

# An Edugame as a Didactic Tool for the Development of Executive Functions

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## ABSTRACT

The aim of this work is to design an edugame, created at the Laboratory H of the Department of Human, Philosophical, and Educational Sciences of the University of Salerno, as a didactic tool to assess and promote the development of executive functions in children with special educational needs attending primary school. The good functioning of executive functions is assessed through specific tests and is a predictor of the prerequisites necessary for school learning and the development of social skills. The edugame prototype will be composed of several interactive games to allow students to train some cognitive skills at an increasing level. The prototype will consist of several interactive games to enable students to train certain cognitive skills at an increasing level. In the first design phase, work will focus on one of the components of executive functions: inhibition. In fact, the first game was implemented starting from an application created in Lab-H, built on the basis of the circle drawing task, to assess the capacity for inhibition.

## KEYWORDS

Didactic Tools, Educational Technologies, Edugame, Executive Functions, Special Educational Needs

## 1. INTRODUCTION

Edugames are now a reality for both PC and mobile devices, in this regard think of the Android operating system for mobile phones (Hssina et al., 2014). Also, the age groups are the most varied, certainly have great relevance of edugames realized for elementary school students (Ibid.). It is not only Western countries that are interested in this issue (Novaliendry & Andriani, 2020), but also those in the Far East (Sudarmilah et al., 2018) and this allows researchers who are attracted to this specific research topic to broaden the comparison and compare results. In a sense, educational research is already ready for a paradigm shift within which edugames will have their own role in the future of teaching disciplines (Free et al., 2022) e.g. history (Hong & Chin, 2006).

The following research is part of a larger project on teaching methodologies aimed at fostering perspective-taking (Di Tore, Aiello, Sibilio & Berthoz, 2020) in children aged 6 to 11 years through the creation of an edugame. The objective is to develop, at the Lab-H of the Department of Human,

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Philosophical and Educational Sciences (DISUFF) of the University of Salerno, a prototype edugame with a narrative structure of an educational video game that aims to support primary school pupils to discover some interactive games focused on the enhancement of some Executive Functions. This work is part of the panorama of innovative teaching strategies and specifically embraces the methodology of Game based learning based on learning through games, in which the player who coincides with the student learns and at the same time has fun (Gee, 2013). The edugame is part of this methodology (Martens & Muller, 2015) and is defined as a type of video game developed to enhance a skill and Educational videogames are didactic tools used to increase learning motivation and create meaningful learning (Gee, 2013; Di Tore, 2016), they are configured as didactic mediators in classroom teaching to promote inclusion processes and the educational success of all and everyone (Aiello, 2013) with a view to improving the effectiveness of the teacher's teaching action (Sibilio, 2014). In an inclusive educational system, edugames are seen as eclectic tools with multiple design possibilities, this feature is fundamental to foster personalised paths respecting students' needs, aptitudes and inclinations (Anolli & Mantovani, 2011).

Designing an educational edugame means creating an inclusive tool that can be used by all pupils. This is possible thanks to the possibility of making modifications to the game in a short time, changing the settings and implementing extra aids in the interactive game that can be used *ad personam*, such as additional aids, changing the font, font size, response modes or feedback.

The edugame was created/is designed as a space in which the pupil can enjoy different interactive games, each of which is specific to the improvement of a certain skill. The whole process of designing the didactic medium took into account all the criteria of the educational game outlined by Bryan Bergeron (2006):

1. It presents challenging tasks;
2. It is engaging and able to entertain the pupils;
3. Incorporates a score;
4. Provides the player with a skill and knowledge that can be used in everyday life.

The aim of the edugame we are developing would be to act as a didactic tool for the development of Executive Functions, acting on the one hand as training for the development of the functions in pupils with typical development and also with Special Educational Needs, and on the other hand as a digital tool useful for formative teacher assessment. Being able to have a continuous evaluation of these functions throughout the school year would allow continuous educational planning, timely at the onset of different needs and therefore inclusive. In this paper we will only talk about the digital application inspired by the Circle Drawing Task that has been designed and tested in a primary school to be integrated into the edugame for training the motor inhibition function.

## 2. RESEARCH BACKGROUND: THE EXECUTIVE FUNCTIONS

The expression "executive functions" was first used in 1983 by Muriel Lezak in reference to all those abilities through which an individual carries out purposeful and adaptive actions (Lezak, 1983). The multi-componential nature of these functions has made it difficult to find an operational definition of them that is widely accepted in the scientific literature. By the term "executive functions", Baddeley means a cognitive system geared towards optimising performance in situations requiring the simultaneous activation of several cognitive processes. EFs can be defined as the multiple abilities to control and regulate aspects of behaviour and other complex cognitive functions (Welsh et al., 1991) that substantially influence learning activity and school inclusion (Orsolini, 2019). The construct of FE also includes skills of programming and sequential planning of actions to achieve a specific goal and/or their inhibition as well as problem solving skills (Friedman et al., 2006; Pennington & Ozonoff,

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