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Likert scale as a tool to assess awareness in children

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Abstract

Introduction: In the sports field, the use of proprioceptive training is an effective method in optimizing athletes' performances. For this reason, we thought also to try this method also in the field of physical education, namely in the physical education lesson in a public school. Our intention was to organize an intervention through a physical exercise program that would stimulate the proprioceptors in order to improve the sensory-motor function of children. We wanted to observe and highlight whether students can express what they feel when they do exercise. Before starting to practice, the students were instructed by the physical education teacher to focus on the signals received from the external and internal environment of the body, e.g., proprioceptive, or tactile information in the absence of visual information. **Purpose:** The purpose of this study was to highlight the level of awareness in children during physical exercise in order to evaluate and compare it with other children. **Methods:** bibliographic study; observation method; the Likert scale tool; the method of comparing the results; data collection; graphing and data analysis and interpretation. **Results:** The subjects of this research were a total of 74 students, of which 48 children from the 4th grade and 26 children from the 7th grade, enrolled in a public school in Bucharest. We created a chart, which we have distributed to the students, and measured their level of awareness immediately after they finished their exercise. **Conclusions:** There are large differences between the 4th grade and the 7th grade students in terms of the results obtained. Thus, the 4th grade children aged 10 were much more aware of what they were feeling than the 7th grade children aged 13.

Keywords: awareness, children, Likert scale, *physical education*, *proprioceptors*,

Introduction

At the level of primary education, there is a school curriculum grouped by years of study from the preparatory grade, the 1st and the 2nd grades, respectively for the 3rd and 4th grades. But what is still not understood by children, their families, as well as colleagues who teach other subjects in school, is the fact that physical education subject is not sports subject at all. Although they may have the same meaning to all non-specialists, the terms physical education, sport and physical activity are not synonymous because they do not have the same purpose or objectives. This misunderstanding of the terms could mislead students about the content of our subject, as well as what it can do for them through the multitude of specific skills that children should achieve at the end of the academic school year.

The term kinesthesia is used, according to Konczak et al. (2009), to refer to 'the conscious perception of limb and body movement' (Konczak et al., 2009) and the term proprioception is used to refer to 'the unconscious processing of proprioceptive signals used for reflexive motor and postural control, while recognizing that proprioceptive information also forms the basis of kinesthesia' (Konczak et al., 2009). According to the same author, kinesthesia is commonly defined as the conscious awareness of body or limb position and movement in space. It relies on sensory information derived from receptors in muscles, tendons, and joint capsules. These receptors provide information about muscle length, contractile speed, muscle tension, and joint position, information that is also called proprioception or muscle sense. According to Goldscheider's (1898) classic definition cited by Konczak et al. (2009), the four properties of muscle sense are (a) sense of passive movement, (b) sense of active movement, (c) sense of limb position, and (d) sense of weight (Konczak et al., 2009). Also, for all these aspects to function in optimal parameters, health and well-being is very important in the commitment to achieve important objectives in physical education class (Ardelean et al. 2022). In other words, exploring children's cognitive ability, how much they like to learn, their ability to concentrate in school, and their school skills and performance are very important as well.

It is known that, according to Aman et al. (2015) citing Sherrington (1907)[6], 'the function of proprioception has an unconscious component where the information provided by the proprioceptors is used for reflexive control of muscle tone and posture control'. To make a distinction between conscious and unconscious processing of proprioceptive information, 'it has been suggested to refer to the sense of movement as the conscious perception of the position and movement of the limbs and body, and to reserve the term proprioception to refer to the unconscious processing of proprioceptive information' (Aman et al., 2015 citing Konczak et al., 2009).

Another point of view shows that the motor behavior it is controlled by perception, in the conditions where visual perception serves the behavior (Gibson, 2015, p.213). This confirms what Nadin (1986) stated in his study of perception that indeed perception or 'analysis of sensory data' (Nadin, 2003) involves global information, while emission, as an effect of information processing in the brain, is directed, structured, essential.

According to Epuran (2011, p.75), 'the multitude and variety of exteroceptive, proprioceptive and interoceptive information are analyzed, interpreted and organized in the cerebral cortex system [...] on the basis of which responses, both stereotypical, can be generated for ordinary situations, as well as unique, creative, for new situations'.

As Ifrim & Niculescu (1988, p.147) state, ‘the nervous system transforms stimuli from the environment into either defense or adaptation movements, depending on their nature and intensity, creating engrams[7], memorizing them, and learning and their education’.

Other authors state in their books that the child's physical development depends mainly on 'hereditary baggage and environmental conditions, especially economic and social' (Gurău, 1994, p.230), so physical exercise favors an average growth and a harmonious development that they practice accordingly. Natural factors such as air, sun, and water 'strengthen the organism and increase its power of adaptation to environmental conditions and resistance to their sudden changes' (Ionescu, 1994, p.52).

[6] In 1907, Sherrington stated that Lewandowski considered the cerebellum to be the central organ of muscle sense, as well as the assumption that this organ is the main coordinating center of the proprioceptor reflex system.
[7] neural imprints from the action of stimuli

According to Aagten-Murphy et al. (2019, p.8) and Davidenko & Hopalle & Bridgeman (2018), potential mechanisms of visual perception (Brenton & Müller, 2018) are generated by eye saccades during object pursuit. The authors state that 'the perceptual system will anticipate that the visual landmark would be after the correctly executed eye movement being used to calibrate the visual space and the auditory space in the eye movements'.

The main purpose of the elaborate processing and storage of information that takes place in the brain is to enable us to interact with our environment both internally and externally. This is important, because several authors (Wagman & Blau, 2020, p.140, Hutt & Redding, 2014; Evangelos et al., 2012; Kostopoulos et al., 2012; Raibert, 1977, p.761; Wolpert & Pearson & Ghez, 2013, p.743) argue that through stimulating the function of proprioception, new information about the sensations felt by the body is transmitted to the central nervous system.

According to Gagea (1994, p.357), muscle contraction changes the initial positions of body segments, moving according to all the classical rules of levers and according to the principles of conservation of momentum, power, and energy.

Children's choices about whether and how an object is accessible, as well as what kind of motor skills should be used, e.g., whether the object is grasped with one or two hands or with sports equipment, are 'sized according to the anthropometric properties of the person' (Wagman & Blau, 2020, p.140).

In physical education lessons with physical presence at school compared to video cameras permanently closed by students in the online teaching system, a real help in increasing attention and developing motor skills in children is also the tracking and correction of exercises demonstrated by physical education teachers. A new word has been invented, *'covibesity'* (Khan & Moverley, 2020), which requires rapid, efficient, and comprehensive management involving multiple stakeholders. This phenomenon refers to the rapid weight gain that occurred in some people during the SARS-CoV-2 pandemic (Camenidis & Băițel, 2021).

What is known from the practice of teaching in students' lessons is that the motor skills of children are similar, while the level of assimilation and the peaks reached in motor learning are different among children in the same class. Through the creativity of didactic strategies, the physical education teacher tries to take into account children's reaction to effort, their motivation

level, native or acquired family habits and attitudes, so that individual motor skills are improved during school lessons.

The use of movement games by children, both during and outside of school lessons, but also during school holidays, develops their capacity for effort. Children will improve their skills and motor skills during the game. Mentally, they will develop a robust, balanced, mobile nervous system, outstanding ability to focus attention and resistance to stress and mental fatigue, operative, concrete thinking, as well as good visual-motor coordination, speed, and efficiency in the analysis of unforeseen situations and in decision-making, anticipatory spirit (Camenidis et al., 2020). Also, all these factors of child development (physical, technical, tactical, theoretical) could also have an appreciable psychological load because any intervention on the motor skills development is aimed at the person and leads to its improvement.

Materials & Methods

The hypothesis of the research was the following: there are differences in kinesthesia between the ages of 10 and 13 when we apply a program to develop the sense of movement by stimulating proprioceptors.

The main research methods used were the following: bibliographic study; measurement on the Likert scale; the method of comparing the results; data collection; graphic representation; method of data analysis and interpretation.

A total of 74 subjects (N=74 students, 48 children from the 4^{th} grade and 26 children from the 7^{th} grade) were included in this study.

The children followed an exercise program with their eyes closed, and after completing it, the students opened their eyes, took one blank model each (fig.1.1) and colored one arc of a circle corresponding to the level of individual awareness of what they felt.

To measure the level of awareness, we applied an evaluation tool, namely the Likert scale[8] for validating the answers given by the children, as follows: 1 = not at all; 2 = little; 3 = moderate; 4 = a lot; 5 = very much (Vrasti, 2018, p.18).

We explained 8 exercises to the children, and where they did not understand what they had to do, we offered the following explanations:

- *Exercise no. 1*: Recognize and name what you feel. *For example:* You have done this exercise before with your eyes open. Do you recognize it now when you work with your eyes closed? Can you say what you feel now that you've practiced with your eyes closed?
- *Exercise no. 2:* How do you feel the effect of the exercise in your body. *For example:* when we are afraid that the other children around us will laugh at us or even at ourselves, we may not want to do the exercise anymore. Or we work without feeling like it/we don't pay attention/we don't hear what we need to practice. Or if we don't care what those around us say, then we may be impatient to practice/pay attention.
- *Exercise no. 3:* The influence of the effect on individual practice. *For example:* Do you feel more confident after completing the exercise than at the beginning? Notice how the effect of the exercise influences your motor behavior. How does your motor behavior affect your current state?
- *Exercise no. 4:* What do you think about when you practice. *For example:* Words or sentences (positive/negative) such as: I can't do that; I will never succeed; I'm not good; I'm weak or the opposite.
- *Exercise no. 5:* The cause of this state/sensation come from inside or outside of you or both. *For example:* Is a child laughing at you, telling you that you won't make it (external cause) or having an internal dialogue (talking to yourself – internal cause)? Or there's noise around you and you can't focus. Or it's quiet and you feel safe.
- *Exercise no. 6:* I accept what I feel when I practice. *For example:* Try to tell yourself what you feel even if the movement is not correct, without arguing/judging yourself or the other children around you.

[8] Rensis Likert created the method in 1932 as a personal contribution to his doctoral thesis to identify by scaling the extent of a person's attitudes and feelings towards international affairs. The Likert scale is used in surveying, with applications in business-related fields such as marketing or customer satisfaction, social sciences, and attitudinal research projects (https://en.wikipedia.org/wiki/Rensis_Likert)

➢ *Exercise no. 7:* Be present in your exercise. *For example:* I understand what I have to do, I learned how I feel, to say what I feel, what thoughts I have, I learned to identify the cause of my thoughts. What can you do next? Replace negative words with positive ones, both about yourself and others. Pay attention to your motor behavior when you practice.

➢ *Exercise no. 8:* Be active and aware of what you are doing. *For example:* You can also decide how to approach this physical exercise in a personal practice. Choose to participate in the lesson instead of staying away.

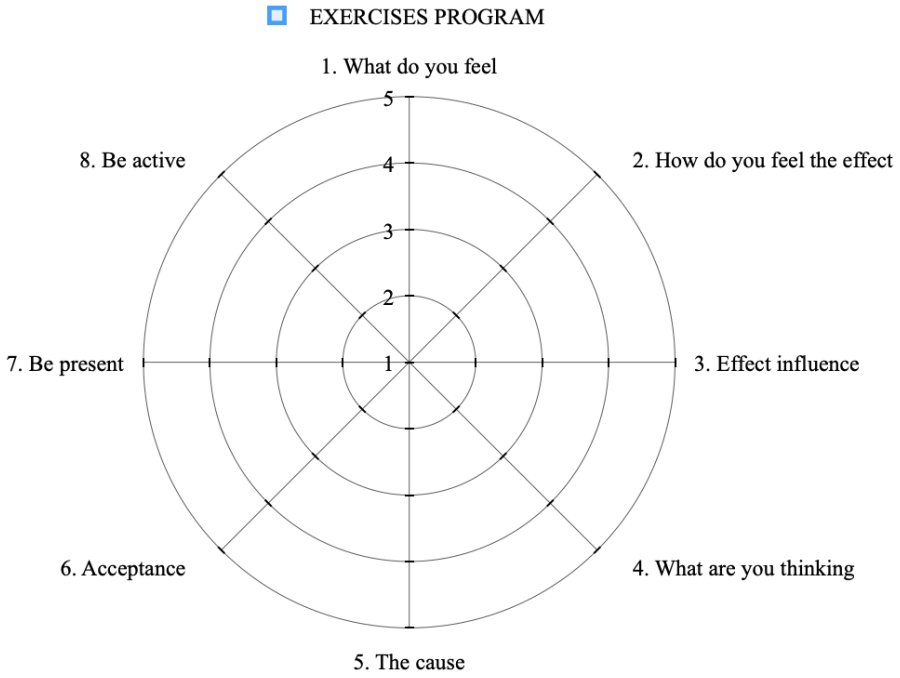

Fig. 1.1. Awareness assessment

(Source: figure arising from the original research activity)

Results

The obtained values are presented in the following tables:

Table 1.1. Awareness exercise program data from 4th grade

(Source: original data resulting from research activity*)*

No.	Item	Not at all	Little	Moderate	A lot	Very much	n	Mean	Standard deviation	C.V. %
1	What do you feel		5	7	15	21	48	12	7,39	61,61
2	How do you feel the effect	2	7	6	11	22	48	9,6	7,64	79,54
3	Effect influence	3	5	10	13	17	48	9,6	5,73	59,66
4	What are you thinking	3	6	6	14	19	48	9,6	6,66	69,33
5	The cause	2	8	5	10	23	48	9,6	8,08	84,18
6	Acceptance	1		3	13	31	48	12	13,71	114,26
7	Be present		1	2	12	33	48	12	14,85	123,79
8	Be active		2	8	16	22	48	12	8,79	73,28

Table 1.2. Awareness exercise program data from 7th grade

(Source: original data resulting from research activity*)*

No.	Item	Not at all	Little	Moderate	A lot	Very much	n	Mean	Standard deviation	C.V. %
1	What do you feel		5	14	5	2	26	6,5	5,20	79,94
2	How do you feel the effect		7	4	13	2	26	6,5	4,80	73,78
3	Effect influence		6	8	7	5	26	6,5	1,29	19,86
4	What are you thinking		8	5	7	6	26	6,5	1,29	19,86
5	The cause		5	10	7	4	26	6,5	2,65	40,70
6	Acceptance		3	8	5	10	26	6,5	3,11	47,83
7	Be present	1	1	6	9	9	26	5,2	4,02	77,40
8	Be active		2	7	9	8	26	6,5	3,11	47,83

Our intention in carrying out an exercise program was to organize an intervention aimed at stimulating proprioceptors. This intervention focused on using signals received from the external and internal environment, such as proprioceptive or tactile information in the absence of visual information to improve sensorimotor function in primary school children.

This led us to turn our attention, and scientifically discover, to what children feel when they exercise.

We wanted to analyze a comparison between the level of awareness of 4th grade vs. 7th grade children.

At the beginning, physical exercises were practiced with eyes open to familiarize with information from the external environment, e.g., demonstration of exercises by the teacher,

structure of sports materials, space-time dimensions, safety of space, distance between colleagues, then with eyes closed.

Discussions

The results obtained from the tests are presented in graphical form in Fig. 1.2. and Fig. 1.3.

Before completing the radar chart, all children completed the same exercise program. The results of the data processing that we obtained, we presented in the form of tables and statistical graphs with the aim of highlighting scientific differences between the variables of the children of the 4th grade and those of the 7th grade.

We have chosen to gather the data obtained as follows:

- in the first column, we have written the names of the 8 exercises (items).
- in the following 5 columns we have centralized the frequencies of the answers received from the children (Likert rating scale).
- in the last 3 columns we applied the statistical indicators from the Excel program 'SUM' (the sum of the data on each row), 'AVERAGE' (the arithmetic mean for each row), 'STDEV.S' (the standard deviation based on a sample) and the coefficient of variation (C.V.%) evaluation of the standard deviation in relation to the arithmetic mean, in order to observe if the groups are homogeneous or heterogeneous (CV < 10% = homogeneous population; 10% < CV < 20% = relatively homogeneous population; 20% < CV < 30% = relatively heterogeneous population; CV > 30% = heterogeneous population).

Analyzing the coefficient of variation (C.V.%) from the two tables, which we used to compare the degree of variation of different characteristics (not at all, little, moderate, much and very much), we can state that the percentage values for each exercise /item if they are closer to zero, the smaller the variation, this fact could mean that that category/population is more homogeneous (7th grade - 19.86%), and the average of 6.5 has a high grade of representativeness for the 7th grade.

In the case of the coefficient of variation with a value of over 30%, heterogeneous groups predominate in the 4th and 7th grades, and the average is considered to be no longer representative and, therefore, it is necessary to separate the data into groups according to by the variation of another grouping characteristic.

We created the frequency graph (fig.1.2) to observe the data distribution for each item and year of study.

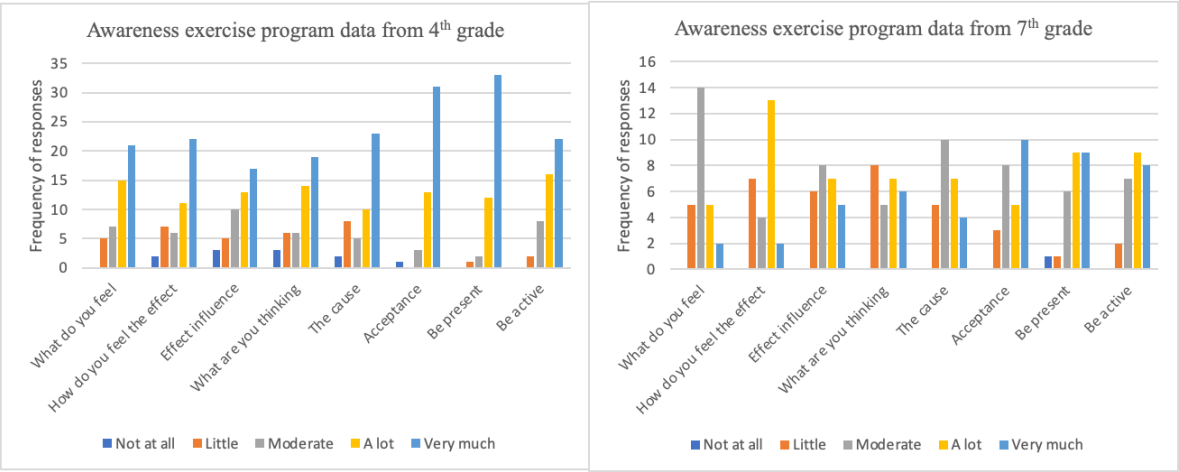

Fig. 1.2. Frequency responses graph

(Source: figure arising from the original research activity)

In the Excel program we selected the collected data and created the radar graph (fig.1.3) to observe if there are similarities or differences between the ages of the children from the 4th and 7th grade (10 years, respectively 13 years).

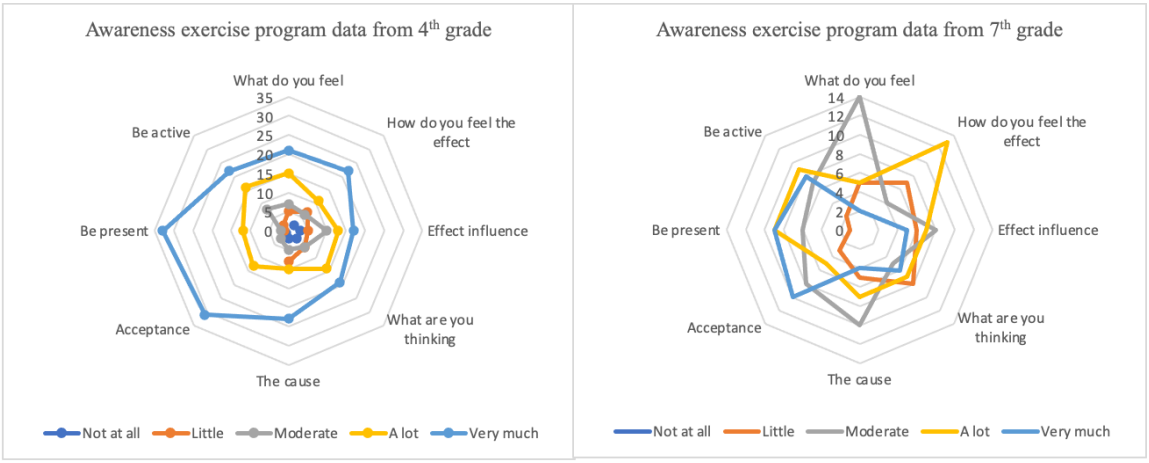

Fig. 1.3. Comparative radar chart

(Source: figure arising from the original research activity)

By means of the radar graph we were able to have a clear and comparative picture of the values of the 5 variables of the Likert scale associated with the 8 exercises, both for the 4th grade and the 7th grade.

At the *exercise no. 1*, saying what you feel, children from the 4th grade had high values *'very much'* (n=48, 12±7.39) for the level of awareness compared to *'moderate'* (n=26, 6.5±5.20) in the 7th grade.

At the exercise no. 2, how do you feel the effect, children from the 4th grade had high values *'very much'* (n=48, 9.6±7.64) for the level of awareness compared to *'a lot'* (n=26, 6.5 ±4.80) in the 7th grade.

At the *exercise no. 3*, the influence of the effect, children from the 4th grade had high values *'very much'* (n=48, 9.6±5.73) for the level of awareness compared to *'moderate'* (n=26, 6.5± 1.29) in the 7th grade.

At the *exercise no. 4*, what do you think, children from the 4th grade had high values *'very much'* (n=48, 9.6±6.66) for the level of awareness compared to *'a little'* (n=26, 6.5±1.29) in the 7th grade.

At the *exercise no. 5*, identification of the cause, children from the 4th grade had high values *'very much'* (n=48, 9.6±8.08) for the level of awareness compared to *'moderate'* (n=26, 6.5± 2.65) in the 7th grade.

At the *exercise no. 6*, accepting that you feel, children from the 4th grade had high values *'very much'* (n=48, 12±13.71) for the level of awareness compared to *'very much'* (n=26, 6.5±3.11) in the 7th grade.

At the *exercise no. 7*, paying attention to practice, children from the 4th grade had high values *'very much'* (n=48, 12±14.85) for the level of awareness compared to *'very much'* (n= 26, 5.2±4.02) in the 7th grade.

At the *exercise no. 8*, being aware of what you are doing, children from the 4th grade had high values *'very much'* (n=48, 12±8.79) for the level of awareness compared to *'moderate'* (n= 26, 6.5±3.11) in the 7th grade.

Conclusions

Even if in school the Physical Education subject is mandatory for all students, regardless of the level of motor skills and abilities, of the physical activities carried out in kindergarten or in their free time, or of their previous experiences in sports, students are different from the point of view of their psycho- neuro-motor, and the pace of motor learning may be different.

The coordination is an important component of voluntary movement because through specific exercises of certain postural muscles could provide the stable support needed for further actions.

But even so, from the age of 10 children can be aware, and even learn to become aware, of what they feel, how exercise affects the body, improving their proprioception function and the quality of motor control.

We believe that the constant and conscious practice of physical exercise is the main argument for improving and sustaining physical activity to maximize the beneficial effects on the human body.

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