DESIGNING AND TESTING AN EDUCATIONAL GAME ABOUT FOOD FOR SCHOOL-AGED CHILDREN

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ABSTRACT

Food and eating is something very mundane, sometimes even an afterthought. Yet they have a great impact on issues concerning health and the environment. This paper describes the design and testing process of a game for children between the ages of 7 and 12. The purpose of the game is to teach children about the health and environmental aspects of food and be entertaining and educational. The first version of the game design was created based on a questionnaire. This version was then tested with classes which participated on the questionnaire. Based on the feedback from testers, the second version of the game was created and tested again with new classes. Based on the feedback, the children enjoyed the game, but further research is needed about how well the game supports the intended learning activity.

INTRODUCTION

Environmental issues are portrayed prominently in people's daily lives, while health-related issues such as obesity (World Health Organization 2015) are all the more common. Both are directly affected by the food industry (Guinée, et al. 2006), which consumers have control over through choices they make in everyday life. Making the right choices is still difficult, when taking into account several variables, such as diets, environmental issues and healthy nutrition. This problem is approached from the viewpoint of educating school-aged children to do more environment and health conscious decisions, and possibly affecting their families.

There are existing games that have been designed to cause a change in people's behavior related to food. One example of them is the The Fatworld by Persuasive Games (2008). Sadly this game is not anymore available for play, but the goal of the game was to show the relationships between nutrition and factors like budgets, governmental subsidies, and trade regulations. In many cases the games created for educational purposes concentrate on narrower range of subject, like the Nutrition Game (Cooper 2007). The purpose of this Second Life game was to show to the players the impact of different foods on health, especially concentrating on the effects caused by fast foods.

As a part of this multidisciplinary study, gamification is being used to improve the education process about the nutritional, ecological and regioeconomic effects of food. Gamification is defined by Deterding "as the use of game design elements in non-game contexts" (Deterding et al. 2011), and its use in education has been previously researched (Surendeleg et al. 2014).

The first section introduces how the development process started, explains how and where testing was conducted, and describes the test subjects. After this, the developmental phases of the game are explained. The section explains the technical basis of the game, the design process and what questions had to be answered during the process involving several testing and improvement cycles. The last sections discuss the outcome of the process, and how well the design has achieved enjoyment.

GAME DEVELOPMENT

The design process began with a food-related questionnaire which 479 children from 17 different Finnish schools between the ages 9 and 11 answered. The questionnaire among other questions, included questions about what they would like to see in an educational game about food. Based on these answers the first version of the game was designed and implemented by the team.

Testing in Classrooms

Classes participating in the testing were chosen from those that answered the initial questionnaire and the selection was based on the location of the schools, i.e. which were close to the developers. The first version was tested with three classes of children from two schools in South-Western Finland during the autumn 2015, approximately a year after the questionnaire. Based on the feedback from the children as well as on the impression of several professionals in food related areas, the second version of the game was developed and tested in two new schools during the spring of 2016. The feedback received from testing was further reviewed and included in the development process.

The tests in actual classrooms were informal events held during regular school classes. On average, one software developer and two experts on food and health education represented the team during sessions. In the beginning of the session, a lecture was held about nutritional health, and

about the ecological and regioeconomical impact of the food industry. It was followed by a brief presentation about game development and games in general.

The testing itself was done on tablets supplied by the school. The children were then observed while playing the game, and notes of their comments and of any bugs found were made. A short, informal interview was conducted with the whole class after the testing: the class was inquired whether they liked the game, and what kind of improvements they would like to have.

Technical description

HTML5 was chosen as the implementation platform, due to its availability on most mobile devices. Construct 2 was picked as the main development tool after an evaluation, due to its perceived ease of use. Initially, creating a 2D-game project is rather simple in Construct 2, but more complicated logic is harder to create, due to its graphical programming system. For increased complexity, Construct 2 allows users to write plugins in JavaScript.

Story of the game

In the game, the player is a cook in a school of animal-like characters. In the beginning of each day in the game, the player has to make healthy and environmentally conscious decisions while purchasing groceries from the store (Figure 1.). After the store, the player prepares the food in the kitchen which is presented in following Figure 2. Then the food is served to the characters which can have different favorite foods, allergies, and diets, which the player has also to consider. This cycle --shopping, cooking, serving -- is repeated for a predefined amount of days, after which the game ends. After the final day, player is shown relevant data, e.g. levels of health and happiness of the characters.
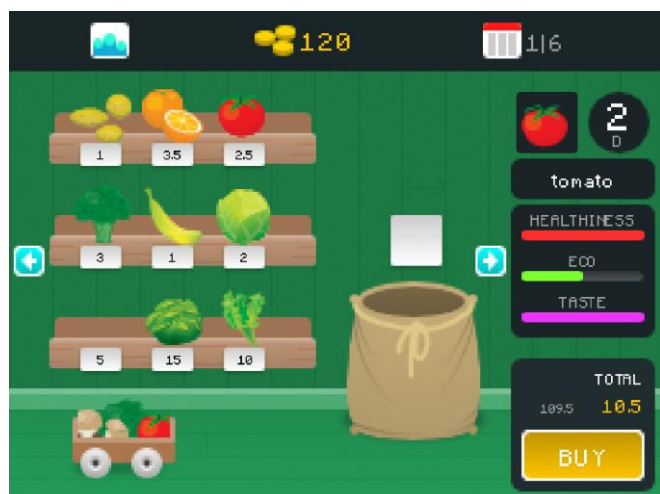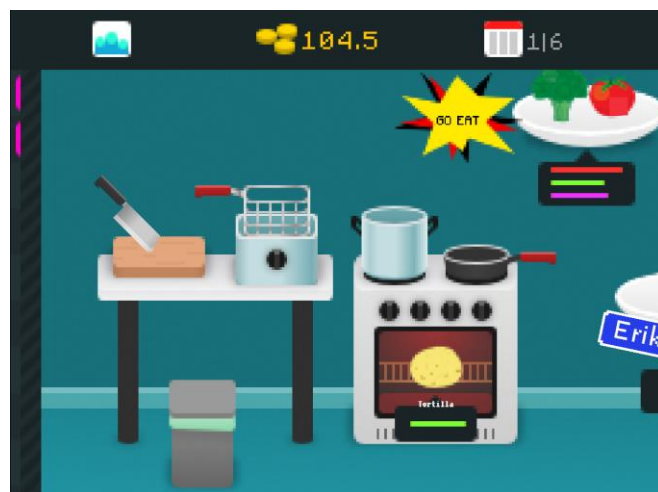

Figure 1. The Store View

Figure 2. The Kitchen View

Initial game design

Following the initial questionnaire results, a rough design of the game was created. The game was prototyped using paper prototypes, and then implemented as a text-based Python-program. Two developers worked on the design full-time, but design meetings by the project team, consisting of two software developers, a graphic designer, two game researchers and a senior software researcher, was held approximately bi-weekly. A few design meetings with extended project team with three additional experts of food nutrition and health-related pedagogy was also held.

The design was meant to be both entertaining and educational, as it has been shown that student engagement increases learning (Trowler 2010). Since the game was targeted for class environment, one essential design goal was to engage the player for a few game sessions but not necessarily longer. This helped to keep the design simple and decreased the amount of necessary content.

The game can be thought of as a management game where the player has to manage a finite amount of money and keep the characters happy. The player has to take different things, such as health, diets and ecological footprints, into consideration while shopping for food items.

Different foods can be found on different shelves, such as the dry shelf. Selected groceries are then bought and transferred to the storage menu that is found in the kitchen view. In the kitchen view, the player has to make sure they cook each food item the proper way, and that they don't burn them. Food can be prepared using any of the available methods, e.g. by using deep-fryer, frying pan, cooking pot, or none of them. Prepared foods are then moved to the plates. There are two plates in the kitchen: the normal plate from where the food is fed to the characters without diets or allergies, and the special plate from where the food is fed to the characters with diet restrictions. Finally, the dining hall view visually shows the characters walking to the plates and consuming the food accompanied with their reaction to the servings.

When designing the initial version of the game, several decisions had to be made about how different foods, diets and allergies were presented:

Nutritional information. The amount of data utilized was vast: there are over 20 different fields for over a hundred different groceries. The data was created by experts based on real data. Some of the data, such as taste, is subjective.

Diets and allergies. Diets and allergies were a core principle from the beginning of the project for educational purposes to understand the diversity of humans as food consumers. Only a vegetarian diet is included so far, but diets such as a fish diet and fruit diet were experimented with. From allergies fish allergy and coeliac were included along with lactose intolerance which although is not an allergy, mechanic-wise it is handled the same way.

Portions and serving. It was discussed whether foods should be combined into pre-made recipes or whether they should be handled as individual items. It was decided that individual foods would work better due to easier implementation and four individual items could convey the plate model idea well. This design decision also turned out to make the game more playful and creative, which seemed to increase the fun factor of the game.

Prices and units. Food item units in the game are symbolic, mostly to aid gameplay. Since there are no clear units for food items, prices had to be normalized by portion, meaning that the price of one potato is the same as the price of potatoes needed for one portion. It was discussed early on whether prices should be static or random. The decision was to keep them static to simplify gameplay and design.

Character statistics. Designing a system for the characters to represent their statistics from eating food was challenging. The system could not be too complicated, as it would not be able to convey clear cause-and-effect relations. On the other hand, too simple a system would not be interesting and would be too easy to optimise by players. It was decided to not go on a macronutrient level, but rather have each food affect the three statistics: happiness, healthiness and fullness. These three variables should be enough to show that while unhealthy food can be filling, it will still make you sick in the longer run.

Second version

We received a plethora of ideas for features and improvements from the first tests. These ideas were discussed with the design team, along with other improvements noted during the development process, to form the new feature backlog. Requests that came up more than once included the ability to earn more game currency, and the possibility for characters to visibly suffer and get dropped from the session.

In the post-test design meetings, the design team tried to think of ways to improve the inclusion of the ecology and regioeconomical aspects. To achieve this, team discussed several features, such as a special outdoors trips, international grocery weeks, and a regional bonus days. As always in development, there were many ideas and feature requests, but only a fraction could be implemented within finite time, and these ideas were left out from this version. Grocery expiration info and the characters not showing up after being dissatisfied for too long. These features were added to the second version due to feedback from participants.

Changing the eating system to better represent the Finnish nutrition recommendations, which state that vegetables and fruit should cover half a portion with a protein source and a side dish covering the rest (The National Nutrition Council 2014), was a request from the a group of specialists related to the field of health and nutrition to which the game was presented to. After making changes to the game, it was tested again with new groups of students. The tests were conducted with the same methods as the earlier tests. Table 1 contains feedback from these tests.

Table 1: Observations, feature requests, design decisions and added features of the first version

Observation	Feature request	Design-meeting decision	Implemented feature
	Visual character feedback	Showing character state through icons and dialogue	Scene that shows changes to characters' statistics
	Characters should die or get ill		Unhappy characters disappear
	A tutorial or guide		A quick tutorial
		Paying for food waste	Grocery expiration system
		Improving the eating system	Improved eating system
Possibility to move foods around after putting on plate			Food can be thrown into trash from plate

Feedback from second version

After making changes to the game, it was tested again with different students. The tests were conducted with the same methods as in the earlier tests. Table 2 contains feedback from the tests.

Table 2: Feedback from the second version

The character with the special diet was difficult
More animal characters should be added
More foods should be added
More money in the beginning and the ability to earn money
The tutorial was not very clear
There should be more game scenes
There should be kitchen utensils
The game was too hard
The game was easy
The oven was hard to use
Dragging food from storage to trash should be possible
Possibility to prepare same food in several cookwares
Possibility to move foods between plates
There should be recipes
Clicking cookware was difficult

Similarly to earlier tests, new requests were made by participants. These and other improvements have been moved to feature lists reserved for potential future versions of the game.

DISCUSSION

When evaluating the game design in regard to test feedback, it becomes clear that some features, such as the ability to earn more money, should be implemented. It also tells about the need to balance the amount of starting money, as so far this has been neglected. Requests for more game assets, such as characters and foods, were usual forms of feedback. While it is something to consider, adding more assets would not add much in terms of value to the game and is something that players tend to request no matter how many assets a game already has. One of the design objectives was to make the game fun, which seems to have succeeded, according to feedback.

Often gamification in education is achieved through leaderboards and badges that promote competition, and add little actual substance to the teaching process (Deterding 2012). This can sometimes be worse than non-gamified teaching (Hanus and Fox 2015). In this case, the game had engaging gameplay and visuals that helped to convey ideas to the students. Further studies on the game's effects on learning will be done.

CONCLUSIONS AND FUTURE WORK

This paper introduced the design process of a food-related educational game and the feedback it received from testing, and how feedback was included in the game. Feedback received from testing made it clear that many improvements could be made, but that the game was also well-received by the students. Although the game tries to teach about the ecological and regioeconomical aspects of food, it mostly covers the topic of health, and this should be improved in the future.

Other future work includes further assessment of the feedback and observations, and adding and refining some of the features listed in feedback. So far only the game's enjoyability and engagement has been assessed through observations and interviews, but little work has been done in terms of researching its educational potential. Thus, further studies will be performed to research the game's effectiveness in learning.

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