

Effect of Motor Activity on the Sustained Attention and the Pleasure of Learning in Math Class: Case of 6 - 7 Aged Tunisians Pupils

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Abstract

The objective of this work was to examine the effect of motor activity on sustained attention and the pleasure of learning in math class among Grade 1 students. It is an experimental study comparing two methods of learning in mathematics class. Two groups of 44 students participated in this study, one experimental group (N = 22) participated in motor-activity-based math sessions, and one control group (N = 22) participated in conventional teaching sessions. This experience demonstrated that students found more enjoyment after the movement activity sessions and showed an improvement in sustained attention among the experimental group. These results also highlight the value in actively involving the student in the task and the importance of using active methods in the teaching-learning process.

Keywords

Motor Activity, Transfer, Learning

1. Introduction

Robert Rigal (2009) and Le Boulch (1971) note that motor education is an integral part of physical education and represents the branch at the primary level. It has an impact on the different dimensions of the child's personality: the cognitive dimension, the social and relational dimension, the affective dimension, and finally the expressive and creative dimension. It also has a positive influence on learning at school. It is therefore important to use it in other disciplines, which implies the notion of interdisciplinarity. In this context, Allieu-Mary (1998) argues that the concept of interdisciplinarity is taken as an interaction between two or more academic disciplines ranging from the communication of ideas to

the integration of concepts or methods.

In addition, the pleasure and attention of the student are related to physical and sports education and they are the main elements of learning. [Lobor \(1996\)](#) states that “pleasure is not only an ingredient of learning, but it’s a driving force, without which it is impossible to learn”. For example, according to [Cortadellas and Vallet \(2009\)](#), “attention is a prerequisite for any other cognitive function, including learning”. The child keeps his attention supported in a task when he is moving. Several studies imply that movement activity facilitates learning and is a means of optimizing the student’s attention. In any teaching-learning situation, for the teacher’s message to get through, the child must be attentive and his or her attention sustained. Among the factors that arouse the learner’s interest and support his or her attention, there is one that is particularly powerful, and that is to be an active element in the intended pedagogical scenario” ([Paoletti, 1999](#)).

1.1. Relationship between Motor Development and Cognitive Development of the Child

In psychology, it is shown that learning period in children aged 6 to 12 is the longest time in childhood when the child will be able to learn and develop in primary school. The child’s development is broken down into three or four major areas: motor development, cognitive development, and finally, emotional and social development even if it is very artificial and questionable because every individual can only conceive of himself as a whole. In the school context, several studies assert that the development of the child’s motor skills will have an impact on the development of his other affective abilities through the autonomy that the control of his motor skills confers, by exploring and adapting to the environment that his motor skills allow, and by playing with his peers and friends ([Haywood & Getchell, 2001](#)). Indeed, several components of this development (body schema, spatial and temporal structuring, etc.) are even considered as important prerequisites for school learning ([De Lièvre & Staes, 2000](#); [Lauzon, 1990](#); [Rigal, 1996](#)). In this sense, [Grissmer, Grimm, Steele, Aiyer, and Murrah \(2010\)](#) and [Diamond’s \(2000\)](#) neuroimaging studies suggest that cortical areas (cerebellum, NGC) associated with motor learning and those associated with cognitive activities (prefrontal cortex) are co-active in some motor and cognitive tasks. On the one hand, several cognitive activities use control and modulation functions that are found in the cerebellum and the central grey nuclei (NGC) that develop during the acquisition of basic motor skills. On the other hand, the neural structures that are set up during motor development, between the prefrontal cortex and the motor areas, are also used in cognitive learning. Furthermore, in cognitive psychology, [Pailhous and Bonnard \(1989\)](#) set out three reasons for the links between cognitive research and motor skills: The first is related to the fact that movement itself can be the object of cognitive processes, and the second is that, for a number of authors, motor skills appear to be the source of ideas ([Piaget, 1947](#)), or through its role in socialization processes, of personality ([Wallon, 1959](#)). And the third, finally, stems from the fact that the integrated

motor performance is the place of integration of the processes that ensure its organization and control

1.2. Attention

1.2.1. An Essential Link in Learning

In schools, many activities are directly related to the attentional process (Grabe, 1986). Also, Boujon and Quaireau (1997) show that students' success is influenced by their level of attention. Attention is therefore a prerequisite for any other cognitive function and especially for learning" (Cortadellas & Vallet, 2009). In addition, it plays the role of a cognitive function that intervenes at different levels of information processing. It also provides a supervisory function at the executive level. Indeed, it participates in the execution of a task or an act through the implementation, the continuation, the cessation, or the passage from one activity to another. In this context, LAPP. D (2006) indicates that attention is one of the links in the chain that belongs to the memory mechanism necessary for learning and if there is a break between these different links, there is forgetfulness and consequently lack of learning:

Motivation => Attention => Concentration => Organization => Learning. In this chain, all the links are intrinsically linked to each other. In summary, without attention, there can be no learning (Simon, 1986).

1.2.2. The Link between Attention and Motor Activity

It seems important that teachers know the most effective ways to capture or re-focus the attention of their students. Indeed, according to (Houart & Romainville, 1998), "Every teacher knows that capturing students' attention is the gateway to learning and that it is sometimes the hardest to get through". In addition, Paoletti (1999) states that among the many possible learning situations that keep the student's attention, there are those that rely on the learner's movement activity. Active participation for the student in any situation is undoubtedly physical and motor participation. Thus, as Humphrey (1985) points out, the attraction to action can be explained by a variety of reasons: the child enjoys movement, movement and manipulation, and invests all his or her attention in action. In the school context, when the child moves their body and limbs in a learning activity, this contributes to the improvement of his attention during the task as well as the establishment of learning situations based on motor experimentation does not eliminate the benefits of taking auditory and visual information, but on the contrary it strengthens them by adding proprioceptive sensory information, stimulated by movement (Crattyb, 1972).

1.3. The Pleasure in Learning

The notion of the pleasure of teaching and the pleasure of learning has diminished at school. Teachers are more interested in the learning side and have neglected the emotional side of the learner. According to Dania Ramirez (1998), the notion of learning is approached from the cognitive angle, leaving aside the

emotional aspect and the pleasure of learning. Yet emotions are at the heart of learning. Lobor (1996) states that, “pleasure is not only an ingredient of learning, but its engine, the element without which it is impossible to learn”. “Pleasure” is closely linked to increased self-esteem (Coleman & Iso-Ahola, 1993; Fox & Corbin, 1989). It is also considered as a learning medium that allows the child to identify the presence of a new element, and it plays the role of an indicator. In addition, several empirical studies have also shown that emotions can influence the learning process and that certain emotions can promote learning success.

2. Experimental Protocol

2.1. Participants

Forty four students had voluntarily participated in this study. They are schooled in two mixed classes of first year of primary school each one containing twenty two student. The classes belong to the same public school and with two different teachers. But we chose two teachers with the same basic training and with the same number of years’ experience. To this end, we arrange to work with an experimental group and a control group. The average age of the participants is 6.3 years. These children attend a public primary school. Their middle parent socio-cultural level is defined by the father’s job. All these participants are considered normal and well-adjusted to schooling. They are all in the classes corresponding to their chronological age and are average students for all school subjects. Their parents were informed and give their agreement signature about the participation of their children in the experiment research and they have the opportunity at any time to withdraw their children from it. The results of this research guarantee anonymity and confidentiality and the parents may be aware of their children’s skills assessment.

2.2. Procedure

This study is therefore divided into three parts. First, we conducted a pre-test on two groups of children (1 year of primary school) to verify the homogeneity of the sample and two tests to assess their sustained attention and the level of pleasure in the lessons. Secondly, and for 12 weeks, with four sessions of 50 minutes/week, we submitted on one hand the experimental group learning with a program based on the game, and on the other, the control group with a conventional learning. The third and final section is devoted to a re-test evaluating the sustained attention of the two groups of students.

To assess the sustained attention of the students, we used the test of the two Zazzo dams (1972). Thus the goal of sustained attention, for the subject is to sustain attention for a relatively long time allowing it to spot target information that is clear and simple in the middle of other signs likely to lead to errors by omission or substitution. The test consisted in identifying a particular sign (a small square with a slash down to 45° on the right), and crossing out as much as possible in a limited time (10 min), working line by line, from left to right, leav-

ing aside all the other signs whose orientation of the bar is different Zazzo (1972). On each sheet of paper are 1000 signs represented and divided into 40 lines and 25 columns. Two types of errors can be identified: either the participant bars a sign that is not identical to those displayed on the board (additions: A) or he forgets to bar (omissions: Om). The number of signs to cross out is 83. The results of the Zazzo tests were analyzed based on the techniques of computation and reading as described in the Manual for the Psychological Examination of the Child.

- The inaccuracy in crossing out a sign = $(Om + A) / (\text{number of signs to crossing out} + A)$.
- The speed of crossing out a sign. That is to say, the number of signs considered at the minute = $\text{number of signs considered} \times 60 / \text{time (seconds)}$.
- The performance of crossing out a sign = $\text{the number of signs crossed out correctly in 10 min. Performance} = (\text{number of signs found} \times 10) / \text{time (minutes)}$.

Activity enjoyment. Pupil's enjoyment of the learning activity was measured using the Feeling Scale test (Hardy & Rejeski, 1989). The Feeling Scale (FS) is an 11-point bipolar scale ranging from +5 to -5, commonly used to measure affective response (pleasure/displeasure) during exercise. This scale presents the following verbal anchors: -5 = very bad; -3 = bad; -1 = fairly bad; 0 = neutral; +1 fairly good; +3 = good; and +5 = very good. Previous studies recommended this scale to measure affective responses during exercise.

2.3. Data Analysis

For each measurements taken before and after training, ANOVA was performed with the factor "type of learning" (motor activity learning and traditional learning) as a variable factor inter and "period" (pre-test and post-test) as a variable intra. The factorial model was 2×2 (2 groups \times 2 measurements). Post-hoc comparisons were made with the Sidak test and the level of significance was set at $\alpha = 0.05$.

3. Results

At the beginning, before the experiment, the two groups were homogeneous for all parameters (no significant difference between them before the new learning method). Afterward, the experimental group showed significant differences between the before and after training for all tested parameters, which led that significant differences were recorded between the control group and the experimental group at the after. It's obvious that the progress ($\Delta = \text{before} - \text{after}$) recorded by the experimental group is significantly different from the control group at all settings. All the used data in this test assessment are obtained from the analysis of the answers of all the participants.

3.1. Effect of Motor Activity on Sustained Attention

The appreciation of attention allows evaluating three variables: the perceptual

speed of barrage, the degree of inaccuracy and the performance.

3.1.1. Influence of Motor Activity on Degree of Inaccuracy

The variance analysis revealed a very significant difference in degrees of inaccuracy between the two groups. A decrease in degrees of error between the test and retest was observed in G.E and an increase in G.C (Figure 1).

3.1.2. Influence of Motor Activity on Performance

Analysis of the variance revealed a very significant difference in the performance of the Zazzo bar signs between the two groups. A decrease in performance was observed in G.C between the test and retest at the beginning and end of the experiment (Figure 2).

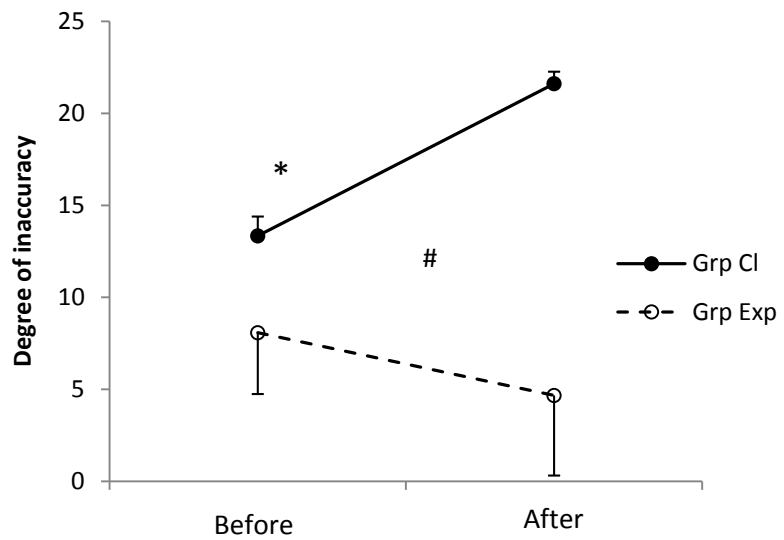


Figure 1. Influence of motor activity on degree of inaccuracy. *Significantly different from the previous lesson at $p < 0.01$; #Significant difference between the two groups at $p < 0.05$.

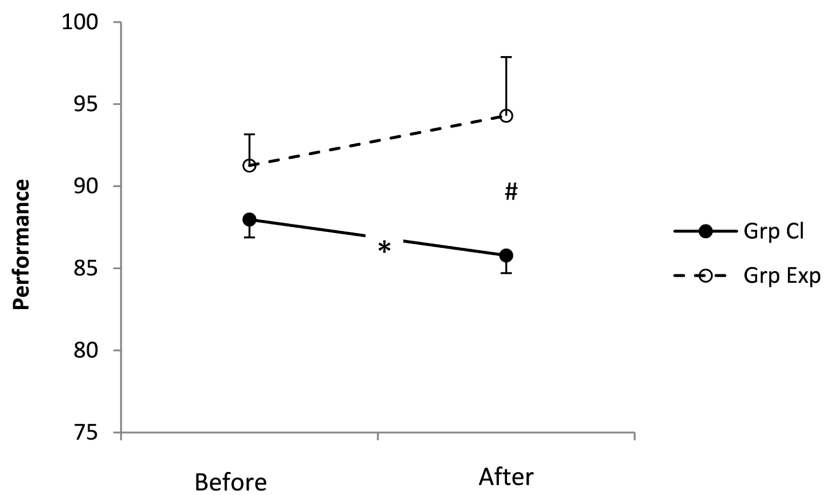


Figure 2. Influence of motor activity on performance. *Significantly different from the previous lesson at $p < 0.01$; #Significant difference between the two groups at $p < 0.05$.

3.1.3. Influence of Motor Activity on the Speed of Barrage

With regard to the barrage speed, ANOVA showed no significant difference between the two groups (**Figure 3**).

3.2. The Effect of Motor Activity on Pleasure

The variance analysis showed a very significant difference in the sense of pleasure between the two groups. In fact, the FS score was much higher after the motor activities than after the classic session. An improvement in intragroup and intergroup is observed compared to each session for the students of G.E. On the other hand, a decrease in sensation is noted in the other group of students because of the aging of traditional learning.

4. Discussion

4.1. Effect of Motor Activity on Sustained Attention

When analysing the results obtained from the effect of the pedagogical support based on motor activity on the sustained attention of the pupils, we find a difference between the same group (test-retest) and between the two groups in the degree of inaccuracy. This means that there is a decrease in the degree of error for the experimental group but an increase in the number of errors for the students in the other group. Also, the performance check shows that the result is significantly different from the previous lesson and between the two groups. But, regarding the Zazzo barrage speed of the two signs, the results show no significant difference. Indeed, it is the rate of inaccuracy that determines sustained attention, the lower it is, the better the sustained attention is described. We therefore check the hypothesis that a motor activity session in mathematics results in more sustained attention in students than a classical class session. This is true for all profiles, that is, students have good, medium or low sustained attention. This is consistent with [Viau's \(1996\)](#) theory that in sessions where students are active

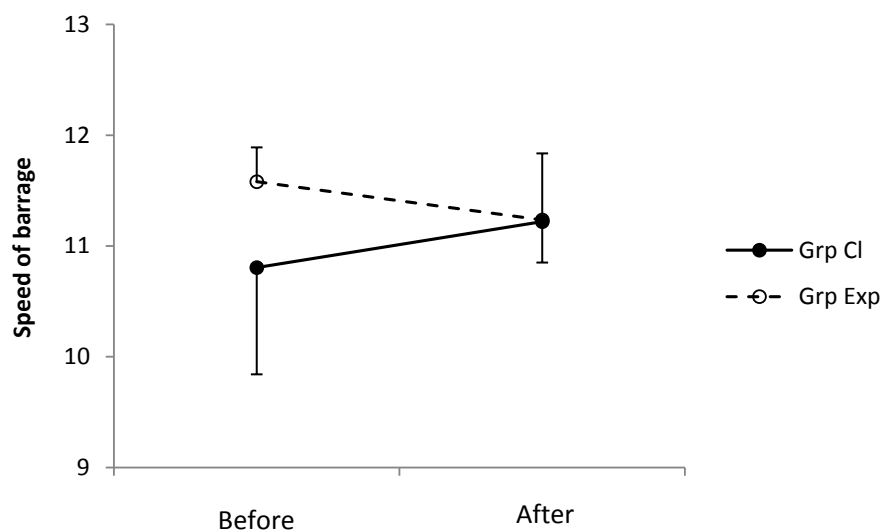


Figure 3. Influence of motor activity on the speed of barrage.

and motivated, this motivation leads to increased sustained attention. By way of conclusion, it can be said that during this type of session, endogenous attention is favored because students voluntarily direct their attention to the relevant sources of information according to their motivation. As they are more motivated, self-determined motivation is better, which promotes sustained attention of students (Guerrien & Mansy-Daunnay, 2003).

4.2. The Influence of Motor Activity on Pleasure

Concerning the test of pleasure that we did, the results show a significant difference of the first session in the same group and between the two groups. On the one hand, there is an improvement in the feeling of pleasure in the students in the experimental group thanks to motor activities. On the other hand, there is a decrease in the sense of pleasure in learning among students in the other group resulting in the aging of learning. Nevertheless, the new strategy for primary school includes “fun” in its title, placing it on an equal footing with the other goal “excellence”. Despite this shift in official discourse towards outcome requirements, the notion of “pleasure” remains more important than in the formal theoretical framework. Several studies state that the notion of pleasure is related to the motivational aspect of the student, movement and body. Thus, we can understand that motivating the student involves the teacher in a double task. Indeed, the first is to understand what motivates the student to engage in an activity and the second is to encourage and maintain the desire to learn. As noted by Girault (2007), fun will provide the necessary motivation for the child to take action. Without it, learning will not take place, because it takes an investment by the child. “Give the child the desire to learn and any method will be good”. Emotions are a central aspect of learning. Emotional processes influence learning and have an effect on student achievement. Indeed, in the area of child development, many researchers say that it is through psychomotor experiences that children learn about the world around them (Doyon, 1992; Drouin-Couture & Gautier-Bastien, 1993; Le Boulch, 1991). Also, the theories on education of the German pedagogue Friedrich FROBEL (1782-1852) are based on a playful pedagogy. This shows that the E.P.S aims to guarantee the physical and mental development of the child and allows self-knowledge in the child and the acquisition of socially positive behaviors during the primary cycle of the student.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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