PICTOTEMPO: An App for Personal Organization in Autism Spectrum Disorders [†]

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Abstract: In this work, we develop a mobile application which allows to create digital schedules for children with autism spectrum disorder. These schedules comprise a sorted sequence of tasks or activities which facilitates children to understand and anticipate the upcoming events, thus reducing their stress and frustration. For that, the activities are identified and described with the help of visual supports (pictograms) which can be visualized on the screen of any mobile device. The developed application also allows to gather valuable information about the performance and interests of the children from their interactions with it, helping to refine and define more appropriate routines or support therapies for the children. In this way, the aim of this work is to contribute to improve the lives of people with functional and cognitive diversity, especially children with these disorders, and also their families.

Keywords: data analysis; diversity support; mobile application; service-learning; social digitization

1. Introduction

The Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder which usually shows up during the first years of a person's life. The use of suitable software tools and adapted technology can become a differential factor by accentuating the positive impact of the professional interventions on their preparation and application, and also on organization of daily routine of people with ASD, thus changing the way they interact with relatives [1]. This disorder includes some common characteristics such as the presence of difficulties in the nature and quality of social and communicative interactions, very restricted interests and difficulty in facing unanticipated changes in their daily routine [2]. In this sense, the use of pictograms helps these people to understand and assimilate those actions, instead of using oral or written instructions [3].

In this work, we present a mobile application, referred to as app in the following, and termed as PICTOTEMPO, which allows to create in a simple and systematic way digital daily schedules for children with ASD or with any other type of functional or cognitive diversity. These schedules comprise the sequence of tasks and/or activities sorted and associated with the corresponding temporal slot in which they must be completed by the child. In this way, the user (child) can check the task/activity at every time interval, which is shown through pictograms that facilitate the child's comprehension. These digital schedules hence replace the "manual" ones which are traditionally used to work with these groups, thus optimizing time and resources. Another important novelty of this app is that it allows the collection of information for the monitoring of the tasks completed by the children with the aim of improving the therapeutic interventions.

2. Materials and Methods

The chosen methodology for the work was Scrum, because it is characterized by being an agile methodology with an incremental and iterative development. According to this, we initially define a set of high-level requirements for the app and split its development into six iterations or sprints with a same length of two weeks.

In addition, this software methodology was combined with another work methodology known as Service-Learning (SL) [4]. SL emerges as an excellent mechanism to integrate the development of socially responsible and committed citizens during student's formal education. Considering this methodology, this work was carried out with the collaboration of a social entity devoted to children with different types of disorders, including ASD, reading and writing disorders or other functional diversities. This collaboration involves the definition of app requirements, the realization of some tests to evaluate visual design and app functionalities, and also the tests in real scenarios with children affected by ASD, which greatly helped to improve the final product.

3. Results

In this section we present the app, which is divided into two clearly different modules: one for the users, i.e. children with some type of ASD, and another one for educators or relatives that work with them.

Regarding the user's module, the app is oriented to show, depending on date and time, the task/activity to be performed by the user in that moment. As observed in Figure 1, this module is designed and adapted to facilitate the interaction with the child. In this sense, the aim was to provide a simple, friendly, clear and uncluttered interface without distracting elements.
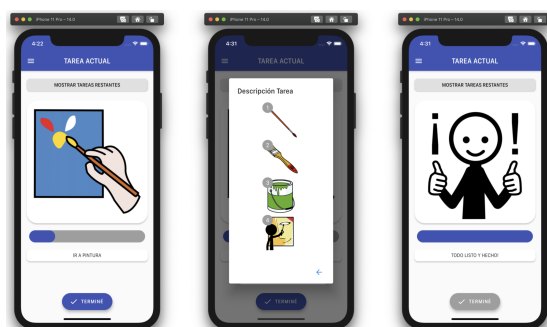

Figure 1. Examples of some views in the child's module.

As before, the educator's module is adapted to simplify the main actions such as create tasks and routines, manage users or obtain and visualize statistical results.

Figure 2 shows some illustrative examples corresponding to the app's view for the creation of routines and tasks. An administrator of this app (relatives, educators, professionals) could create routines with their corresponding tasks/activities, which must be allocated to a specific available temporal slot.

Another relevant functionality in the educator's module is the visualization of statistics as a result of data register. This functionality allows to interactively visualize useful information about the completed tasks (see Figure 3). These statistics show whether the tasks were completed or not, the percentage of time used with respect to the time initially planned for the completion of a task, and the success or not about its completion. The statistics are a key point for education in the context of the ASD since educators will be able to obtain valuable information about children performances according to work areas or their preferences and interests, for example. This information can hence be used to adapt routines or therapies to each child.
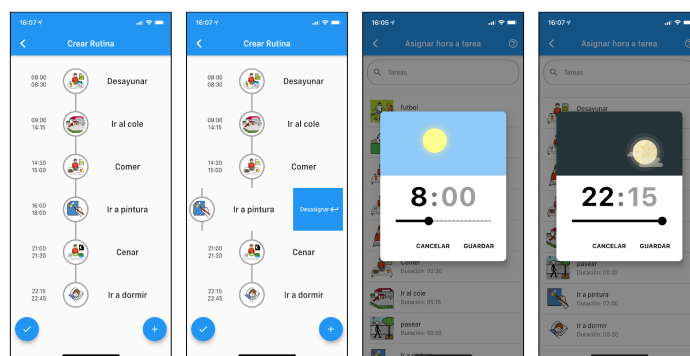
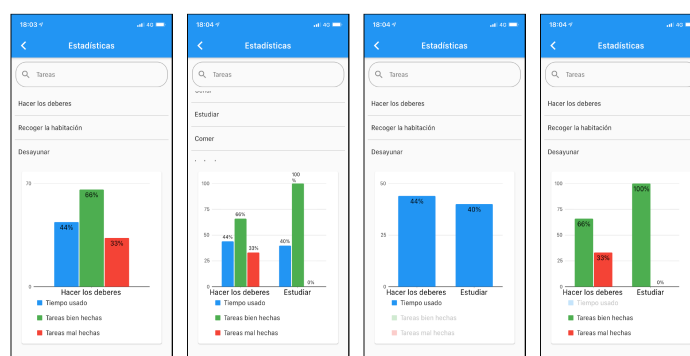**Figure 2.** Examples of some views for the creation of routines/tasks in the educator's module.

Figure 3. Examples of same views of statistics in the educator's module.

4. Discussion

The aim of this work was to improve the lives of people with functional and cognitive diversity, especially children with ASD, and also their families. Considering the feedback from the collaborator entity, we can conclude that a complete and functional mobile application has been developed since it meets its needs and those of its users. Therefore, it could be employed by those entities, educational environments or families of children with ASD. Finally, it is worth noting that in the current pandemic situation, this type of developments allow to remotely monitor and provide support to these more vulnerable groups avoiding risks of a face-to-face service, which is often not possible.

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Abbreviations

The following abbreviations are used in this manuscript:

ASD   Autism Spectrum Disorder
SL   Service-Learning

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