















9. To eliminate the generated category, but only in the English language;

10. To create a new symbol with an audio in a category;

11. To create a new other symbol, exclusive for a student/patient;

12. To add five more symbols to a student/patient board;

13. To add three symbols to all the student/patient boards simultaneously.

Concerning task 1, the therapists did not show any difficulties, so they easily performed the task.

For the therapists, the accomplishment of task 2 was also considered easy. They liked the two possible ways of existing authentication. However, they pointed out that, for a student/patient, there may be problems in entering the password and suggested the use of a standard of colours or images, rather than a typical alphanumeric password.

In general, task 3 was also successful. There was a little confusion on the part of one of the therapists. One of the buttons on the main menu suggested her that the data of her account could be altered, through it, although it was not possible. The name of the button was, then, changed, in order to avoid other confusions.

Task 4 was successful for all the therapists. There were positive findings in relation to some aspects of the interface. However, there was a small detail that caused some displeasure. It was also noted a lack of necessary information.

Task 5 was successful, with nothing to point out.

Task 6 was successful, with no difficulties, but one of the therapists wondered about what she was doing. The information presented was related to the messages created by the selected student/patient, but there were some doubts as to the origin of the displayed messages.

Task 7 was successful. There was, however, a grammatical error pointed out that generated some confusion. It was also difficult to take a photo and obtain it automatically in the application, but this problem is external to the application because it stems from bad implementation in the original application of the camera found in the brand Samsung devices. Using a third-party application, these difficulties do not exist.

In the successful task 8 was just pointed out the fact that a country flag should not represented the communication language used there, but, instead, it should be used some other representation.

Task 9 was performed without any problems and without comments.

In task 10 there were no difficulties and there was a positive assessment because a symbol also had an audible component. One of the therapists thought that possibility was very interesting, for example, allowing a student/patient to go to a public place, for example a coffee shop and show the message, simplifying the communication process and his/her autonomy a lot. That therapist further considered that this mechanism could help the communication between patients with different difficulties. Some suggestions were also made, such as adding different audios to a symbol, in order to simulate the voice of an adult (men or woman) and a child (boy or girl). The most negative aspect revealed with this task was related to the recording time (5 seconds) of those same audios because, as it was, it proves to be a little short. This change was immediately altered.

Task 11 generated some doubts concerning assigning a single symbol to a student/patient and the possibility of, eventually, this symbol being passed on to another student/patient or being available to all of them. Some of the suggestions made by the therapists were a little against the idea of using a single symbol: a symbol that just has meaning to a certain student/patient, as for example a symbol with the photo of his parents. In this context, to pass on this symbol to another student/patient would not make sense and even less if this symbol was available to all the students/patients. A suggestion to solve this problem could come by creating a category with symbols that only one or a few students/patients could use.

In task 12, the icons of the button and expressions used generated some confusion concerning each one's features. Several suggestions were made to improve, such as a new design for the icons and additional information visible when editing the board of a student/patient. There were also found some critical errors that were corrected, after the tests.

Task 13 also generated some confusion for the same reasons of the previous task.

When the tasks were completed, the participants filled out an evaluation questionnaire concerning the system whose purpose was to gather additional information about their experience of using it. A five point Likert scale was used, where 1 is "Very difficult", 2 "Difficult", 3 "Moderate", 4 "Easy" and 5 "Interesting". Aspects were filled on "Easiness of use", having this aspect obtained the classification of 4.5 (Easy), Organization of the information, having



obtained the classification of 4.25 (Good), Layout of the screens, having obtained the classification of 5 (Obvious), Nomenclature used in the screens, having obtained the classification of 4.25 (Obvious), Messages of the system, having obtained the classification of 4.75 (Obvious), Assimilation of the information, having obtained the classification of 4.75 (Easy) and overall assessment, having obtained the classification of 5 (Interesting).

In the end, the participants also had the opportunity of openly comment on the tests. So, they had the chance of entering a student/patient's account in order to also give some opinions and suggestions concerning the difficulties they thought the patients would experience. Overall, they liked it and they found useful and suitable the implemented features. There also were some suggestions concerning the implementation of new features. Among them, there is the possibility of sending a message created by e-mail. Another one concerns the existing of a new button, in the screen where the message is created, enabling erasing a message at once. This button would still have a new role of restoring the message, if the student/patient would have touched it by mistake.

In performing some tasks that required more information from the server, such as listing all the categories and symbols, there were some technical problems due to the slow access to the Internet. One of the most serious problems was the fact that the application was constantly waiting for the rest of the data, but these data were slow to be sent by the server. If a connection remains too long without any flow, it is cancelled. However, it was not the case during the tests with the therapists. Once the application is "blocked" when communicating with the server, it will be necessary a way to cancel the operation, if a similar situation happen again.

Another problem found, in only one of the test devices, was the lack of memory to support all the symbols available at the time. Although the device had more than enough memory to support the information that was being requested, for one reason or another, the application was discontinued by the Android system because there was no more available memory for the application. As this problem could quickly become alarming, when the number of symbols would increase, it was fixed as soon as possible.

## 5 Conclusion

As active citizens working with technologies, we cannot ignore the possibilities that they can offer to promote the inclusion of people with disabilities. In this paper we presented the Symbolum, an alternative communication system using pictographic symbols to promote the possibility of individuals not able to communicate verbally and/or writing (such as those with cerebral palsy). Since the beginning of the planning process, we followed an iterative development methodology focused on users. Hence, throughout the development we focused on understanding the user, their goals and tasks as well as the environment (physical, organizational, social) around them, with permanent meetings with therapists and carrying out some observation sessions with Cerebral Palsy users and with users who just have speech difficulties. Now, because the Symbolum application is almost finished, we submit it to tests with therapists. The description and results of these tests were presented in this paper. The next phase will be the scenario-based usability tests with patients. This is a fundamental aspect, which was not forgotten, because if they negate the system then all other evaluations will not make sense. Nevertheless, we considered that the small-scale evaluation done was useful for improving usability of the Symbolum and UX of prospective users.

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