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## APPLYING BIOMECHANICS IN PHYSICAL EDUCATION CLASSES THROUGH THE USE OF VERBAL CUES.

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### SUMMARY

Physical Education teachers were supposed to use biomechanics' concepts during practical classes and in daily activities with the students. Verbal instruction is an easy way to introduce biomechanics knowledge in the classes. This study has the aim to describe how Physical Education teachers apply biomechanics' concepts in classes, through the use of verbal cues. The study was conducted by applying a semi-structured interview to ten teachers, who work with child's basic education, from São Paulo's surroundings. Three typical learning situations were presented to the teachers, related to: force application, stability and falls. They were asked about which would be the verbal cues they would give to the students, so that they would perform the proposed movement successfully and with the basic understanding. Only one subject declared that he did not use biomechanics' concepts in his classes. Teachers communicated several biomechanics' concepts, through the verbal cues, like: first and third Newton's Laws (angular and linear form), centre of gravity's position, torque generated by the subject's weight and the relationship between impulse – momentum. These results show that teachers' point of view is changing in relation to the old idea that biomechanics is only linked to sports activities or to bachelor course. School Physical Education teachers are using their biomechanics' knowledge in their professional lives to obtain a more efficient movement from their students. We suggest a systematic use of these verbal cues so that they evolve along with the student's body and cognitive development.

### INTRODUCTION

Applying biomechanics in School Physical Education classes makes possible to teach concepts from other disciplines and also promotes a better understanding of the human body concepts and how they apply during the physical activity [1].

However, it is necessary that University teachers show the Physical Education undergraduates that biomechanics is present in the daily life and not only in the studies of high performance athletes [2]. This way, students will value the

learned knowledge and will understand the importance of applying the biomechanics concepts in their classes.

Physical Education teachers were supposed to use biomechanics' concepts during practical classes and in daily activities with the students [3] once the National Curriculum Parameters stresses the importance of having biomechanics in their School Physical Education classes as a complement to the practical classes [4]. Verbal instruction is an easy way to introduce biomechanics knowledge in the classes.

This study has the aim to describe how School Physical Education teachers apply biomechanics' concepts during classes, through the use of verbal cues.

### METHODS

From a qualitative and descriptive point of view, this study was conducted by applying a semi-structured interview to ten teachers, of both genders, who work with child's basic education, from São Paulo's surroundings.

The interview dealt with questions regarding the use, or not, during the classes, of verbal cues linked to biomechanics. Three typical learning situations were presented to the teachers, related to: force application, stability and falls. They were asked about which would be the verbal cues they would give to the students, so that they would perform the proposed movement successfully and with the basic understanding. The answers were processed using Content analysis.

### RESULTS AND DISCUSSION

From all the subjects analysed in this study, only one subject declared that he did not use biomechanics' concepts in his classes. Two subjects, from the group that uses the concepts, related that applied the three Newton's Laws to their classes. Most of the group (seven subjects) worked with biomechanics' concepts during recreational activities.

The first learning situation presented to them dealt with force application to a ball: two children were passing the ball to each other, but one of them was not able to apply enough force, and the ball did not reach the mate. It was

neither possible to change the distance between them nor the ball.

Six subjects suggested that the students should use a different joint flexion; five would ask them to apply a greater force; two would tell them to pay attention to the final extension of the joints and another one would make them think about how the movements done around the joints influence directly on the force applied to the ball.

The suggestion to apply a greater force alone, probably, would not help the students to solve the problem. That is what anyone could tell the students, not what is expected from a professional. But this together with the other verbal cues, linked to the biomechanical basis of movement, could bring the solution. These verbal cues are linked: to the first Newton's Law in its angular form – inertia's momentum; to the sum of angular velocities generated during the whole movement; and to the change in movement radius that helps to increase hand's linear velocity and therefore the ball's velocity ( $V = \omega r$ ).

In the next learning situation, we wanted to know which would be the verbal cues that the subjects would use to improve the stability: a child had problems to walk on a rope placed some centimeters above the floor. The verbal cues more used by the teachers were: open the arms and keep them at shoulders height, look at a fixed point, align the body and watch out the foot positioning at the rope. We would add two more verbal cues: let your arm swings in accordance to the need and low your body if you feel you are unstable.

The biomechanical principles related to these suggestions are: the third Newton's Law in its angular form; and the ones that interfere directly at the stability – the position of the centre of gravity and the torque generated by the subject's weight.

The last proposed situation was: the child would have to jump over a rope, tied in two plastic cones, and fall over a mattress. The verbal cues were: fall with the forefoot first and then with the heels; when you touch the floor flex at the knees, than at the hip and finish with a roll; fall with the superior members semi-flexed, protect your head and bring your chin close to the chest .

These suggestions are related to the relationship between impulse and momentum and have the intention to cushion

the fall, increasing the time of force application and decreasing the force applied to the subject in order to avoid injuries.

These results show that teachers' point of view is changing in relation to the old idea that biomechanics is only linked to sports activities or to bachelor course. School Physical Education teachers are using their biomechanics' knowledge in their professional lives to obtain a more efficient movement from their students. Efficiency that is not exclusive of high level sports, because everybody can increase the efficiency, reducing the energy expenditure, time, path, etc.

## CONCLUSIONS

Biomechanics concepts should be used by Physical Education teachers, with their students obtaining great benefits, for being able to better understand the movements and so use these knowledge to improve their daily movements.

The School Physical Education classes cannot be seen as only a sport class or a playing moment, is supposed to be a class in which the main goal is the learning of how the human body works for an independent practice, and biomechanics has a lot to contribute to this goal.

We suggest a systematic use of these verbal cues so that they evolve along with the student's body and cognitive development.

## REFERENCES

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