Diligo 2.0: a game to assess geometric and emotional competences in preschoolers

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Abstract.
Transition from kindergarten to primary school is a turning point in children's life; as one of the most complex challenges in a child's life, it needs to be faced with a set of skills that can be trained in early childhood. Diligo 2.0 is a serious game developed on STELT platform, built up adopting an Agent-Based Model approach. It is a monitoring tool to assess, in 5-years-olds, the emotional competence and the geometric and numerical thinking: two of the competences useful to children accessing primary school. The tool also assesses the children's attitude to engage in slow or fast thinking activities. The assessment can be both normative and ipsative: when normative, it is based on inter-individual comparisons; when ipsative, it becomes an intra-individual assessment.

Keywords: Serious Game, Agent-Based Model, Emotional Competence, Geometrical competence, School Readiness.

1 Introduction

Children's transition from kindergarten to primary school is not a single event, but it can be defined as a complex and long process [16] which has a consistent impact on their future academic success and personality configuration [11]. Recent studies define the concept of School Readiness as a set of specific characteristics and skills through which children become able to learn in school [8]. Beside the pre-academic skills of literacy, communication and mathematics, several soft skills have been individuated as a part of early childhood development outcomes fundamental to the School Readiness [5, 7, 9]. In 2012, Italian National Guidelines for Kindergarten, issued by the Italian Ministry of Education, recognized those skills and competences as essential achievements for the 6-years-olds to face their transition to primary school; however, their teaching is not always included in the national curriculum.

Diligo 2.0 is a normative and ipsative monitoring tool to assess in 5-years-olds two of the skills part of School Readiness concept, such as the emotional competence and

the geometric and numerical thinking, and the psychological and behavioral attitude to engage in slow/fast thinking activities. [10]

In particular, this tool lets teachers and parents assess the specific components of each competence considered. On the side of the emotional competence, there are: awareness of the emotions, use and comprehension of emotion-related vocabulary, recognition of facial expressions and their link to the emotions, comprehension of the situations that elicit emotions, knowledge of the cultural rules for displaying emotion and regulation and management of one's own and others emotions [3, 6, 15, 18]. On the side of the geometric and numerical thinking, the components are: knowledge of the geometrical figures, acquisition of big and small concepts, recognition of number representation, spatial concepts of in-out and up-down, temporal order in terms of before and after, spatial directions left and right. [4, 14]

The third dimension considered by the tool is the behavioral attitude of fast/slow thinking; it changes depending on motivation, emotions, environments, situations, etc. Kahneman [10] describes the human mind as the product of two thinking systems interaction: "System 1", fast, automatic, unconscious, emotional and "System 2", slow, logical, conscious, effortful. The two systems interact with each other and System 2, after a long training, can be able to modify and supervisor all the fast thinking activities. In our fast and interactive society would be helpful to support and motivate children in school to choose slowness, training them in monitored slow thinking activities. [13]

2 Prototype description

Diligo 2.0 is a serious game developed on STELT platform, Smart Technologies to Enhance Learning and Teaching [12], and will be available on Android devices.
It is a monitoring tool to assess, in 5-years-olds, the emotional competence, the geometric and numerical thinking and the psychological and behavioral attitude to engage in slow/fast thinking activities.

The assessment can be both normative and ipsative: when normative, it is based on inter-individual comparisons; when ipsative, it becomes an intra-individual assessment, useful to highlight personal strengths and weakness of the single child, while tracing his/her dynamic developmental profile.

Diligo 2.0 is expressed through a narrative metaphor, and that's one of its strengths: narratives are a pervasive feature of human cultural products [1] and they become frequent and early experiences in children life, in the form of dialogues, stories, biographies [17]. Actually, adults use narrative to introduce the world to the child: it is the primary and most familiar tool the child has to gradually comprehend reality [2].

As the child access into the test section from the app homepage, s/he is introduced to the narrative framework of the game and its main character, Leo the Explorer: the child is actively involved to help Leo, facing several tests. The game is structured in eight different sections: when the child chooses the one s/he wants to play in, s/he has the opportunity to select a fast or slow mode. The only difference between the slow

mode game and the fast one is a major presence of narrative introductions to each test in the first one. Every test is a question Leo the Explorer asks to the child and s/he can answer simply touching specific graphic elements on the device display.

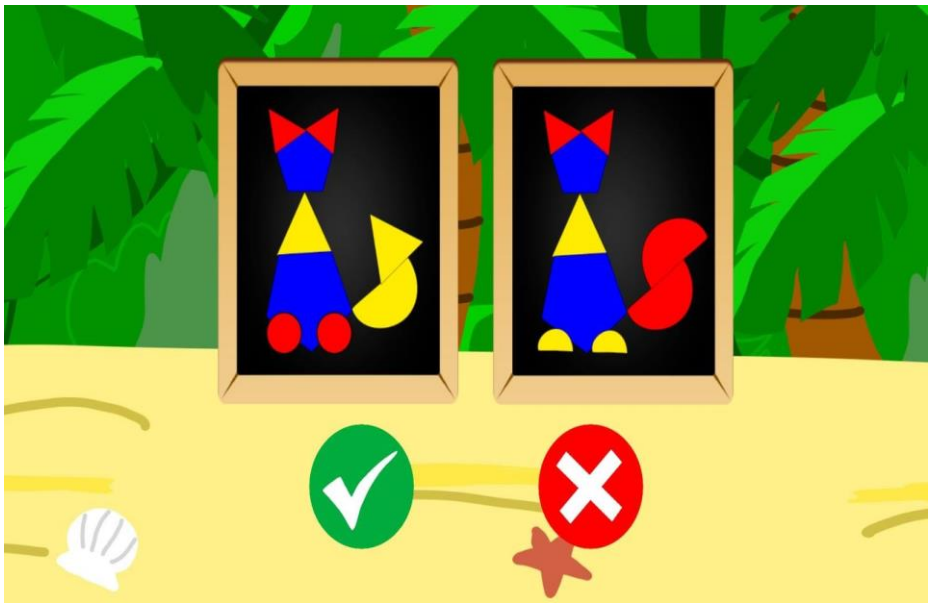

Fig. 1. This picture shows a test about a specific component of geometrical competence. In this particular section, Leo the Explorer asks the child to find any difference between these two similar representations of a cat. As shown, the cats' bodies are made by basic geometrical shapes; so, Leo's question would be: "Can you tell me if their tails are of the same shape?"

The game path is predetermined, to ensure the test validity and not affect the assessment. At the end, when the game session is concluded, a brief report is available with the assessment of all the skills and competences evaluated during the test. The scoring is the same for the slow and fast mode: 1 point for every correct answer and 0 point for every wrong one.

To create an ipsative profile of a child, when s/he starts again a new game session, Leo the Explorer recognizes the player and lets the supervisor choose to repeat the same old items or get new alternative ones.

Diligo 2.0 has been built up adopting an Agent-Based Model approach. There are two main interactive agents: the first one is the user, who plays all the tests trying to help the main character of the game; the second Agent is "Leo the Explorer", an artificial agent who guides the user in the several sections of the app and during the game through tips, instructions, feedbacks and narrative introductions.

3 Conclusions and future directions

Diligo 2.0 is an assessment and monitoring tool which focuses attention on several development components, quite overlooked by current national school curriculums. Providing both normative and ipsative assessment, it represents a tool with a great potential to promote a more sensitive awareness about each child specific educational needs and to support the teacher monitoring the class group to adjust its educational path along the way.

In the future, the app could be used also as a training tool to help the children improve their skills, providing them an entertaining learning experience. In the actual version of the game, all the tests are based on structured materials; this feature, combined with the use of STELT platform, makes all the tests replicables in other two ways: a not-digital mode and a hybrid mode. The opportunity to play the game in different ways and conditions, with or without the peer group or the caregiver, makes it more adaptable to the specific children or group.

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