The Curriculum Design of Nutrition and Food Safety Game for Elementary School Students

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Abstract: Because of food serves energy and nutrition for human, human beings extremely rely on food. Furthermore, micronutrients help our bodies function normally and keep us healthy. Without micronutrients, we may lose our lives. Recently, as many food safety issues revealed, we really should pay more attentions on how to eat healthily. Because tainted food caused by dishonest or ignorant men may damage our health even severely. On account of those reasons above, this study basically aims at K-5 and K-6 elementary school students, the important stage of human lifestyle building, to develop a RPG game played on mobile device. Hope the children can enjoy the game and easily applied what they've learned in the game to their daily lives.

Keywords: Nutrition education, food safety education, game-based learning, mobile learning, RPG game

1. Introduction

Food is essential to keep us alive. Recently, the scandals about illegal ingredients and additives of food are exposed one after another in Taiwan. In addition to the tainted food, there are also many dishonest food business were revealed. In order to make a profit, the food industry owners reduce the production cost by replacing high-quality elements with low-quality ones. Yet, even worse, some of them use harmful substitutes to reach their goals. Those food safety incidents passed down a message that people who run the food business have put morality far behind. This is a serious problem because human beings can't live without food. The contaminated food affects children more greatly (Meysenburg, Albrecht, et al., 2014). Under the threat of food safety problems, children should equip with sensible discernment in their choice of food and good nutrition education to fight for their own healthy growth.

2. Background

2.1 Nutrition Education for Elementary Students

Except for energy, human begins also needs to get nutrients from food to stay healthy. According to the amount of nutrition which human body needs, the nutrient falls into two groups. One is macronutrient, the other is micronutrient. Macronutrient, which provides calories, mainly contains carbohydrate, protein and fat. Micronutrients, including vitamins and minerals, are essential for human body (Crowe, et al., 2011). Human being only needs a little micronutrient. They can regulate physical function, but cannot be produced by our own bodies. The knowledge of micronutrient is extremely important for us to live healthily. Micronutrients can be found in variety of food. Nevertheless, only intake of micronutrients from fruit and vegetable leads to less burden to human bodies (Herrero, 2011).

Most of nutrition curricula are in elementary school for K-5 and K-6 Students. Those students are at the mental and physical growth stage (Wu, 2012). They have tenacious memory at the same time.

Also, they have enough capability to understand the systematic structure of nutrition knowledge. Some research indicated that the habit or thought students built in this stage will affect and last the rest of their lives most (Fu & Jien, 2012). There are many types of micronutrients with various sources and different functions. In existing materials, micronutrient knowledge is represented by text description, table with text or adding pictures in table beside the text. However, neither of them is easy for students to memorize and build the concept of micronutrients. In order to get the students' attention, this study is trying to develop the effective way to teach them micronutrient knowledge and to ease their fear with fruits and vegetables.

2.2 Food Safety Education

However, there're some studies indicate that it's risky to get nutrients form natural crops (Martin-Belloso & Fortuny, 2011). According to these studies, there may be toxic residue left on the plants. As we have the fruit or vegetable for health, those contaminants could come with the food to enter our bodies. Some of them may make us feel physically uncomfortable. Even worse, they may cause death. In light of the situations above, food safety is a significant problem when people try to eat healthily. It is possible that people who are not in the food producing process pollute food the most. Some factories were built near by the farmland. But they didn't deal with the pollution they made well. This is a serious problem because pollution form factory usually contain heavy metals, which can't be metabolized by human body (Marshall et al., 2007). The factory managers may not notice that they also have the responsibility to agricultural production, yet their emissions cause immeasurable damage to the crops. Therefore, we think everyone should pay attention on this issue and treat this issue with morals.

According to the study of Haapala and Probart (2004), they found the middle school students are not with enough knowledge, perceptions and behaviors of food safety. Once students get into adolescence, their chance of accessing to the drugs, tobacco and alcohol will increase (Choquet et al., 2004). That's why we think K-5 and K-6 students are the ideal learners of food safety curricula. Before they become teenagers, they should learn how to live a healthy life. After all, everyone only have one chance to become adult. So growing with health is crucially significant. Instead of abstruse knowledge about food safety, we think that the upstanding mind is which they need the most. They should learn to put themselves in anyone else's shoes. The characteristics mentioned above could be cultivated by simulation. Students can get their own experience when undergo the simulations in the game story. Moreover, we hope that they may adopt the experience on their real lives.

2.3 Game-based Learning

Micronutrient knowledge is something abstract to children. Food safety is also something hard for them to realize. To overcome the abstraction and complication of learning content, we must find the way to concretize it and maintain learner's attention on it at the same time. Before solving those problems above, there is one thing we would face first. How to attract K-5 and K-6 students to learn these contents? The "motivation" leads us to game. There are many cases we can follow (Papastergiou, 2009; Prensky, 2003). Combine teaching with game can always gain more interests from children. Using game to teach can bring them fun and reduce their stress when learning (Kanthan & Senger, 2011). Especially, the RPG game can pull students into the game world easily. They will be the super mayor character of a game. They'll treat what they face in the game extremely important. Therefore, we think the RPG game is better than other candidates. Like a simulation, children meet some events that happened in real life when playing game. They learn how to deal with them by the guidance of assignments. It is a good method to keep danger away and save resource such as time, money and so on when simulating in the game (Pidd, 1992).

The main point of instructional game is the learning content. There is a model of games and learning showed in Figure 1 (Garris, Ahlers & Driskell, 2002). At first, we should put learning content and game features together. Design a reasonable and joyful game. Once students get into the game, they start the game cycle. They receive stimulus from game and produce their own views. Then, they'll reflect the thought in mind on their behavior. After catching the stimulus from player's behavior, the game also responses back. Students will undergo the game cycle again and again and get their own

experience. We evaluate their performance to reach their learning outcomes. This is the model gave us confidence to teach our subject by game. Although the content in the subject is not friendly at all, we still can make it adorable to children. Blend them into the game and intersperse some charming stories with lovely game scene. In contract of the fantastic image, the knowledge students would learn in game is true in real world. Instead of memorizing the contexts in the book, we believe this is a good way for students to realize numerous micronutrients and their various source and function (Kiili, 2005).

Figure 1. The games and learning model.

3. Method

3.1 Game Design

Our goal is to equip children with enough nutrition knowledge and clear-sighted view of food safety issues. At the same time, attracting children to keep learning the content is our challenge. That is why we tried to pass off the instruction as game. Children can enjoy the fun and feel less pressure when learning by game. Especially when they played the RPG games, they only focused on their missions and the role they played. Totally immerse in the game, enjoy characteristics of game. Children will see the game as their second life. Therefore, we developed the game described below to meet our goal. In the game system part, we'll talk more about the entertainment which can distract people's attention from learning. The game story is the background we create to match the subject. The last is the part of integration, explaining those ideas we use in embedding the learning content.

3.1.1 Game System Development

We build a RPG game by Unity 4.3.4. In addition to basic RPG game features such as role training, level bonuses, interactions with NPCs and game tasks solving, we added duel and collecting book. Basic features can challenge players and invite them to play. The collecting book is another shot at the game for players. Once children meet the fruit or vegetable in the game and prevail it, it will be recorded in the book automatically. Collecting the items in the book all is the motivation for players to continue the game. Besides, the duel gives the game more appeal and excitement. We need to sustain children's interest, so the RPG game is our choice to involve players in learning content. We want children to forget they're learning and enjoy totally fun. For this purpose, we create a lovely world which can be seen in Figure 2 and decide to run our game on mobile devices. M-learning (mobile learning) means that learning will no longer be limited by time or location (Hwang & Chang, 2011). There are two main properties in mobile learning. One is arbitrary learning place, the other is short time interval. With these two properties, children can play the game anywhere and anytime.

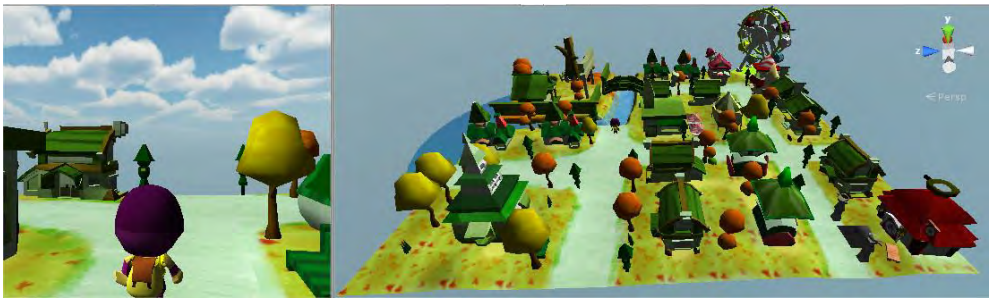

Figure 2. The world in the game.

They don't need to stay steadily. With mobile devices, they could learn anytime, anywhere. They could lie down or sit casually when holding light device and learn. They play the game in their daily lives and easily connect what they've learned to their real lives (Chu, Hwang, Tsai, & Tseng, 2010). They may be interrupted by others when playing game on mobile device. But the features of RPG game could pull the players back fast. The familiarity of plants could urge students to try them for food. Meanwhile, the short time interval could also reduce the learning burden of children. For example, they could play the game when taking a break in the school or waiting for dinner prepared by mother. Give them more flexibility to connect the content of the game to real world.

3.1.2 Game Story Design

To close the distance between children and plants, the background of our game is a kingdom lived on fruits and vegetables. There are soldiers called "armed-grape", whose duty is saving people's life and health. They're trained by the government since the incredible event changed the kingdom dramatically. Some of plants can move like animals. They started to protect their own kind from human. People couldn't get essential micronutrient from them, so the weakness and disease rage on. "A-Ni" is the hero of our game. At the beginning, A-Ni is one of new recruits undergoing training and sees fighting for people as his or her own destiny. After the training, A-Ni steps on the journey to help people and enhence the ability. A-Ni will be promoted as more and more assigned tasks being solved. For this reason, A-Ni has more power to deal with classified problems. In the meanwhile, some secret and evil plans of government are available to A-Ni, too. At the end, we could only rely on players to lead A-Ni to make wise decision and do sensible action.

We use the tasks to guide players. For instance, players may receive three assignments first. One is to collect the material, such as vitamins. Another might ask them to satisfy the NPC's needs. And then they meet some plant monsters on the road. They have to prevail the monster to take the material and record the plant into the collecting book. The material form that monster may just meet the NPC's need. Therefore, players solve the tasks at the same time and continue their trip. Of course, they still receive another assignment in the following adventure. Analyze the example mention above, there're three types of assignments, material or plant collecting, the requirements of NPCs and achievement making. We cross these assignments to build the situation in the game. Players will be required to fight or pick the plants on the road and follow the guidance to interact with NPCs. Players will need to collect something for NPCs, or heal them by knowledge and experience. As for achievement making, players can know their own state, like the ability of the role, the progress of collection and journey.

3.1.3 Learning Content Integration

Children will play the hero of the game to help the kingdom back to placidity. Follow the assignments, we set micronutrient knowledge and food safety issues in the story. Children need to organize the information and use those items in their hands to solve the problems. Every assignment is designed for learning contents. The assignments of material or plant collecting are mainly related to micronutrient knowledge. The interaction with NPCs is the most flexible part. It can embed in the food safety cases and the events of micronutrient deficiency or excess. In addition, children should understand their learning pace or condition in the game. That's why we design the assignments of achievement making for a short-term target. The achievement reminds children that they have already had some knowledge or experience. By the similar cases in the story, players can realize the reason behind and know the key points they should put their eyes on when facing food safety problems. The simulations are merged into game tasks to teach children the skills to find out the solutions of food safety cases step by step.

Further, we would prefer to see them adopt those skills on their realistic life and prevent people from the threat of unsafe food. To increase micronutrient learning effects, collecting book and fighting effect are designed. Players can record the plants they have met. There is much information in the collecting book, such as the name and the short introduction of the plant, the micronutrient in the plant and the effects they provide to human body. The description above can be displayed more clearly by Figure 3. The content of collecting book is edited by the real information of those plants. In the game, it could also help player to look for solutions of the assignments. By this way, children could know much about fruits and vegetables and understand how to get healthy with

them. The other design to help children learning micronutrient knowledge is the fighting effect, like Figure 4. Players should fight to the plant monsters to get the micronutrients they need. As fighting, once the player hit the plant monster, the micronutrients which the plant contains will appear and drop down from it. The micronutrients are showed by text. The times of every text showed in fight are set on their percentage in the plant.

Figure 3. The schematic drawing of collecting book.

Figure 4. The schematic drawing of fighting effect.

3.2 Design of Experiment

The target of our game is K-5 and K-6 students. We want to get more details about children's learning in our game, so the questionnaire comes to us. There are two parts in the questionnaire. One is about the performance of students' learning, the other is the system usability scale. In the game, we try to build the knowledge and concepts of micronutrient and food safety. Therefore, the questionnaire of students' learning performance is divided into two themes, micronutrient and food safety. Students will do this questionnaire before and after playing the game to evaluate the effect of our learning game. The system usability scale will be done only after the game to collect students' thoughts of the game and understand that if the game actually can help students to learn something. We want to know whether or not the results meet our previous expectation.

The experiment will be implemented in the Health and Physical Education class of K-5 and K-6 students. The duration is about one month. We'll occupy two time HE & PE class time. One is at the beginning of the experiment. We must to introduce our game, tell students how to play the game and let them do the pretest. Then, they can play the game whenever and wherever they want in the next month. After one month, we'll let them do the posttest in the class. In addition to questionnaire, we'll do some interviews with students who had participated in experiment. We believe that children will give us more feedback in the interview.

4. Conclusion

K-5 and K-6 students are at the critical stage of lifestyle building. As we mentioned previously, our plan is to equip children at that stage with the knowledge and concept of micronutrient and food safety. To reach the purpose, game becomes our conclusion. Game can make fun for people. There are many types of games. The RPG game is our choice to combine with the learning content we prepared. Students can solve assigned tasks and learn something through game. Base on the real food safety cases, we design

tasks in the game story. Students can do the simulation in the game world. They enrich their own experience when playing the game. Give them the capability to protect themselves and anyone else. The information of fruits and vegetables is also something true in the game. We hope students to be close to plants for food and have correct micronutrient knowledge about plants. There are some ideas being developed to aim our target, such as collecting book and fighting effect. Help students to improve their learning effects.

Everyone lives on food. It is important for us to care more about something we get into our bodies. This game is the brainchild of everyone in our team. We try to deliver some useful knowledge and information about food to K-5 and K-6 students. It is our hope that they could learn these serious things, realize them and deal with them. Further, learning by mobile devices could help them practice all they learn in game to daily life more flexibly. The final goal of ours is to help people to guard their own health and others. At the end, we all have a clean, safe and healthy life.

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