministry of Education Malaysia, Sultan Idris Education University, and Philippine Normal University, the institutions where the authors are serving.

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