GameMove: A proposal for evaluation of motor development in children mediated by digital games

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Summary

The purpose of the test is to present an active digital game with a set of sensors called "GameMove". In the first stage is the Game Development (GameMove). In the second stage will be presented proposal to use the game GameMove (digital). GameMove is constituted in a digital game in exergame format (active digital game), which, with a set of sensors, will capture movements, to assist in the evaluation of engine development. The Game proposes to generate data from each individual and can be used in the educational or health context, allowing professionals of Education Fitic can evaluate the Dinvolvement Motor (DM) of children and propose motor interventions. It will be up to the child to follow the game's motion instructions, in a fun and engagedway.

Key Words: Development motor; Crianças; Games digitais ativos

ABSTRACT

The purpose of the essay is to present an active digital game with a set of sensors called "GameMove". In the first stage, we present the game development (GameMove). In the second stage, a proposal of use of the game GameMove (digital) will be presented. The GameMove Game is a digital game in exergame format (active digital game), which, with a set of sensors, will capture movements to assist in the assessment of motor development. The Game aims to generate data from each individual and can be used in the educational or health context, allowing Physical Education professionals to evaluate Motor Development (MD) in children and propose motor interventions. It will be up to the child to follow the game's movement instructions in a fun and engaged way.

Keywords: Motor development; Children; Active digital games.

1. Introduction

Human development according to Papalia and Feldman (2013) among its numerous nuances includes physical growth and motor development. Nista-Piccolo and Moreira (2012) affirm that development does not always happen linearly, because it is not only processed by biological or genetic aspects, but also by the influence of the environment. That is, development takes place in cognitive, motor, affective and social dimensions, based on the construction formed by the relationships that the human being makes with the other and with the world.

Regarding the motor dimension, understood by motor development, it is understood that since conception, the human organism has a biological logic, an organization, a maturative and evolutionary

calendar, a door open to interaction and stimulation (ROSA NETO, 2002). There is special attention to the description and identification of developmental motor milestones in early childhood, when motor development (DM) presents observable behaviors of great social significance, since, through body movements the child interacts and acts dynamically in the physical and social environment (KREBS *et al.* , 2011; ABIKO *et al.* , 2012).

In this sense, motor development can be considered a sequential process, continuous and related to chronological age, by which the human being acquires an expressive amount of motor skills, which progress from simple and disorganized movements to the execution of highly organized and complex motor skills (SOARES et al, 2015).

For Gallahue, Ozmun and Goodway (2013) motor development is the continuous change of motor behavior throughout the life cycle, caused by the interaction between motor task requirements, individual biology and environment conditions. That is, it is a process of changes in an individual's level of functioning. Thus, the study of motor development has as a premise to describe and explain the changes that happen in motor behavior throughout life.

Regarding the evaluation of DM, it is understood that, through it, it is possible to monitor developmental changes, identify developmental delays and obtain clarification on instructive and interventionist strategies. Also, it is possible to trace the motor profile of Brazilian children, providing an adequate physical programming for the reality of each one (FERNANI *et al*., 2011).

A child with proper motor development tends to become a young and adult who learns better and has a better quality of life. This means that, by conquering good motor control, the child will be building the basics for their intellectual development, preventing them from having impairment of motor and cognitive abilities (ROSA NETO *et al.* , 2010).

Thus, evaluating children's DM becomes fundamental, as it makes it possible to identify proficiency in motor skills for sport and leisure, as well as the ability of children to make friends and engage in social groups, in the construction of feelings, autonomy, competence and motivation for achievement and for the search for challenges and achievements (LUBANS *et al.* , 2010).

According to Gallahue, Ozmun and Goodway (2013) basic motor skills are: balance, global and fine motricity. The overall motor ability is the one that involves in its manifestation the movement of large muscle groups promoters of trunk strength, arms and legs also including postural reactions such as balance of the head, sitting, standing, crawling and walking. After the child has mastered the movements linked to the large muscles, then the development of fine motor skills is developed. Fine motricity involves the coordination of small muscles and coordination between eyes and hands, such as buttoning shirts and drawing figures. These skills make it possible for children to have the greatest sense of responsibility and personal care (SILVEIRA *et al.* , 2014).

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In this sense, motor skills are part of motor development (DM) and evaluating them becomes fundamental to explain children's development(NOBRE; FLAG; ZANELLA, 2015).

In recent decades it is evident that the motor possibilities in childhood present significant changes due to technological advances. Digital, computational games and video games are part of the children's routine. Raupp and Eichler (2012) point out that there is a vertiginous increase in the use of different forms of Information and Communication Technologies (ICT) by society in general, which inserts the different types of technological resources into everyday life quite often.

Considering this scenario, we noticed a *gap* in terms of solutions using digital technologies as a means of expanding the forms of evaluation of DM, as well as solutions that enable the evaluation of children's DM. Therefore, a gap in digital technologies that can meet the recreational playful universe of the child is identified and at the same time provide data to enable the diagnosis of DM by qualified professionals.

In this sense, the proposal arises to develop an active digital game to assist in the evaluation of the motor development of children from 03 to 10 years. The game, in exergame format (active digital game), along with a set of motion capture sensors, can be used in the educational or health context allowing qualified professionals to evaluate children's DM and provide *feedback*. This would incur a significant gain to develop motor intervention strategies collaborating, both with the elements of learning and health of the child.

So far it has not been evidenced in the scientific literaturethatis a protocol from Active Digital Games that evaluates the motor development of children with motion sensors. Nessthe perspective, it is aimed at developing research and an active digital game that implements a protocol to evaluate the motor development of children called "GameMove".

2. What is the relevance of Gamemove?

In Brazil, the main references of protocols for the evaluation of children's DM are[1]: EDM proposed by Rosa Neto (2002); LC-MABC-2 proposed by Henderson *et al.* (2007) and validated in Brazil by Ramalho *et al.* (2013); TGMD-2 proposed Ulrich (2000) and validated in Brazil by Valentini *et al.* (2008); McClenaghan and Gallahue (1985). The protocols mentioned present solutions with the use of concrete and analog material demonstrated the lack of tests using active digital games to assess motor development.

Studies that used the protocols referredto, show that the children investigated present lower motor development than expected for chronological age. Spessato *et al.* (2015), for example, investigating the motor development of 1,248 children aged 3 to 10 years from Porto Alegre pointed out the low performance for fine, global motricity skills and spatial organization in children investigated in this region of the country. In northeastern Brazil, Nobre *et al.* (2009), Nobre *et al.* (2012), Costa *et al.* (2015) and in the Southeast, Coelho *et al.* (2010) confirm the results found in the South. Thus, there is a tendency of children to have low motor proficiency in fundamental abilities in most ages and in both sexes, regardless of geographic context.

Costa *et al.* (2015) found high percentages of children with much lower motor development. Marramarco *et al.* (2012) also studied the motor development of gaucho children aged between 05 and 10 years and found that the vast majority presented performance between low and lower normal.

[1] An example of protocol application can be seen at: http://www.motricidade.com.br/kit-edm.html

Based on the results presented in the studies mentioned above, itis questioned whether the protocols used for the evaluation of motor development meet the demand for a technological generation, or children effectively present such an expressive motor deficit.

If we consider that environmental and task stimuli have changed, create a protocol for the evaluation of DM that dialogues with the reality of children of the 21st century, it becomes extremely relevant. In this sense, digital technologies are now used as an important tool in anumber of segments, such as health, training and education. Thinking about education and health without technology becomes incoherent in the current scenario (BROLIO, 2017).

3. How will game GameMovebescarved ?

For the development of the game GameMove will be used the model proposed by (BABA; TSCHANG, 2001), which describes a development spiral with specifications of the steps required for product production, using prototyping, testing and evaluation of all tasks cyclically.

Thus, the development of the product, from conception to the application of the final product, will involve the Development Phases, namely: 1- Inspiration; 2- Concept; 3 - Project; 4 -Development; 5 - Test and Evaluation. Each Phase corresponds to a project milestone. In Phase 1 called Inspiration there will be the understanding of the product vision by the team, to support the fundamentals of the project and compose the contents that the game and set of sensors. Profile study of participants and technological support environment. Initial product design game and set of sensors.

In relation to Phase 2 or Concept, the game conceptions will be deepened with definition of the playful universe of the game (narrative), mechanics and content manipulation. The definition of requirements and information will be provided by the game and set of sensors.

In Phase 3 or Project will be developed the game project that will contemplate the layout, rules, gameplay elements, characters, narrative and the fictional universe that will involve the theme. Planning the interaction of children with the product. Visual prototype generation for information analysis and interaction. Design of the sensor set.

For Phase 4 will be developed the game and will contemplate, among other elements, the setting /fictional aspect, script, definition of rules and interface, production of visual and sound *assets*, *layo*ut,gameplay prototypes, content insertion, etc.

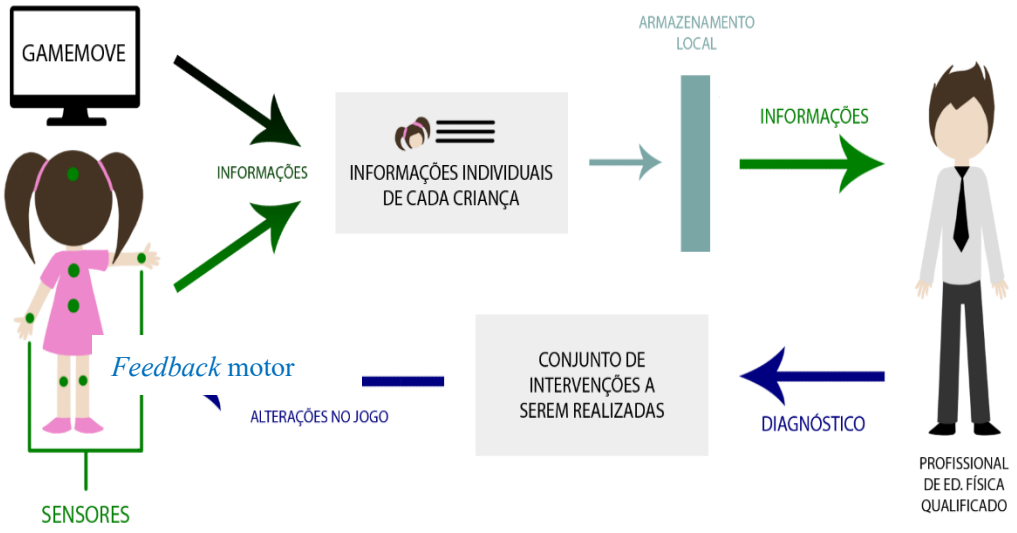
For Phase 5, intermediate tests of the Viable Minimum Product (MVP) of the product between team and validation of the proposed solution will be performed with a sample of the target audience.

The sample will be non-probabilistic will include 90 children in the age range from 03 to 10 years of age of both sexes, regularly enrolled in a school in the Valley of the Bell Region. The distribution of children will be performed by age group 1 (G1) will include 30 children aged 3 to 5 years; Group 2 (G2- 30 children) from 6 to 8 and Group 3 (G3- 30 children) from 8 to 10 years. In this sense will be contemplated the motor phase is foundedl; stages: initial, elementary and mature (3 to 7 years) and specialized; transient internship (7 to 10) according to Gallahue, Ozmun and Goodway (2013). The GameMove pilot test iscarried out in the educational context. All evaluations will be carried out after the signing of the Free and Informed Consent Form for Minors, according to the determinations of resolution 466, december 2012, of the

National Health Council. Participants will receive information regarding their right to participate, from warranties of anonymity. It is noteworthy that relationships already have prior authorization through institutional contracts for the development of research and testing of products in the format proposed by EDM and GameMove with the target audience. The project was approved by feevale University's research ethics committee with CAE number: 17201119.8.0000.5348.

The game will produce data from each individual and can be used in the educational or health context, allowing qualified Physical Education professionals to evaluate children's DM and propose motor interventions. Figure 1 presents a conceptual model of the proposed Game.

Figure 1- Proposed Game conceptual model



Source: Prepared by researchers

A set sensors will be positioned on children according to a manual that will be made available along with game GameMove. The game, in exergame format, will run via computer through an interface with a set of sensors and motion capture. In this sense, stabilizing, locomotor and manipulative movements that are linked to body perception, space and time will be evaluated, and are basic domain components for both motor learning and school training activities and quality of life.

It will be up to the child to follow the game's motion instructions, in a fun and engaging way. "GameMove" proposes to be a product accessible to the Brazilian reality, focusing on the educational and health market.

With each child's assessment, the data will be stored locally,in the game, for the realization of a diagnosis of DM by qualified physical education professionals. After the diagnosis, a proposal for motor intervention will be made available to teachers/professionals, such as school physical education planning, age-appropriate sports and recreational activities.

For application and validation of the game will be made available to the evaluator (physical education professional) a manual together with the game and a set of sensors, with the appropriate position

of each of them. Three kits with game + sensors are planned to be 1 for ages 03 to 05 years (G1); 1 for ages 06 to 08 years (G2) and 1 for ages 08 to 10 years (G3), enabling testing with up to 3 children simultaneously.

Data analysis will take hold from the information generated by the game and set of sensors that will be programmed to create engine development scores of those investigated according to chronological age and performance in the motor skills proposed in the game.

Necessary changes in the game will be developed taking as input the application performed and the data collected. At this stage, *feedback*will also beconsolidated, where professionals from the Physical Education course at Feevale University will be able to access and propose interventions related to children's DM.

4. How will GameMove be used?

In the educational sphere GameMove will be applied by physical education teachers trained to install the sensors in the muscle groups responsible for the specificity of the movement and later analyze the data and propose motor interventions.

For the health area GameMove, can be used in clinics and hospitals, expanding the field of action of PhsicEducationprofessionals, who will assist in the diagnosis and propose interventions in the motor development of children who present pathologies that compromise cognitive and motor development. Validation aims to evaluate the aspects of us,gameplay, and its potential, from the interaction subject-content - digital resource.

Currently, in Brazil, the evaluation of motor development of children is performed analogously. For this, an ADAPTATION EDM protocol proposed by Rosa Neto (2002) will be used. With this, it will be possible to evaluate and identify the motor profile of those investigated in the skills: fine motricity, global motricity and balance.

With the developmentofthe game GameMove, which constitutes an active digital game in exergame format,it is expected todevelop a digital solution for the evaluation of motor development. In this sense, it will be possible to evaluate the motor development of children through an interactive, playful, recreational active digital game with a narrative adherent to the profile of the child of the 21st century.

In general, the qualification of an individual in a given motor state would be based on the characterization of their performance skills, which would be representative of a minimum motor competence so that the individual can act according to the demands of the motor activities of daily, occupational, expressive, recreational and sports life. In addition to the diagnosis, valid criteria, such as scores, will be used to characterize DM according to chronological age.

As a vision of the future, from the information provided by the game and by the set of sensors, it will be possible to organize a network of physical education teachers/professionals in schools, clinics and hospitals that consume and generate information for interventions regarding the motor development of Brazilian children. From the data generated, longitudinal studies will be conducted dedicated to the description of developmental changes. The data may also support public policies in the area.

GameMove can also be used to diagnose DM of children with disabilities, as it will assign scores to DM according to chronological age and performance in motor skills.

5. Final considerations

By developing an active digital game it will be possible to incorporate it into programs for child development and training of health professionals and schools. It is also expected to strengthen the segment of development of digital games for health, especially with regard to issues related to child development, as well as develop *research know-how* in the education, digital games and health interfaces in the theme of child motor development in order to support the practices of teachers and physical education professionals.

With GameMove it will be possible to still understand, with the participation of the different subjects and in light of the results of this study, how digital games can help in the evaluation of child motor development considering the profile of Brazilian children. With this there will be the strengthening of the Creative Industry and technological solutions focused on Health Education actions, as well as the development and strengthening of a group of researchers involving digital technologies for this area.

The firstimpact l predicted on society from the application of GameMove is to enable an evaluation motor development in childhood rationing the ludicity and active digital play; bringing the possibilities of digital games beyond entertainment.

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