Pirate Bri's Grocery Adventure: Teaching Food Literacy through Shopping

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Abstract

Food Literacy (FL) is associated with the improvement of autonomy and confidence around food, healthier dietary intake, and chronic disease prevention. However, to date, behaviour change research at CHI has focused on motivating healthy eating mainly through weight loss and calorie control, which can lead to poor nutritional choices as consumers optimize caloric intake over a balanced diet. To address this gap, we designed a mobile game called *Pirate Bri's Grocery Adventure*, that seeks to improve FL through a situated learning approach to grocery shopping. Our game leverages Self Determination Theory (SDT) to build a player's competence, autonomy, and relatedness as shoppers are encouraged to develop an understanding of the nutritional benefits of foods and are rewarded for balancing sugar, sodium, fats and fibre in their purchases.

Author Keywords

Mobile Nutrition Game, Food literacy, Grocery Shopping, Self Determination Theory

ACM Classification Keywords

H.5.m [Information interfaces and presentation]: Miscellaneous; J.3 Life and medical sciences: Health.
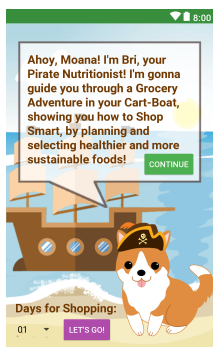
Figure 1: After creating a character, players are introduced to Brigitte, the Pirate Nutritionist, who explains how the game will help them develop food literacy skills.
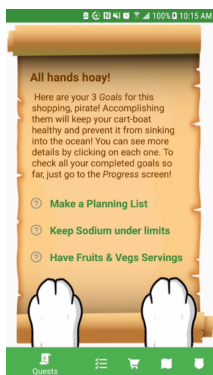

Figure 2: Next, players create a shopping list and are presented with personalized challenges for their next shopping trip.

Introduction

Food Literacy (FL) is the combination of knowledge, skills, and behaviours required to plan, select, manage, prepare, and consume foods that meet nutritional recommendations. Understood to be an important component of healthy living, FL is associated with confidence, autonomy, and empowerment towards food. On the other hand, a lack of FL can contribute to many health issues. For instance, an unbalanced diet is the main risk factor for many of the leading causes of death including cancer, cardiovascular diseases, hypertension, obesity and type 2 diabetes, that can be easily prevented through a healthy diet, particularly if such behaviours are established early in life.

Developing these skills early in life remains a challenge. For many youth, family members often purchase and prepare food, providing little opportunity to develop skills related to budgeting, planning, shopping, and preparing their own food before they start to live independently. In many cases, youth are first faced with challenges related to FL when they move to university and must manage budgetary constraints, and the ease of buying ultra-processed and ready-to-eat foods, which can lead to unhealthy eating behaviours.

Youth are also particularly interested in video games, making them a potentially effective mechanism for health behaviour change. However, to date, the games for nutrition and mobile applications research communities have largely focused on weight loss and using calorie control to promote healthy behaviour (e.g. [3, 4]). While sometimes effective at reducing short term weight loss, calories alone do not predict overall healthiness of a product, and are only a small part of FL. Therefore, there is a need to develop FL in youth during their first years of independence, and an opportunity to develop these skills through gameplay that remains uninvestigated by the research community.

To support such nutrition-centred behaviour change, we designed a mobile game called *Pirate Bri's Grocery Adventure* that develops FL through a focus on planning (at home) and while shopping (at the grocery store). Our game incorporates support for Self-Determination Theory (SDT) [8] to foster internal motivation. The combination of in-game experience mixed with a real-life behaviours at the grocery store is a promising and novel approach to increase FL among students, promote healthier food selections, and prevent chronic disease.

Related Work and Motivation

The motivation of healthy eating behaviour has been of interest to CHI for some time, and has led to the development and evaluation of a number of nutrition mobile apps. However, to date, this research has primarily focused on weight loss and in particular calorie counting, rather than more broadly on FL [3]. This focus can be problematic, as it is primarily associated with short-term weight loss and is therefore not deemed to be particularly effective by the nutrition community, and can even have negative effects on users with eating disorder behaviors [2]. The literature also has raised concerns about the long-term utility of these mobile apps. For instance, Krebs and Duncan [5] report that approximately half of health app users stop using it mainly due to loss of interest and a high data entry burden. Notably, while calorie counting may help users lose weight, it does not directly help develop FL skills.

To address these limitations, and to more broadly develop FL skills for youth living independently for the first time, we decided to investigate how games can motivate and maintain healthy behaviours, promote internal motivation and self-efficacy, and lead to lasting behaviour change. We were particularly motivated by the opportunity to use mobile devices a means of developing FL skills during grocery
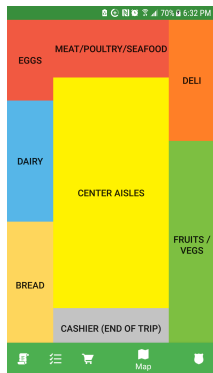
Figure 3: Players are provided a map of a generic grocery store layout, and use that map to select the sections they want to go.
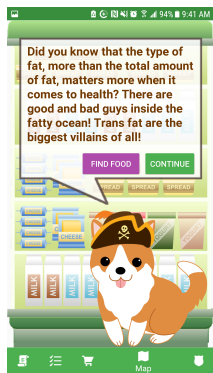

Figure 4: As players enter each area, Bri provides tips about the types of food they will encounter.

shopping trips. For instance, the nutrition community has found that individuals often shop quickly, purchasing foods that are mostly habit-based and automatic, and that this behaviour can deter from players establishing healthy eating habits. Using a mobile game to promote reflection seems like a potentially effective intervention, and may improve adherence in the long-term. With these issues in mind, we developed our own game.

Game Design: Pirate Bri's Grocery Adventure

Our game develops FL skills in players through elements that incorporate the psychological needs of competence, autonomy, and relatedness described by Self-Determination Theory (SDT)[8]. Our use of SDT is motivated by its substantial overlap with FL; SDT facilitates internalization of motivation and autonomous execution of behaviours, supporting a shift from "having to" to "wanting to" [1]. For instance, an individual develops autonomy when they are provided a meaningful rationale to understand why specific behaviour or activity is important. We enhance autonomy by providing food and nutrition-related knowledge and skills that they need for taking action, which is the core of FL. Relatedness also has a strong correlation with FL, as food choices are often made surrounding social events, and food is often prepared and enjoyed in the company of others.

Our game builds a player's FL competence through elements such as in-game visualizations that highlight the amount of nutrients in foods as players shop, and challenges that encourage players to consume more fruits, vegetables, and fibre and less added sugar, sodium, trans fat, and ultra-processed foods. To engage and motivate players we also incorporate a creative narrative, where the player is guided by a 'pirate nutritionist' who teaches the player about their nutritional needs.

Our game was developed using Android Studio, and is compatible with Android versions 4.0 or above. Artwork for the game was downloaded from icons8, vecteezy, pixabay, and free clipart[1]. We now provide a game walkthrough, with a particular focus on how its design supports the development of FL through the three components of SDT: competence, autonomy, and relatedness.

Creating a Character
Upon starting the game for the first time, players create a character based on their personal information, so the game can assess their nutritional needs (i.e. based on sex, age) and food preferences to determine the order of challenges. After creating their character, the player is introduced to Brigitte the Pirate Nutritionist (Figure 1). During the game, Brigitte presents information about different nutritional content, explaining why each aspect addressed is important to our health and well-being and how they're related to our choices. We designed our game to teach the importance of each action, in accordance with the RECIPE for meaningful gamification [6].

Bri then asks for how many days they will be shopping for, presents three challenges for the player during that trip (Figure 2), and encourages the player to create a grocery list before going to the store. Creating a grocery list has been shown to be the most effective means of minimizing waste, and by only buying what is needed helps to keep each trip within budget. Helping players remain within their budget can be a meaningful strategy as financial constraints are common among post-secondary students [7].

As a serious game, we were conscious of the need to create a game that is played just long enough for a player to

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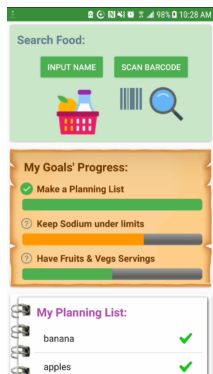[1] www.icons8.com, www.vecteezy.com, www.pixabay.com, www.freeclipart.pw

Figure 5: As players put food in their cart, the game helps them visualize progress towards each challenge.
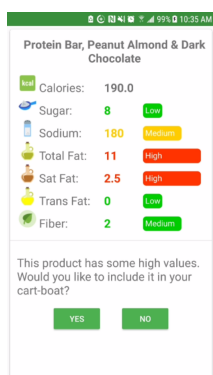

Figure 6: As players decide on which products to buy, the game visualizes each item's nutrients using colours that highlight low, moderate, or high amounts.

learn and internalize content to maintain their behaviour outside the game [6]. Thus, we designed the game to be played over a three week period for three different shopping trips. This design applies the concept of slow technology, by giving time to players to reflect upon new content, apply the knowledge, and have time to discover the consequences of their actions.

To develop a player's sense of competence and progress through the game over the three week period based on their preferences (Table 1), players are presented with three challenges per shopping trip, with increasing difficulty. For instance, a person who prefers salty food will more likely struggle to complete a challenge that requires them to keep sodium intake below the recommended amount than a person who prefers sweet food (who might have more difficulty keeping added sugar intake down).

Playing in the Grocery Store
After creating a grocery list, players head to the store for the next phase of the game (It's time to go shopping!). While in the store, players navigate using a map screen (Figure 3) that shows a top-down view of a common supermarket layout. While layouts commonly vary between supermarkets, they typically follow a similar distribution concept, where fresh produce is placed on the perimeter area and centre aisles contain mostly processed food. The player then manually chooses the sections they want to go to, depending on their shopping list. When the player enters each section, Bri presents an important tip related to specific nutrients or types of foods that are related to that section (Figure 4). For instance, when entering a bread section, she explains the importance of selecting whole wheat options and of dietary fibre. When entering the centre aisles, she explains common issues with ultra-processed foods, such as misconceptions about fruit juice.

To support social connectedness, we also incorporated content that explains global initiatives such as "Meatless Mondays"[2] and why they are important to our health and to the planet, as well as challenges that ask the player to engage their friends over social networking sites to build social connectivity through real-life activities such as asking a friend to prepare a meal together. This game design strategy not only satisfies the psychological need for relatedness but also shows to the player the importance of involving social aspects around food.

As the player selects foods from the grocery store shelf, they have two options to add it to their in-game shopping cart: scan the barcode, or manually input the product's name, as not all products have barcodes. This screen also shows the players' progress towards each current challenge, so they can keep track of their progress (Figure 5). After finding a specific food, the game shows the information visualization of product's nutrients using traffic light colours, which highlights for each nutrient if it is in low, moderate or high amount in the product (Figure 6). This visualization is accompanied by a message asking if the player wants to include the product. This visual information is included to help the player reflect and think better about adding a specific product to the cart, especially because Nutritional Facts Labels on packages do not make this information clear to consumers.

As products are added to the player's cart, they must also select the number of servings of the product to its food group to encourage players to select products that will, in the end of shopping, fulfill the distribution of a balanced diet. For instance, it is possible to visualize how many servings of fruits and vegetables he or she should aim to meet a healthy intake for the next days.
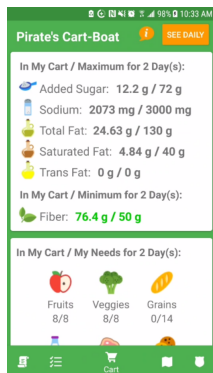
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[2]http://www.meatlessmonday.com

Figure 7: Summary of nutrients and servings for each food group in the cart versus how much is needed for the total trip.
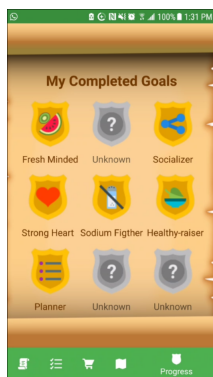

Figure 8: Players can access an achievements summary screen at any time to see which achievements they have unlocked.

Player's Preference	Shopping Trip 1	Shopping Trip 2	Shopping Trip 3
	Make grocery list	Share FL topic with friend(s)	Follow grocery list
Prefer Salty	Keep sugar under limits	Keep sat. fat under limits	Keep sodium under limits
Prefer Sweet	Keep sodium under limits	Keep sat. fat under limits	Keep sugar under limits
'Love' Fruits and Vegs	Reach servings of fruits and vegs.	Reach fiber recommendation	No ultra-processed food
'Try to eat' Fruits and Vegs	Reach fiber recommendation	Reach servings of fruits and Vegs.	No ultra-processed food

Table 1: Example challenges presented to players over three successive shopping trips.

After each item is added to the cart, a summary screen (Figure 7) is presented to the player. That is, if the player input that the next shopping will be for 5 days, it is displayed their daily needs times five. The player can also switch this view for a day, to help with comparisons with a specific product. This feature is intended to help players learn about their daily needs.

In addition, we intentionally do not include the recommended number of calories, since they can be a poor predictor of healthy foods. Instead, we encourage the consumption of more fibres, fruits, and vegetables and the careful monitoring of nutrients such as sugar, sodium and trans fat. As the user adds products while shopping, the game helps to visualize how much of each nutrient and servings of each food group is in the cart and how much is still needed (or how much exceeded).

Checking Out
Finally, when a player checks out of the grocery store, Brigitte presents a summary of completed and uncompleted challenges and give an opportunity for the player to reflect and maybe go back to the aisles to keep shopping to complete a challenge. For example, if they did not meet the required servings of fruits and vegetables, they can return to this section to buy more before checking out.

If a player completed all three challenges, they receive an in-game gift, which is an animated buddy released from a chest. A gift as an incentive is an artifact vastly used in games, and in our case, was used to surprise the player, serving not only as a reward but also as an incentive to foster their curiosity to the next shopping trip. We also incorporated badge elements as a reward of accomplished challenges as a way to help players visualize their progress (Figure 8).

Conclusion and Future Work
We designed a novel, mobile, and situated game to increase Food Literacy (FL) among youth by improving autonomy and confidence before and during grocery shopping. In particular, our game's design is grounded in Self-Determination Theory (SDT) to develop the psychological needs for competence, autonomy, and relatedness. It promotes nutrition-related behaviour change by combining an in-game experience with real-life activities at the grocery store, such as planning a grocery list, making purchase decisions, and balancing the nutritional benefits of an individual product with one's overall nutritional goals.

This work addresses an important gap in the literature that has primarily focused on weight loss and use of calorie control to promote health. Our game is an important first

step towards understanding how game design can be used to develop FL skills, and is targeted towards youth who are living independently for the first time in their lives.

Next, we will conduct an experimental validation of the game with university students to understand how their perceptions of nutrition change during play, their perceived barriers and benefits to healthy eating, and the impact of play on self-efficacy regarding food. This study will provide us with critical information about how a mobile game played during shopping can affect players' knowledge and skills regarding healthy food and be used to change attitude towards planning and selecting better food choices.

Based on the results of this study, we will develop implications for the design of other serious games for behaviour change. Our work will contribute a better understanding of how to design serious, mobile, and in-situ games to health behaviour change. In particular, they will provide an understanding of how such change can be grounded in the health literature, and applied in practice to promote FL in youth. We expect these results to be of broad interest to the CHI community as they seek to understand how to best promote healthy eating through gamification and gameful design.

Acknowledgements

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