Development of an interactive tool for soft skills enhancement in people with mild cognitive disabilities

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Abstract. Audio-visual tools make learning and retention of knowledge much more practical and dynamic, both for people with special educational needs and for most of the student population, because human beings tend to be more receptive to visual and auditory references about any subject. For this reason, this research proposed the development of a digital booklet to strengthen the soft skills of people with mild cognitive disabilities since these persons have more significant adaptive difficulties limiting their interaction in different activities and environments. At first, a documentary search allowed the delimitation of the problematic area in general. After the selection of the target population, different techniques and instruments were applied to know in detail the real conditions and learning needs of the selected sample. The obtained information led to the characterization of the population under study and the classification of their learning needs. The analysis delivered the design and structural requirements of the booklet, in the form of partial results leading to the next research stage to develop the prototype of the primer.

1. Introduction

In current education and society in general, information and communication technologies (ICTs) have evolved from a luxury for a few persons into the media for fulfilling the universal needs of many people. Specifically, ICTs have become one of the main tools to generate significant learning in educational environments. This significant learning process starts with informal educational structures such as the family, and higher education institutions must guarantee the availability of different tools and teaching materials appropriate for interaction with the new technologies. The use of ICTs makes possible the integration of many audiovisual aspects, producing a more active and dynamic learning process and increasing knowledge acquisition. In addition, ICTs for education allow the construction of significant learning from self-exploration and experimentation not only for people without any cognitive limitation but also for persons with special educational needs (SEN).

In this context, the research interest looked for meeting the needs of the population with SEN through ICTs. For this purpose, the target population was defined, considering the classification issued by World Health Organization (WHO) concerning the different types of disability [1]. Attention focused on the mild cognitive disability (MCD); a condition medically understood as a disease with vast social implications [2]. Beyond the ailment itself, the main problem of patients lies in the social limitations
from the lack of the necessary conditions for the diagnosed individual to enter society without major trauma [3]. Mild cognitive disability is also characterized as a disability in “educable stage” producing minimal deficiencies in the sensory-motor area. Often, patients are not distinguishable from individuals without cognitive disability, since they acquire adequate social and labor skills for a minimum autonomy [4]. With an adequate support system in place, subjects with mild cognitive disabilities get to live satisfactorily in community [5].

Consequently, the research objective is the creation of a set of illustrated digital booklets to strengthen the development of soft and hard skills in people with mild cognitive disabilities. Hopefully, these primers will improve the integration of patients with MCD in different social environments. The set of booklets will serve as a library, including several learning modules with technical, applied knowledge but also focusing on the human being. This article describes the experimental work and the design processes required to create the booklet characters. The desired booklet intends to strengthen essential soft skills identified as lacking in the population under study. Results also present the definition of the design priorities and the structure of the digital booklet, through the identification of individual and collective contexts.

2. Design of state observers

2.1. Findings from documentary search

A documentary search identified that the didactic material existing for the population with mild cognitive disabilities (and with special educational needs in general) is mostly limited to video games [6]. This fact presents an opportunity to deliver teaching material through digital booklets, with illustrated and animated contents contributing to the development of soft and hard skills in the population of the study [7].

This work expects to help people with cognitive disabilities to recognize and improve soft skills such as self-confidence, creativity, teamwork, responsibility, and respect. This will impact their performance in daily activities, in the labor and social field, in stress management, and improve leadership, and emotional communication, among others. So, the selected media for communication with the MCD subjects was a digital booklet. The booklet also intends to encourage MCD patients to solve problems on their own and to become aware of space and time.

The booklets are considered as publications that concisely expose the concepts and tools necessary to teach and develop new skills or provide information to the reader. Directly or indirectly, a booklet or primer entails a pedagogical component, either from the content or the tone of the transmitted message. This feature makes the booklet a prime candidate for achieving high impacts on the population that has access to them [8]. For the specific objectives of this research, the designed booklet needs to satisfy the following requirements [9]:

- To deepen the learning experience, the activities developed by the booklet characters must be repetitive, since people with cognitive disabilities learn more through repetition and the performance of simple cyclic actions. Repetition helps MCD patients to internalize and develop the rational process somewhat mechanically, with clear and concise commands, which sometimes make use of the notions of the so-called common sense [10].

- The digital content for the development of skills in people with MCD should consider some formal characteristics that enhance the effectiveness of the intended message. These could be named as the requirements of this condition, such as clear and concise representations, quick reading elements, shapes, colors and easy to identify textures, iconographic language, intuitive methods of use, fair information, color plans, and basic volumes [11].

- To preserve their attention, everything in the material should be visually attractive but avoiding the excess. The overload of stimuli or information generates a state of disintegration where the person with a cognitive disability does not relate to the product. Then, the subject would be unable to internalize the message, or the understanding process will be more laborious [12].
2.2. Experimental framework
The research carried out was qualitative, non-experimental, cross-sectional, with an exploratory-descriptive approach. Experimental work led to the extraction of the specific characteristics, profiles, and features of the population under study, producing the necessary input for the development of the booklets. In this way, it was possible to determine precisely the dimensions of the context and real situation of the apprentices participating in the sample [13].

Once the study problem was known in-depth, the applied investigation stage focused on the resolution of the identified problem, through the design and development of the illustrated digital booklet. The planning phase of the primer development involved the use of Scrum methodology. A very important feature of this methodology is adaptability since the practices in the product development process are not specified, providing flexibility and the adjustment of the design process to the conditions of each project.

The study population of the project consisted of young “Servicio Nacional de Aprendizaje (SENA)” students with mild cognitive disabilities, with ages between 20 and 30 years. The type of sampling used was probabilistic at convenience, applied jointly with the participation of another group of SENA students, this time from the logistic assistant program. Primary information was obtained from the instruments designed by the researchers through different data collection techniques. As the sources of secondary information, databases of indexed journals were consulted to gather information about the current state of the problem investigated, in both national and international scenarios.

3. Results and discussion
This section presents the results of each phase of the experimental stage of the project. Results of stage 1 give an account of the fieldwork that was carried out to characterize the population under study and their learning needs. Results of stage 2 describe the development of the booklets according to the findings of stage 1, highlighting aspects such as colors, designs, preference of animals, and learning needs. The goal of the second stage was to account for the highlighted aspects in the booklet design to make the product more suitable for the study subjects. The results are presented sequentially, starting with the fieldwork that involved observation, interviews, and tests with focus groups, and finalizing with the modeling and animation of the story characters.

3.1. Phase 1: Data collection for the design of the characters of the primer
At first, an observation visit was initially carried out to know the reality through the direct perception of the studied subjects and their environment. For this, checklists were elaborated to determine the most significant focus of attention. Observers freely interacted with studied subjects, and all the participants knew about the reasons for the visit and the study being performed.

This initial approach identified the different health maladies and disabilities suffered by the target population. Some of the diagnoses corresponded to Down syndrome, deafness, blindness, and mild cognitive disability. Once the different diagnoses were known, the unfeasibility of designing a product that would reach all the population was evident. Each disability has a different way of learning according to its characteristics, and the research team prioritized one of the impairments to address with the booklet.

So, this process led to the focus on the patients with a mild cognitive disability. The observation visit identified some behaviors and characteristics of subjects with MCD. People with mild cognitive disabilities are very visual people, and they paid attention to the way other people looked at them, to how they looked. They breathe harder than other people and always felt the need to see the facial gestures of those who were talking. They demonstrated excellent handling of mobile devices. Subjects with MCD repeatedly showed immaturity in social interactions compared to the remaining of the population. They also like pets because it reinforces the company and the feeling of happiness. Although many of them perform activities within the community, they often suffer from anxiety and notoriously low self-esteem.

The second approach involved the interview of several experts with daily interaction in educational settings with the selected subjects of study. Their information was collected through a professional
conversation with a semi-structured form, and the data allowed to recognize the investigation object from an external point of view. In particular, the psychologist who daily supervised the formative process of the apprentices stated (textual cite): “These persons have been overprotected, and most of them have been raised by their parents or by family. They have not received the chance to see what they are capable of, nor what they are capable of achieving”. These interviews led to focus the research into boosting the confidence of the MCD patients, and the increment of their autonomy in aspects such as money management and urban mobility. Therefore, the soft ability selected for the first primer was self-confidence, understood as the intimate conviction of being able to complete a specific task or mission successfully.

In the third experimental interaction (see Figure 1), a Focus Group was carried out with basic association techniques to determine the preferences of the MCD subjects about colors and animals. At first, the subjects were invited to give a presentation of themselves, indicating full name, age, favorite animal, and a color for the animal. The presentation activity involved the analysis of aspects such as creative ability, empathy, preferred colors, attitude when they indicated color, relationship with animals, preferred animals, and body expression. Later, the study subjects were invited to draw freely with color pencils, while different musical tones were played in the room. The most used colors were green, blue, yellow, red, orange, purple, and pink. Collected information determined the characteristics and circumstances involving the story characters in the booklet. Also, researchers decided to feature characters with fanciful characteristics, but reality based.

![Figure 1. Images from the third experimental contact with apprentices with cognitive Disabilities.](image)

3.2. Phase 2: Design of the characters for the primer

From the findings of the previous phase, the first schematic illustrations were drawn in a paper using red and granite pencils. The sketches propose two complementary characters resembling a young man and his pet. The latter represents a bond of empathy between characters and an agent of identification with the target population. This phase also explored the interaction of the study subjects with the didactic materials and their perception of reality. The analysis helped to delimitate character features and the fantastic elements to make the characters more striking for the population under study. So, the young man called "Teo" has superhero traits, and his pet "Stains" (called Manchas in Spanish) has the phenotype of a dog with dragon-like wings and tail. The fantastic elements of the pet obey to the presence of the dragon figure in the findings of fieldwork. Figure 2 describes the features of both characters, materialized in a front view and a side view of each one.

![Figure 2. Sketches for Teo (left) and his pet Stains (right), characters designed for the booklet.](image)
Then, a color proposal was made for each character considering the predominant colors identified in the previous fieldwork. These inputs were used in the process of digitalization of the characters. Figure 3 shows the computer-generated sketches closer to the characters in 2D and 3D formats intended for the primers.

**Figure 3.** Process of creation and development of color sketches for booklet characters.

### 3.3. Phase 3: Design of the characters in 3D modeling

Once the characters were available in colored digital sketches, the process for their representation in 3D computer models starts with using a rectangle to create volumetric spaces. The 3D modeling tools include Blueprint technique and the software package Autodesk Maya. The first 2D sketches are inserted in the software as reference images. Then, the volumetric rectangle is morphed into the 3D character with the front and side views from the sketches as guiding images, and a polygonal grid for drawing reference. The same process goes for both characters, as seen in Figure 4.

**Figure 4.** Process of creation and development of 3D modeling of booklet characters.

The hair of the "Teo" character was one of the more attractive features according to the information from tests with the target population. For the booklet, character hair was modeled using the ZBrush software, a computational resource with tools offering better results in terms of shape and structure of the design. Figure 5 illustrates some aspects of this process. The sketch started with a sphere, and then a mask with the partial hair pattern was created with a standard brush. Then, the hair details were molded using specialized paintbrushes from ZBrush. After finishing the latter process, the designed hair discretized in the least possible number of geometric polygons, using the geometry tool of ZBrush. The resulting design was exported in a format compatible with Autodesk Maya to be integrated with the 3D sketch of the character.

The final step relies on the texturing process to increase realism and the feeling of the characters being alive. This feature improves the interaction with users generating more interest among them. However, textures are still images reflected over the character design using coordinated representations.
The latter is a tool that skews the primitive figures to achieve a better similarity with the initial sketches. At this point, the prototype design of the booklet characters is obtained, resulting in the images shown in Figure 6.

![Figure 5](image1.png)  
(a)  
(b)  

**Figure 5.** Images from the hair modeling process. Mask creation in Zbrush (a) and hair integration with the 3D sketch in Autodesk Maya (b).

![Figure 6](image2.png)  

**Figure 6.** Booklet characters after the texture creation process.

4. **Conclusions**

This work intends to help people with cognitive disabilities to recognize and improve soft skills such as self-confidence, creativity, teamwork, responsibility, and respect. This will impact their performance in daily activities, in the labor and social field, in stress management, and improve leadership, and emotional communication, among others. So, the selected media for communication with the MCD subjects was a digital booklet.

A documentary search identified the lack didactic material existing for the population with mild cognitive disabilities, and the design requirements for the booklet. The experimental work highlighted the importance of the identification of young people with disabilities with the proposed characters in the designed booklet. For this reason, the personalization of design is a recommended resource. The subjects are given simple options to involve them in the creation of the final characters for the didactic experience.

In general, the project seeks to impact the lives of people who have this different type of condition through the development of the so-called soft skills. This will increase their capabilities of incorporation in the labor market.
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