Design of a tablet application for supporting nutrition and dietary guidance for children and caregivers

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ABSTRACT

In this paper we describe the design and implementation of an application for Android tablets. The aim of the application is to bring together parents/caregivers and children by providing a tool for them to learn about nutrition. The main goal is to support the development of healthy eating habits in children between the ages of 3 and 6 years old. We describe our design and development process, as well as our decisions regarding the content and language. We also evaluate our design against the official UI guidelines for Android.

Keywords

Mobile application, design for children

1. BACKGROUND

Healthy eating habits are an important part of a healthy lifestyle. It is important to teach children from a young age about the different types of food and why they are good for them. Caregivers and educators have many tools at their disposal to teach children, from posing a positive example in their actions, to books, videos and games[8]. Mobile devices pose new opportunities to expand this toolset, allowing for the creation of stimulating education applications.

Children tend to like food they are more familiar with. Therefore, exposure to healthy types of food can lead to children having healthier eating habits[4]. We believe that by presenting information in a way that can spark children's curiosity, we can contribute to that positive exposure. However, it would be necessary to follow up this theoretical introduction with actual tasting of the food, an action that depends on the caregivers. The role of the application would be to increase the probability of children trusting the food they are being offered and giving parents tools to introduce new food to their children.

As part of our exploration for this design, we searched for educational and nutrition related applications in Google Play and the App Store.

The most common applications related to nutrition are directed to a general public and show nutrition fact of packaged foods[10][11] . Many applications for dieting and counting calories extend this category. These applications are aimed mostly for adults, and teenagers in some cases, to use as reference when selecting the food they eat. However, the information they provide is numeric and very specific, e.g. the amount of calories, protein or fat in a portion, and is not useful to teach children about the general properties of different types of food.

In the category of educational applications for children, we found examples that rely mostly on images and sounds to teach different subjects. Applications like Kids Zoo[2] and Learn with Fun[3] rely on the association of images and audio to teach children about animals, vegetables, shapes and colors. The design choices in these applications are also consistent in the graphical choices made in children's books, which make use of big images, short and simple text and, in occasions, audio[15]. Another important aspect to note is that these products are often aimed at parents as well, given that children at that age are not yet able to read.

Another interesting educational game is Go Go Mongo[16], which has the purpose of teaching children about the quality of food. The player has to make sure that the character eats the indicated food. The character will get sick if he eats the wrong thing, for example, cake when he should eat pineapple. The interaction is simple and straightforward since the player just needs to tilt the device to make the character move. (**Figure 1**)

The use of digital games as educative tools is not new, and it can be traced back to the 50s [6]. Therefore, an extensive research about the topic has been and still is being conducted, providing many different approaches and ideas. A big part of these discussions are related to how to engage the user and, hence, take the most educational advantage from it.

Malone and Lepper [14] talk about the different types of motivations one can use when designing a game. Some of them are extrinsic to the game, and make the game more dependent to external factors, and the others, the ones we will focus about, are intrinsic to the game. Those motivations are challenge, control, fantasy, curiosity, competition, cooperation, and recognition, and help generating what it is usually referred as the flow [5], state that is a strong sign for learning [9].

A good approach in order to achieve the flow experience is to relate the educational material to the intrinsic motivational elements [13], making it part of the game world and delivered by the fun parts of it. Moreover, representations of the information play a big part in the learning process [1], since the use of appropriate interactive representations increases the learning outcomes of the game.

Figure 1. Go Go Mongo

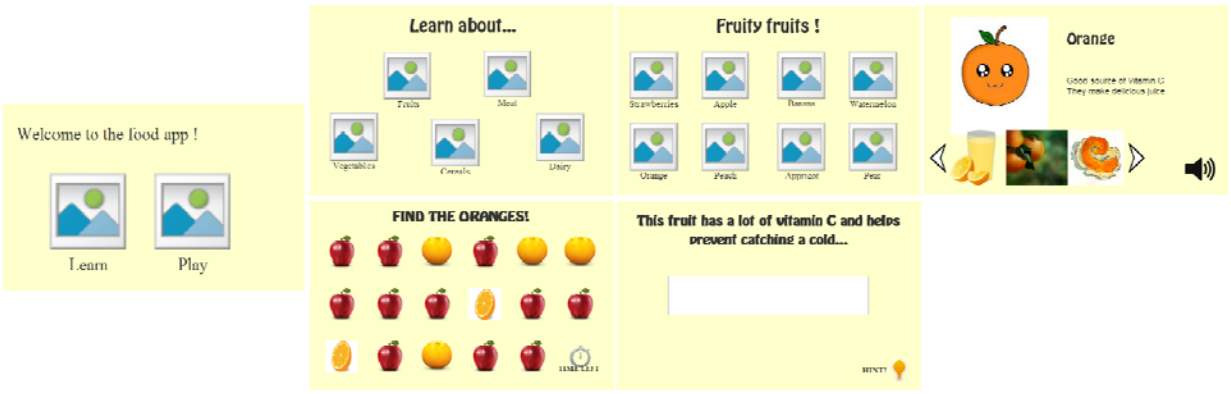

Figure 2. Prototype

2. CONCEPT

By designing a tablet application, we want to take advantage of the novelty element of the device and the possibilities of creating interesting interactions, while providing a new way in which parents can help their children adopt healthy eating habits. With this application, we aim at assisting the caregivers (parents, teachers or tutors) to guide children through the learning process. The idea is to get caregivers and children to learn and play together in a stimulating and fun way.

We have designed a tablet application, for parents and their children, that serves as a tool to build healthy eating habits by teaching the nutritional values of the most common food groups. The application has two sections: Learn, which has "cards" with information about the food, organized by category; and Play, which helps children view healthy food as fun and reinforce what they have learned.

Our main target group is children between the ages of 3 and 6 years old and their caretakers, though it could be used by older children. Since our aim is to reach children that have not learned how to read yet, we will be making heavy use of images and sound, while including text description to give caregivers the opportunity of reading to the children themselves.

We envision this application being used when parents want to increase the chance that their child will accept new types of food. For example, if they would like to include broccoli in a meal, they can start by familiarizing the child with it. This would be a good tool because it is easier to teach children when using visual aid and playful activities.

3. PROTOTYPE

After defining our concept, we created a low-fidelity interactive prototype with the intention of defining the basic elements of the interface and navigation. As you can see on **Figure 2**, the main screen has two options: Learn and Play. At this point, we had decided on tapping as the main mean of interaction with the elements on the screen. When tapping on Learn, the user is directed to a menu of categories and the navigation follows to a grid with the food items and an individual 'card' for each one. For each food item, a main image, a description and related images are displayed. An option to play an audio recording of the description is included as well.

In the case of Play, the user is directed to a mini-game where he must collect the food item that is indicated. A second mini-game consists of a quiz question related to the description of the food item and the user must enter the right option.

From making this prototype we learned that we should keep text to the minimum in the design. In the final design, shown on the mock-ups in **Figure 3**, we rely mostly on images and audio. Our design states that all the images are accompanied by an audio recording with its name when they are tapped. For example, if the category of fruits is selected, the name 'fruits' will play for the child. The user gets the same audio feedback when tapping any of the related images in the details section. The use of text is limited to the navigation buttons, with the understanding that an adult in will be the one doing this part, and the description/quiz question for each food item. In this case, we also include the option to play audio. Caregivers may choose to play the text for their children or read it themselves.

4. DESCRIPTION OF THE APPLICATION

The final app is called Food School. **Figure 3** shows an overview of the different sections and a video of the working app can be seen here: https://vimeo.com/55961620.

As we have said before, the app has two sections: Learn and Play. For the Learn section, we feature five categories: Fruits (12 items), Vegetables (12 items), Protein (6 items), Dairy (4 items), and Cereals (5 items). We decided to limit the selection of items for this implementation by presenting only one page for each food category; however, it is possible to extend it in the future, if we decide to release the app. In the extension of the categories, more pages can be added and the interaction will include swipe and navigation buttons.

For the final version of the Play section we added the option of playing by category, adding 'All' as an option for players to quiz their knowledge on all categories. The objective of this section is not to keep track of the right answers, which is why the app does not keep score. Instead, it is to reinforce the knowledge gained from the Learn section.

The play section we have designed consists of two parts or mini-games. The target of those mini-games is mainly to enable the child, with the help of the parent, to identify a specific food. This is achieved through the gameplay we have chosen. We have separated the foods in categories according to their type (vegetables, fruit, dairy, protein/meat, cereals). The player can pick one of these categories to play with, while there is also a category which contains all the foods. After the user has chosen a category, the game starts.

The first part is a quiz game where the player has 60 seconds to pick the right answer. A description of a food is given, which contains facts about its nutritional value. Below the question there are four possible answers in the form of images. The player can

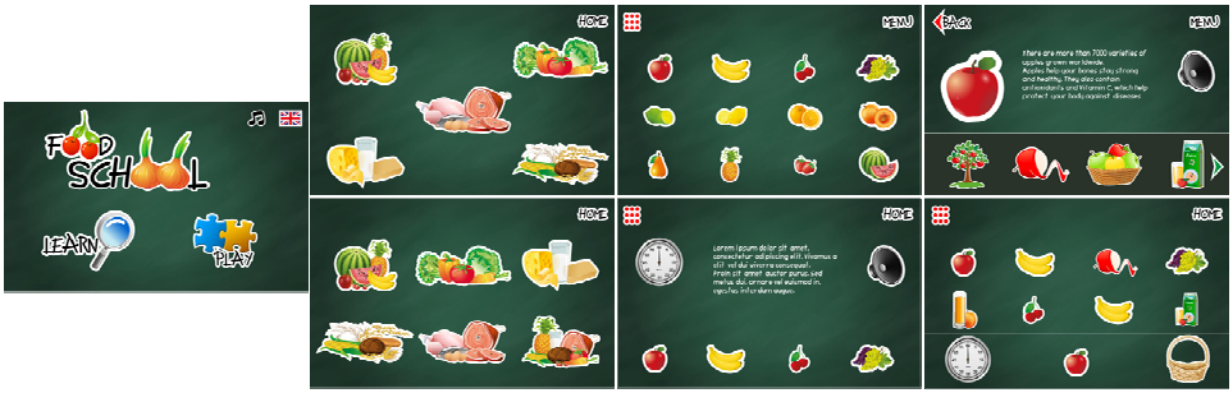

Figure 3. Final design mockups

tap on an image to select it as an answer. After the player taps on an image, feedback is provided on whether the answer is correct or not and the second mini-game starts automatically after a few seconds.

The second part is a drag and drop game, where the player must collect as many items of the food mentioned in the previous part as possible, within 60 seconds. The items are placed in a grid and the player must drag them and drop them in a basket that appears on the bottom right corner of the screen. Again, feedback is provided when the player attempts to place a food inside the basket. The grid re-populates with random foods every time one item is dragged away. After the 60 seconds are done, the quiz mini-game comes up again automatically with a new random food from the selected category.

The number of rounds is as many as the foods in the category chosen. After all the foods of the category have come up, a simple ending screen appears that informs the player that the game is over.

Due to time-constraints and prioritization, the actual implementation of the game lacks a couple of the aforementioned features. To be specific, the second mini-game works a bit differently since the player taps on the proper food, receives feedback and then the quiz game starts again. So there are no draggable items and re-population of the grid within a 60-second time span.

5. USER TESTING

During the process we got the chance to contact one of the teachers at the "The International Preschool of Gothenburg" who gave us an important feedback regarding how to communicate with children, from an expert point of view. This input helped us in the design of the graphics and written information to be used within the app interface and database.

In addition, the possibility of carrying out a user test with children within our target group at the mentioned school was presented during these conversations. We thought this test as a workshop where children were allowed to use the app freely and, at the end, we would analyze the results of the observation with the collaboration of the teachers as experts.

Unfortunately, we were not able to match their calendar with the schedule for the course and we decided to limit our collaboration to the feedback from the teachers. However, it would be an interesting addition to the app's evaluation if the project was to be continued.

6. DESIGN AND WORK PROCESS

Our work process was divided in four major stages:

1. Definition of the concept, in which we decided the main questions of what, who, when, where and why.
2. Low-fidelity interactive prototyping and delimitation of the functions. At this point, we discussed the functions that would be included in the application and the basic interaction. Then, we incorporated these decisions in the simple interactive prototype that was described above.
3. Mockups and definition of visual language. With the basis from the prototype, we decided on the look and feel of the application, the navigation and the interaction. In this stage we also decided on the style of the images and text that we would use.
4. Implementation, which includes the creation/compilation of the content and the coding of the application.

The main elements of the interface changed very little after the first prototype, which was useful to make sure that the entire team was on the same page in terms of what needed to be done. However, there was a lot of refinement in the visual style of the application. In general, we made sure to follow a grid to place the items on each screen, which made the application look organized and balanced while facilitating the implementation in the XML layout.

We were very careful when selecting the images because it was important to keep a consistent visual language. We should note that most of the images used in the interface are modified images from free vector repositories. This was done to save time in the generation of the artwork, though we made sure that all images were following a similar style. The images provide most of the color in the application, which is why we did the selection making sure that they didn't have complicated patterns, shadows or transparency effects, since that would break the visual unity of the application. In addition, the color contrast was tested to make sure that colorblind users could understand the images as intended, following the principle of accessibility stated in the guidelines[12].

As we have stated, we use sound feedback heavily because we this app is intended for children who are not able to read yet. For the generation of the sounds, we employed text-to-speech software. Nonetheless, we understand that for an official release of the application it would be optimal to record the audio in a child-friendly voice, with great attention on the type of voice and tone.

Such is the case for the language on the descriptions. Since we compile the information about the food items ourselves, the language used in the text doesn't have the most appropriate level for the user group it is addressing. The text would require a thoughtful revision and expert review of which is the best way to convey this information to young children.

In terms of the visual design and our consideration of the official design guidelines for Android, we decided not to use standard Android elements, like the Action Bar[12], because they didn't fit with our vision for the application and the language that was expected from our target audience. However, even without the Action Bar, we managed to keep the navigation consistent across the application, albeit finding some problems when displaying some of the elements in the layout.

In terms of gestures and navigation elements, we have a very simple interaction. Most of the interaction occurs by tapping the images, since all of the images were meant to be pressable. We must note that in the current implementation not all images are pressable, this is due to problems encountered related to the size of the application and the high quantity of image and audio files we needed to use. They all have the same visual style, though, because they are meant to have the same response[12].

We included to variations in relation to gestures: In the second mini-game, the player must drag the fruit to the basket. We introduced this variation instead of tapping because we wanted to emulate the idea of picking up food. Furthermore, in the navigation between 'pages', users should be able to swipe as well as pressing the button to move between pages. Note that in this case, we are not including swipe as the only mean of navigation, making it an interaction that the user could discover on his own.

For the navigation, we decided to have a general 'home' button that directs to the initial screen of the application, a 'grid' button that directs to the most recent grid and 'back' and 'last' buttons that allow for navigation between food items. The function of these buttons is consistent throughout the application. The use of text was done under the assumption that children will learn the function of the buttons after repeated use.

We worked upon the concept that in the future it should be possible to change the application's subject with minimum effort on the programming part. For this reason we use XML files to import the data we need to display within the app. The interface provides a more generic structure and thus can be easily modified to fit different subjects.

We also decided to use an OODBMS to serve our database needs. This way the database is integrated with Java and we can maintain consistency within our application's environment. As a result we have the same model of representation both in our code and in the database. Our OODBMS is db4o [7] which is an open source project that can run in java and android. This decision resulted in fast development of our database related functionality.

7. CONCLUSIONS

The education to make healthy eating choices begins in early childhood. We believe that this application could be a useful tool to assist parents and caregivers in the process of teaching children about nutrition. Further development and user testing is required to make sure that the application conveys the information in the best way possible. However, we think that, at this point, we have in our hands a thoughtfully designed application that can positively expand the offering of apps for children in the Android Market.

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