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# Software for Teaching Emotions to Students with Autism Spectrum Disorder

Software para enseñar emociones al alumnado con trastorno del espectro autista

## ABSTRACT

This paper reports the results of a research project in which educational software was used to teach social and emotional skills to primary and secondary school students with autism spectrum disorders (ASD). The participants with difficulties in recognizing emotional states were nine male and female students aged between 8 and 18, with a mental age range of between 5 and 7 years. A single group design with pre-test/post-test was used. The students were assessed before teaching in relation to their levels of social and emotional skills. This assessment was intended to set the starting level of the teaching process for each student. The educational intervention consisted of two 45-minute weekly sessions for 20 weeks over two academic years (2006/08). Following the intervention, each student was again assessed. Results indicate that the pupils improved their performance in tasks that evaluate the ability to recognize and understand emotional expressions. These results confirmed that the use of educational software for teaching social and emotional skills helps students with ASD to improve their ability to perform tasks aimed at the understanding of emotional skills. In addition, the participants improved their social skills significantly, a fact that was noticed by both teachers and families.

## RESUMEN

En este artículo se presentan los resultados de una investigación en la que se ha utilizado un software educativo para apoyar el proceso de enseñanza y aprendizaje de competencias emocionales y sociales en alumnado con trastornos del espectro autista (TEA) escolarizado en educación primaria y secundaria. Los participantes, con dificultades en el reconocimiento de estados emocionales, han sido nueve alumnos de edades comprendidas entre los 8 y 18 años, de ambos sexos y con un rango de índice de edad mental entre 5 y 7 años de edad. Para ello, se utilizó un diseño de grupo único con pretest-postest. Así, antes del proceso de enseñanza, el alumnado fue evaluado con relación a sus niveles de competencia emocional y social, con la finalidad de establecer, también, el nivel de inicio del proceso de enseñanza para cada uno de ellos. El proceso de enseñanza se desarrolló a lo largo de dos sesiones semanales de 45 minutos, cada una, en un intervalo de dos cursos académicos (2006/08). Tras el proceso de intervención educativa, los alumnos fueron nuevamente evaluados. Los resultados obtenidos confirman que la utilización del software educativo en la enseñanza de competencias emocionales y sociales ayuda a los alumnos a mejorar su capacidad para superar tareas encaminadas a la comprensión de competencias emocionales. Además, los participantes mejoraron sus competencias sociales ya que docentes y familiares apreciaron progresos significativos en esta área.

## KEYWORDS / PALABRAS CLAVE

Educational software, ICT, inclusive education, education-learning, students, special education needs, emotional education, social interaction.

Software educativo, TIC, educación inclusiva, enseñanza-aprendizaje, alumnado, necesidades educativas especiales, educación emocional, interacción social.

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## 1. Introduction

The presence of information and communication technologies (ICT) in society is an evident reality and an area of special reflection and continuous evolution that has expanded in recent years due to the speed of technological advances and their impact on the educational world (Selwyn & Gouseti, 2009). This is a necessary factor for a profound educational revolution in the use of new language for greater access to information, knowledge building and improving of communication.

Social and educational institutions have been concerned to incorporate these technologies into schools and endow schools with ICT equipment as an indicator of quality and improvement in teaching and learning processes. In fact the presence of ICT equipment in schools has increased exponentially over the years (Aguaded & Díaz, 2010). The need to incorporate ICT and the political will to promote their use in education was reported in 2001 (Eurydice). Subsequently, ICT access has increased as a means to combat technological illiteracy and geographic isolation, as well as to facilitate access to new sources of knowledge and provide new services and resources for citizens. Similar guidelines and initiatives have led most countries to plan the introduction and promotion of ICT use in educational organizations (Ballesta, 2006). In Spain, the Organic Law of Education (LOE) integrates ICT in the educational process at all school stages, because ICT play a mediating role in the experiences of a student and act as a support tool in their learning, including students with special educational needs. The school, therefore, must use technology as a didactic resource to enrich and improve the teaching and learning process (Chacón, 2007), while understanding that the didactic resources are curricular elements whose systems of symbols and strategies favour the development of cognitive skills and values in the subjects within a given context. This facilitates and encourages the reality-mediated intervention, the student's understanding of information and the creation of an environment that enhances learning and skills development and, as stated by Collis and Moonen (2008), the development of virtual and cooperative learning processes. However, recent data are not very encouraging in terms of assessing the integrative dimension of these technologies in schools. Reports from 2007 and 2009 (Sigalés, Mominó & others, 2009) show weak ICT integration, reinforcing the contradiction that teachers and students have above-average skills as Internet users but that two thirds of centers have no specific

ICT integration plan. Despite the increasing presence of media technology in schools, teachers' pedagogical practice in the classroom has not changed significantly in terms of the traditional teaching model (Area, 2008). The acquisition of technologies per se does not mean a change in the concepts of the school (Sancho, 2009) so aspects and educational needs must be taken into account (Fernández, 2005). We believe the benefits of technology are not in the introduction of a new support in the compartmentalized school curriculum but in the transformation of the meaning of teaching practice (Ballesta, 2006).

In the case of students with special educational needs, technology is a critical input because the capabilities of these media allow these students to access tasks that would otherwise remain beyond their reach. New technologies configured as a powerful teaching tool could provide the solution to some special educational needs of students, (Alba, 1998; Pensosi, 2010). As Pavia stated (2010), interaction with digital media increases these students' possibilities of interacting with the environment, thus improving their quality of life on the emotional, personal and professional levels, and helping them overcome exclusion by encouraging their inclusion in society (Cabero, Córdoba & Fernández, 2007).

Yet there is a digital divide that affects these students with its roots in accessibility and ICT use that manifests in digital and social exclusion processes (Lozano & Ballesta, 2004, Rodríguez-Fuentes, 2008). The digital divide, the distance between those people and communities who dominate, access and effectively use ICT and those who do not (Ballesta, Bautista & Lozano, 2008; Bautista, 2010; San Martín, 2009), affects various groups, including students with special educational needs.

We believe that access to computers and the Internet by these groups, as well as the ability to make effective, social use of ICT, is important for full participation in political, economic and social development in developed countries (García, 2005; Tirado, 2007). Consequently, schools have been using a variety of technological tools to promote and encourage learning among pupils with special educational needs in general, and students with autism spectrum disorders (ASD) in particular.

In terms of teaching students with serious difficulties in social and communication interaction and in the attribution of mental states, that is, in understanding what others feel or think, the new technologies seem to be a good fit for their characteristics and educational needs. In fact, many people

with ASD seem to have a natural affinity with ICT because they provide a controlled environment, individual attention and the possibility of repeating the activity proposed. Learning tasks developed in digital environments using information technology can motivate the desire to learn in ASD students (Cheng & Ye, 2010; Parsons, Leonard & Mitchell, 2006; Pensosi, 2010). Most kids are motivated by information technologies, but children with ASD find them even more attractive due to the cognitive information processing features, especially the visual (Lehman, 1998).

In this sense, ICT use in schools is associated to a pedagogical model that becomes a means, not an end, for student learning. It goes without saying that ICT must be configured to enable access to information and knowledge building. In fact, the LOE preamble seeks to «ensure universal access to information and communication technology», but the eradication of the digital divide in use and accessibility for people with special educational needs to computer media is much more complex than having or not having access to technology (Fernández, 2005). There-

fore, we call on teachers to use computers and software as a resource in their teaching programs and educational projects for pupils with ASD, as an integrated element in their education. Technology is configured to help these people to compensate for their functional limitations, and to increase and enhance learning, independence and autonomy, mobility, communication and environmental control.

We must avoid the concept of technology as an end in itself (Levis, 2006); that is to say, the incorporation of technology in the education of pupils with ASD must be accompanied by a methodological reflection and rethink of the objectives to be achieved. The use and benefit of information technologies in the intervention with ASD students will depend on their characteristics and special educational needs. The potential benefit of this use of technology media depends on how this resource is used (Passerino & Santarosa, 2008).

We have set specific targets for intervention,

based on the person not the technology, and if properly implemented, we can overcome those myths of the isolated child with ASD attached to an isolated computer because, according to Cheng & Ye (2010), children with ASD can use computers as an individual activity, but also collectively, just like all other children.

This research presents our experience of computer use in the teaching of social and emotional skills to students with ASD. We develop, implement and evaluate educational computer software for a teaching process that enables us to understand the beliefs and emotions of ASD students, which in turn

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helps us to improve their understanding of social and emotional skills. We specifically used educational software for teaching these emotional competencies that integrates a multimedia presentation of the information. Multimedia systems that employ multiple formats for the presentation of information enable multi-sensory teaching; it is a functional tool that can be adapted both to the characteristics of students with ASD and to the complexity of the explicit teaching of these skills.

We also generate an active, dynamic stage that facilitates the acquisition of knowledge; we foster creativity and the development of the imagination, so important in an educational intervention involving people with autism spectrum disorders; we also provide channels for interaction because the program allows for dialogue and encourages cooperative learning; we offer access to learning content and motivation in the task of teaching, enabling the program to fit users' needs (Alba, 1998).

## 2. Research objective

This paper presents the results of an investigation that has used educational software to support the teaching and learning of social and emotional skills to students with autistic spectrum disorders. The objective is to show the advantages and benefits of incorporating technological media in an educational program for teaching social and emotional skills to students with autism spectrum disorders, both in primary and secondary education.

## 3. Methodology

### 3.1. Research Design

The research is applied in nature and context for improvement procedures to be implemented as a treatment study in natural classroom situations. The project used a single group design with pre-test/post-test, since the objective is to analyze and assess the improvements in participants' social and emotional skills by using a software-based educational program. Before the teaching process began, the students were evaluated in relation to their levels of social and emotional skills. This initial assessment was intended to mark the starting point for each student in order to develop the teaching and learning process, which consisted of two 45-minute sessions per week for 20 weeks over two academic years (2006/2008). After the intervention process, each student was again assessed with the aim of discovering possible development and improvements in these skills.

### 3.2. Research participants

Nine students with autism spectrum disorders participated in the investigation, aged between 8 and 18, of both sexes and a mental age range of between 5 and 7 years old. Participants were selected according to the following criteria: having a confirmed and updated diagnosis; enrolled in primary or secondary schools in the Autonomous Community of the Region of Murcia, with a mental age of more than four years old.

### 3.3. Data collection instruments

The educational software «Aprende con Zapo. Propuestas didácticas para el aprendizaje de competencias emocionales y sociales» (Lozano & Alcaraz, 2009) was used to teach and assess the social and emotional skills of students with ASD.

This educational software is composed of tasks structured on levels ranging in complexity from basic to advanced both for teaching the recognition of basic and complex emotions, as well as for teaching how to

predict people's actions from their true or false beliefs (Table 1). The software was constructed with a tool used for creating quick and easy multimedia applications. It is ideal media for educational work with students with ASD. It provides a controlled environment and individual attention through contact with the main character (the clown Zapo) who the student can accompany while performing the various tasks in the program. The program also keeps a record of each student's progress, or the difficulty experienced, in each task in a personal file; this customizes the teaching-learning process and enables teachers to monitor each student's progress, even when they are not present, and to tailor the program's pace to suit each student's needs.

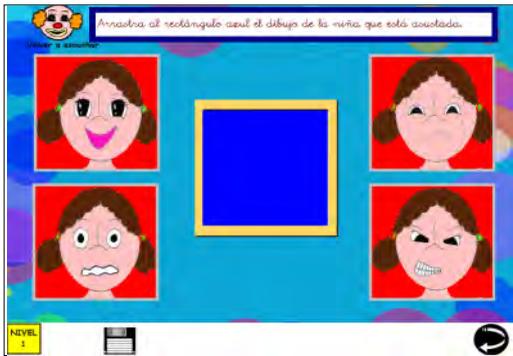
Interviews were used to discover the changes, development and improvements in these skills in the students' everyday contexts (school and home). These provided information on the perception of the student's teacher (interview 1) and family (interview 2), and on progress in participants' social and emotional development after the teaching and learning process. Both interviews were two-dimensional in concept: a) positive changes in emotional and social skills (Examples: Do you think he has improved his ability to spontaneously express emotions? Does the child relate more to others?); and b) educational software to support student learning (Example: What has brought the child to use educational software?).

## 4. Results

The results confirm that the use of technological media in teaching social and emotional skills is a support for students with autism spectrum disorders (ASD). The participants, despite the difficulties they showed before the intervention process, have improved their ability to successfully carry out tasks on emotional skills (Figure 1 and 2). These results are in line with the findings in previous studies (Cheng & Ye, 2010, Parsons, Leonard & Mitchell, 2006), whereby it is possible to improve the social and emotional skills of people with ASD with specific, explicit instructions through digital media.

Although these results must be interpreted with caution and their generalization is limited to the research participants, there are grounds for optimism as the teachers and families identified significant positive effects on the everyday lives of the ASD students. These improvements were noted in various situations (break, play, class) within the school context. To see if the learning acquired by students at school was extrapolated to other contexts in the real world

TEACHING THE RECOGNITION OF BASIC AND COMPLEX EMOTIONS



Level 1: Global recognition through drawings

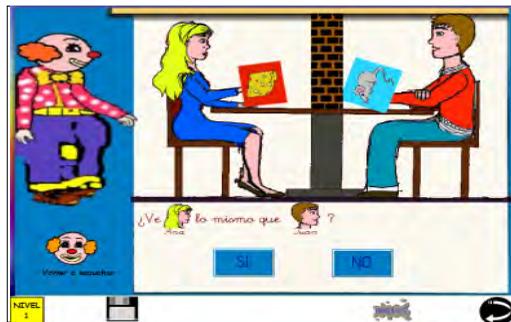


Level 5: Emotion judgments based on beliefs



Level 2: Global recognition through photographs

TEACHING TO PREDICT THE ACTIONS OF PEOPLE FROM THEIR TRUE OR FALSE BELIEFS



Level 1: Adopting a simple view



Level 3: Emotion judgments based on a specific situation



Level 2: Adopting a complex view



Level 4: Emotion judgments based on wishes



Level 3: Beginning to see it to know



Level 4: True belief and action prediction



Level 5: False belief and action prediction

Table 1. Educational software tasks.

such as the family, we asked the students' parents to judge whether the educational intervention process had been effective. One mother's comment was particularly relevant: «I can see significant progress in emotional recognition, in spontaneity and, above all, in the understanding of the emotional causes of his actions. For example, the other day he told me he would do a good job for me to make me feel happy with him. He was not able to express this previously».

The educational software used in this research is a recognized tool for teaching social and emotional skills to students with ASD. While typical children develop this emotional understanding without the need for an educational program, this is not the case with ASD students who require explicit teaching of social and emotional aspects.

We are in favour of educational intervention for students with ASD by means of computer and digital materials to improve their quality of life. Our research has shown the benefits of educational software which are integrated in a patient, continuous and systematic educational program that positively affects the daily lives of students with ASD – computer technology at the service of pedagogy. We believe it is possible, through continuous, systematic and explicit work with the support of visuals, graphics and interactive materials, to teach ASD pupils emotional and social skills.

The educational software used in this research has stimulated the emotional processes of identification, recognition and expression in students through an interactive, graphical environment that has systematized the teaching. Educational software, due to its simplicity and easy interpretation, has become a useful resource for students with ASD because of its user-friendly information processing, compared to other types and forms of representation. Educational software opens the way for sorting visual preference information, which is the predominant factor in these students' cognitive processes. This not only motivates the student but allows the teacher to develop the teaching of complex concepts (emotional and social skills) and positively encourages the student to tackle the learning content.

Another important aspect of the educational intervention with ASD students is to respect the pace at which they normally learn. The students need to learn and control a new skill before acquiring it. For this reason, the software was sequenced across various education levels to enable a consistent pace of learning in relation to the acquisition of those skills. Teachers with experience of students with ASD confirmed the accuracy of the sequencing of content, as the following comment testifies: «I value the materials very positively because they help to consistently systematize teaching concepts that are very important yet difficult to work with».

The educational software in this research not only motivates but also facilitates interaction, cooperative work and peer support. This has empowered ASD students to work in pairs, in which each student respects the learning pace of the other and helps with any difficulties. This is a considerable advance for people with reduced capacity for communication and social interaction, and was one of the main goals we set for the development of the intervention process. We did not wish to restrict the process to the instruction of the tasks proposed by the software, but to make the performance of these learning tasks converge with the development of social interaction processes.

The educational software can also be adapted to different contexts and to ASD students with a wide range of characteristics. The material designed, developed and implemented in this research can be applied to educational intervention with ASD students of various ages, as the material for the teaching-learning process is appropriate for students aged from 8 to 18. It can also be successfully applied to achieve the objectives set out for the teaching of social and

emotional skills to students enrolled in primary and secondary school education. Another advantage of the software is that it enables teachers to work with students with varied degrees of ASD. Its versatility, flexibility and task range adapt to the heterogeneity of characteristics presented by students with ASD. In addition, since students are used to different forms of schooling (standard classes and specialized open classes in mainstream schools), it can adapt to the organization and methodology as developed by teachers in their work with ASD students.

We conclude that the use of educational software for children with ASD responds to their individual characteristics and developmental needs as a means to improving their social and emotional skills.

### 5. Discussion

The approach of this research to the context of teaching people with special educational needs, particularly those with autistic spectrum disorders, enables us to draw a number of conclusions to reflect upon. First, education for diversity requires a wealth of materials in the classroom for teachers to draw on to be able to vary and adapt their students' learning processes (Lozano, 2007, Sanchez-Montoya & Madrid, 2008). This, together with the increased provision of equipment for schools, means that teachers of ASD students should have a wide range of resources at their disposal. Technological tools such as

the computer and software are one such resource. However, due to the specific needs of ASD students requiring instruction in social and emotional and skills, and the necessary customization of that teaching, teachers who currently work with pupils with ASD find they have few resources to count on. Our research suggests that educational software is a useful support tool for teachers and those in training to meet those needs.

What are the opportunities and possibilities presented by the use of technology in the teaching of students with specific educational support needs and those with ASD? More research is needed to realize the educational potential of the applicability of technologies to these students, especially those with ASD (Rajendran & Mitchell, 2000). It is necessary to discern how technologies add value to the education of pupils with special educational support needs, to confirm that they are more than just tools, and that they can be incorporated in curriculum areas and help achieve individual goals to solve difficulties in accessing or learning in specific educational cases. This investigation confirms that ICT use in educational contexts enables the development of methodologies that promote the individualization and personalization of education. New technologies, thanks to their varied pace and combination of graphics, sounds and animation, create a dynamic, attractive and motivating environment for pupils with special educational needs, particularly for students with ASD.

Secondly, educational software is intended to assist those teaching social and emotional skills and to be an affordable means for teaching the standard curriculum. Educational software motivates and stimulates the learning of these skills, and can individualize instruction to promote the autonomy of students with ASD, allowing pupils to initiate, develop and complete the tasks at their own pace and enable them to step out of their isolation by interacting with a character (Zapo the Clown) and participating in a learning task that is fun. It also allows them to interact with a peer, thus enhancing the child's relationship with others. The software aims to support teachers as

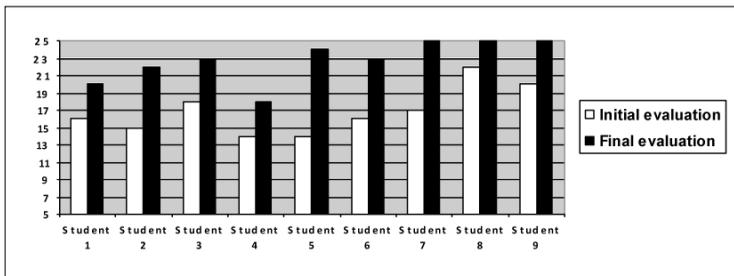


Figure 1. Learning outcomes of the recognition of basic and complex emotions<sup>1</sup>.

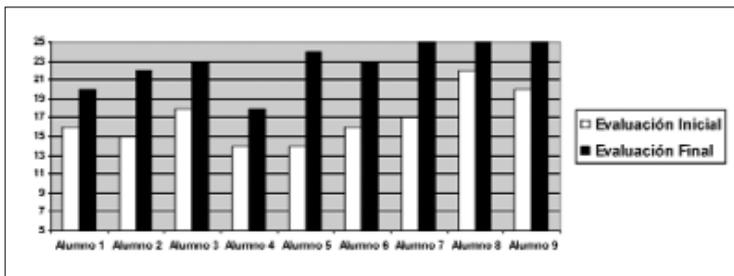


Figure 2. Learning outcomes of teaching to predict the actions of people from their true or false beliefs<sup>1</sup>.

they impart the content that promotes the development of a teaching-learning process of social situations which tells stories, presents rules and norms, and aims to foment the social inclusion of these students by exploiting their learning potential to help them overcome their possible cognitive limitations; it provides information by processing visual preference with its incorporation of a multisensory communication model. Thus, the instructions given by Zapo are given in auditory and textual form in clear, simple language adapted to the needs and information processing of individuals with ASD.

Thirdly, the results of this investigation lead us to agree with Chacón (2007) on a fundamental requirement of incorporating ICT as a tool for personal development in the teaching of pupils with special educational needs. The significance of technology is not only in access to important curricular content, but the personal and social consequences of such access (Alba, 1998).

In this sense, the media must be appropriate to the teaching methodology and consistent with the abilities and learning styles of students. One of the advantages of educational software is the possibility of using it in different scenarios: regular classes, small group classes, computer classes for all, etc. As the educational software logs the progress of each student who uses it, the teacher can adapt the course to each student.

In conclusion, the research objectives have focussed on the concerns of social and educational institutions to meet the challenge of accessibility and use of technological media. This project aims to promote digital inclusion in the media to enable the integration of people who have difficulty in accessing technology. In our view, the overcoming of this barrier is conducive to inclusive education and positive educational settings where all students have a place. This in turn will help to eradicate the digital divide in access to and use of computers that occurs among different groups, such as people with ASD.

## Notes

<sup>1</sup>The teaching tasks are divided into five levels where the point awarded at each level varies in progressive value to task completion (Value 1: Do not exceed the level. Values 2-4: intermediate values not exceeding the task. Value 5: above the level).

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