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MATH'S AND SPECIAL TEACHER COLLABORATION TO IMPROVE STUDENTS' MATH SKILLS USING THE SMART BALANCE BOARD

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Abstract

In recent years, there has been a significant decline in the results of diagnostic mathematics tests and exams in Latvia, which the authors attribute to a decline in pupils' attention span and critical thinking skills, especially after the COVID-19 pandemic. Many studies worldwide show the positive effects of motor coordination and balance on learning achievement, including in mathematics. The authors of this article aim to investigate how the Smart Balance Board, which provides movement coordination and balance engagement, affects mathematics achievement in ages 9-10. The authors suggest that collaboration between a mathematics teacher and a special educator can be a successful tool for the development of students' mathematical skills by designing integrated tasks according to students' age. The first results of a study in Latvia and South Africa confirm the authors' hypothesis that students aged 9-10 years, after pedagogical intervention with the Smart Balance Board, show higher levels of concentration and multiplication on repeated tests. The methodology used in the study was- the multiplication test, Wechsler's attention subtest - Encryption. Pedagogical intervention - balance board with integrated multiplication tasks.

Keywords: *Mathematic skills, attention, motor coordination, balance, learning success.*

1. Introduction

As central exam statistics show, in recent years, there has been a significant decline in the results of diagnostic mathematics tests and exams in Latvia (VISC, 2022).

Based on professional observation in daily schoolwork with children and based on literature, the authors of this study attribute the decline in mathematical skills to a weakening of attention, working memory and critical thinking. The biggest problem, because people's attention becomes shorter, is switching attention from one digital application to another at one time. That makes people's attention and perception shorter. (Mark, 2023). As it is possible to read articles, attention and working memory are important to calculate, read and understand the topic, as well as to memorize the topic (Swanson, 2011).

In the article discussion, it is possible to verify that many studies worldwide show the positive effects of motor coordination and balance on attention, working memory, and learning achievement, including in mathematics.

Mathematical skills include verbal components, such as knowledge of numbers, counting, calculating and reasoning and non-verbal components, such as mathematical notation, reasoning in time and space and performing calculations (Spielberger, C., 2004).

In the study that was held in South Africa (Durban) and Latvia the clinical psychologist and special teacher measured multiplication skills and attention before and after pedagogical intervention with Barboleta Smart Balance Boards. The Balance Board is wooden, and the pupil can stand on and do motor coordination and balance movements, at the time doing cognitive exercise. The Smart Board is connected with an app, where teachers create educational exercises. In the study case, the Math teacher created multiplication questions for children from 9-10. During the study, children had pedagogical intervention with those tasks, and they trained in multiplication skills on Barboleta Smart Balance Board. This Study shows the effect of cooperation between special pedagogical and mathematics teachers. Special educator/clinical psychologist knows the importance of movement in the learning process and in math the teacher is aware of the need to multiply skills.

2. Design, objectives and methods

The article presents a quantitative design study to find real and useful solutions and effective tools to address contemporary students' learning difficulties, such as attention, motivation, engagement, and declining math and reading achievement.

Baiba Blomniece-Jurāne has developed a Barboleta Smart Balance Board based on scientific findings on the impact of movement coordination and balance on learning achievements. The Smart Balance Boards are integrated with app and learning tasks. The study plan is that pupils aged 9-10 in both South Africa and Latvia complete control tests in multiplication and attention. After a five-day intervention from 2-5 minutes for each child, the multiplication and attention achievements of these pupils are measured again**.** It is important to mention that in South Africa the intervention was held after a one-, two- or three-day break (Table 1).

In South Africa, the measurements are made on 2023 October. In Latvia, measurements will be done in January. Therefore, the comparison and full discussion of the study will be done in February. Till January the article will show results from South Africa.

The methodology used in the study was - the multiplication test, Wechsler's attention subtest - Encryption. Pedagogical intervention - balance board with integrated multiplication tasks. To compare results, the authors will use mathematical statistics.

3. Results

The results in South Africa study show that 50% of children improved their skills less than 20% and 50% of children improved more than 20%.

Table 1. Pedagogical intervention -Kloof Senior Primary School.

Date	11.10.	12.10.	13.10.			16.10.			19.10.	20.10.	20.10.
Activity	Test, Balance	Training 5 min	Training 5 min	Free day	Free day	Training 3 min	Free day	Free day	Training 3 min	Training 2 min	Test

Table 2. The results of Multiplication in South Africa – Kloof Primary School.

Students	**Points. 1st**	**%**	**Points. 2nd**	**%**	**%**
SA13	5	33,33333	4	26,66667	-6,66667
SA08	3	20	2	13,33333	-6,66667
SA01	4	26,66667	4	26,66667	0
SA10	1	6,666667	1	6,666667	0
SA02	1	6,666667	2	13,33333	6,666667
SA03	1	6,666667	2	13,33333	6,666667
SA07	2	13,33333	4	26,66667	13,33333
SA04	6	40	9	60	20
SA05	1	6,666667	4	26,66667	20
SA14	1	6,666667	4	26,66667	20
SA09	3	20	7	46,66667	26,66667
SA11	4	26,66667	8	53,33333	26,66667
SA06	1	6,666667	6	40	33,33333
SA12	4	26,66667	12	80	53,33333
SA15	6	40	15	100	60

It is necessary to collect the results of attention tests. The full version of the paper also requires measurements and an intervention in Latvia, a description of the results of the mindfulness tests will be produced in February.

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4. Discussion

To analyse the results, it is important to base the discussion on the literature. In 2018 review "Physical Activity and Cognitive Functioning of Children: A Systematic Review" was published and it summarizes the results of different studies on physical activity and cognitive skills. According to the review, the ability to focus attention is improved among children who participate in physical activities, children aged 13–14 years positively affect their ability to focus attention on a given task (Bidzan-Bluma, & Lipowska, 2018) – not in the reference list. Sterr in the article "Attention performance in young adults with learning disabilities" stresses out that attention is essential for cognitive performance, memory, and learning behaviour so that even slight deficiencies in attention can impair learning (Sterr, 2004). These findings are important as we know the connection between attention and performance in mathematical skills, as we mentioned before.

Kashfi, Sohrabi, Kakhki, Mashhadi and Nooghabi, (2019) showed that coordinative exercises versus nonspecific physical education lessons had more effect on the performance of concentration and attention tasks. The type of motor coordination exercises is also important. For example, bilateral movement activities can help develop motor control and coordination. If a child does not master bilateral movements, his or her learning and cognitive development can be negatively affected due to the lack of neural stimulation that promotes brain organization. Cross-lateral movement activities include the movement of the opposite hand and foot simultaneously, also activating complex integrated movement between the two sides of the brain. We have to line that Barboleta Smart Balance Boards are created in a way that children can do bilateral movement, control body balance and motor coordination.

In the 2018 study "The Mediating Role of Cognitive Ability on the Relationship between Motor Proficiency and Early Academic Achievement in Children" was carried out and in conclusions, authors highlight that their study confirms the idea that a child's motor skills are among the necessary abilities for academic achievement and must receive complete attention from educators and teachers during the early school years. By influencing positively cognitive functions such as working memory and reasoning processes, motor proficiency contributed to math and reading performance. Sufficient effort must be made to support children in their motor development in first grade but also before their formal school entry. For instance, children who are less prepared or who have motor difficulties in kindergarten must be supported to develop their motor proficiency in order to be prepared for the first-grade transition (Cadoret et.al., 2018).

Created tool in the cooperation between special educator/psychologist and math teacher is an option to use effective and innovative pedagogical intervention which is based on movement and motor coordination.

5. Conclusion

Results show that children improved their multiplication skills. It is necessary to finish the study and complete the conclusion. This study has an important role in finding if teachers can find a tool to help children reach higher learning results in math. As we have noticed till now, the results from South Africa let us think that it could be possible. It is necessary to continue with more studies.

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