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The design framework for a mobile learning app on eating healthy: Connecting learner needs with app features

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Abstract

This paper aims to propose a design framework for learning technologist to design and develop a mobile learning app in the context of eating healthy. In other words, this study offers a number of theoretical and practical implications that can assist developers in creating more effective mobile apps. In exploring the research behind the foundational problem associated with this study, there are three main learning theories that provide a framework for the app design; the behaviorist perspective, the social constructivism, and the self-determination theory. Based on those theories behind the design, it can be said that personal profile, item search/scan, food snapshot, challenges, social, and resources might be the features of the app to support learning needs.

1. Introduction

It is safe to say that the majority of people are concerned about proper nutrition and eating healthy, probably more-so than ever. One might assume that with such a preoccupation on diet and nutrition our world would be full of healthy individuals. However, that couldn't be further from the truth. The latest statistics from the Centers for Disease Control and Prevention list that 600,000 individuals in the United States die from heart disease every year, that works out to 1 in every 4 deaths (U.S. Department of Health and Human Services, 2018). Similarly, the American Cancer Society reports that 585,720 people are expected to die from cancer in 2014 (U.S. Department of Health and Human Services, 2018). Furthermore, fewer people alive at 70 today survive until 90 than they did forty years ago (Fallon, 2011). It seems that instead of preventing deaths, the population is actually getting less healthy.

In addition to staggering disease rates, we live in a world where processed foods are the norm. Standard grocery stores are filled with hundreds of food items marketed as healthy with claims such as "all natural", "low fat", "low sodium" or "whole grain". If you take a close look at the back of many food items marketed as "natural" you might find a long list of ingredients, many of which are difficult to pronounce. To make matters worse, fad diets are prevalent in our mainstream and social media. Many of these popular diets are based on deprivation techniques (low carb, low fat, etc.) that make them difficult to consistently follow. So who can we trust? What are the real truths regarding healthy foods and our food industry? As consumers we're largely left to determine for ourselves what is healthy versus what is not and how to base our purchases on that knowledge.

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The Real Foodie app proposed in the enclosed paper is designed to calm some of these common confusions and to educate individuals, specifically young adults, on eating healthy. Real Foodie is a mobile application filled with a database of nutritional information on everyday items in food industry and offers a barcode scanning feature as well as a grading system for food items. In addition, the application will provide a profile that will allow users to track their buying habits, challenge their peers and additional activities that will provide scaffolds to support better eating habits. All of the information in the Real Foodie application is aligned with the movement to eat more "real food" and less processed food-like items.

To sum up, even the population is actually getting less healthy, it is getting easier to offer people learning opportunities anywhere and anytime by mobile apps. This paper aims to propose a design framework for learning technologist to design and develop a mobile learning app in the context of eating healthy. In other words, this paper offers a number of theoretical and practical implications that can assist developers in creating more effective mobile apps. The paper uses the example of Real Foodie to explain the design framework and features of the mobile learning app.

Beside, regarding the importance of the study, pedagogical factors have the greatest impact on students' success, intentions, and behavior when it comes to integrating mobile learning apps into learning process, which includes providing more diverse teaching contents/materials, strategies, and learning environments that can improve student learning performance (Suartama, Setyosari, & Ulfa, 2019). However, mobile app developers and instructional designers do not communicate well and do not work together most of the time. For this reason, most of the apps in the market lack of pedagogical factors. This causes learning losses. By providing a number of theoretical and practical implications in terms of pedagogical factors that can assist developers in creating more effective mobile apps. This paper bridges the gap in the learning technologies literature.

2. Theoretical Framework

In exploring the research behind the foundational problem associated with this study, there are three main learning theories that provide a framework for the Real Foodie app design. The first conceptual framework is the behaviorist perspective that stems from the work of Skinner (1974). At a very basic level, the theory suggests that rewarding a subject for particular behavior encourages the subject to behave in the same way in a similar situation (Clark, 2018). The reward reinforces behavior and conversely, if behavior is punished, the subject is less likely to repeat it. Behaviorists look at learning as a change in knowledge achieved through controlled stimulus/response conditioning. In behaviorism, people can learn not to do things as well as to do things (Skinner, 1974).

Driscoll (2000) distinguishes between two types of stimuli called primary and conditioned reinforcers. Based on this separation, primary reinforcers are stimuli whose reinforcement is biologically determined. Examples of primary reinforcers are food and sleep. Another type of stimulus, conditioned reinforcers are those that acquire reinforcement through an association with a primary reinforcer. Gold stars, money and points are all be examples of conditioned reinforcers (Seo & Lee, 2009).

Behaviorism, and conditioned reinforcers, are important elements of computer games and mobile apps (Paraskeva, Mysirlaki & Papagianni, 2010). Computer games are sometimes referred to as "skinner boxes" since they offer rewards or punishments for user behavior (Bogost, 2014). Computer games also typically rely on reinforcement, such as points, unlocks, power-ups and bonuses to increase the frequency and repetition of a desired behavior (Sümer & Aydın, 2018). Furthermore, Bogost (2014) argues that gamification is a simplistic behaviorist approach to game design. He states that, -ification involves simple, repeatable, proven techniques or devices: you can purify, beautify, falsify, terrify, and so forth. - ification is always easy and repeatable.

The second theoretical framework of this design is social constructivism. Constructivism, as a learning theory, stems from the burgeoning field of cognitive science, particularly the later work of Jean Piaget, and Lev Vygotsky (Fosnot & Perry, 2005). Constructivism, as perspective in education, is based on experiential learning through real life experience to construct and conditionalize knowledge (Tobin & Tippins, 1993).

The first aspect of constructivism is Piaget's Cognitive Constructivism (Wadsworth, 1996). He proposed and demonstrated through much research that the mechanism promoting change in cognition was the same as that in evolution - namely, equilibration. Equilibration was described by Piaget (1977) as "a dynamic process of self-regulated behavior balancing two intrinsic polar behaviors, assimilation and accommodation. Assimilation is activity, the organization of experience; it is the individual's self-assertive tendency, a tendency to view, understand, and act on the 'surround' with one's own activity or ideas in order to preserve one's autonomy as a part within a whole system." In addition, accommodation is comprised of reflective, integrative behavior which serves to change one's own self and explicate the object, in order to function with cognitive equilibrium in relation to it (Piaget, 1977).

The second aspect of the constructivist theory is Vygotsky's Social Constructivism. Vygotsky describe the Zone of Proximal Development as the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers (Vygotsky, 1978). One of the most important practical implications of social constructivism for education is Honebein (1996)'s seven goals for the design of constructivist learning environments. Here are Honebein's seven items that it has also used in the design decisions of Real Foodie;

- Providing experience with the knowledge construction process,
- Providing experience in and appreciation for multiple perspectives,
- Embedding learning in realistic and relevant contexts,
- Encouraging ownership and voice in the learning process,
- Embedding learning in social experience,
- Encouraging the use of multiple modes of representation,
- Encouraging self- awareness of the knowledge construction process.

After reading through Honebein (1996)'s seven goals for the design of constructivist learning environments, it was decided to use these goals in the design. For example, food snapshot feature is an example of embedding learning in both realistic and social content. The items in the food snapshot feature are real, and allow users to share them with their peers. Additionally, based on the item they scan, multiple modes of nutritional information are represented, which allows users to choose how they share the items they scan, or conversely, keep them in their profile.

Last theory that was taken into account in designing this application for learner needs was the self-determination theory, as depicted by Ryan and Deci (2000). The purpose of their study was to investigate extrinsic and intrinsic motivation in learners, as well as the importance of such supportive elements in effective learning environments. Extrinsic motivation is understood to be when learners are motivated to do tasks with the reinforcer being outside of themselves. An example of extrinsic motivation may be motivating oneself to write a paper in order to get a good. Conversely, intrinsic motivation, the ideal motivation in education, occurs when learners are motivated to do tasks because they innately want to do the tasks. The reward is realized from within themselves, and there is not an external reward necessary to motivate the learner to do a task. An example of intrinsic motivation may be motivating oneself to complete a project because you are innately interested in the topic and wish to do a good job. Furthermore, Ryan and Deci (2000) argue that in order to achieve the optimal intrinsic motivation, humans have innately psychological needs that should be cultivated in an environment in order for higher intrinsic motivation to exist. These psychological constructs are: autonomy, belonging and competence. These psychological

elements, when fostered in explicit design of educational environments, are thought to achieve higher intrinsic motivation within students. When designing Real Foodie application, it was known fostering a playful and collaborative learning environment would be difficult to achieve, particularly when trying to motivate young adults to change inherently difficult eating habits. After considering principles of self-determination (Deci & Ryan, 2008) in application design, it was tried to best support autonomy, belongingness, and competence by providing several platforms for learner to exercise these principles within the personal profile, social, and challenges features.

3. Method

3.1. Learning Goals

According to previous researches (Elfeky & Yakoub, 2016; Furio, Juan, Segoi, & Vivo, 2015), mobile learning can increase student participation and achievement while also assisting them in learning. Learners can learn not only in a formal learning environment, but also throughout their lives by using various tools and technologies. The Real Foodie mobile app is largely designed with two learning goals in mind. All of the features and activities built into the program are designed to support users of the system to achieve both goals. The two learning goals supported by the Real Foodie application are:

1. Users will be able to tell the difference between "real foods" and other less healthy options.
2. Users will demonstrate an effort to change buying habits away from processed and unhealthy options to more real, nutritionally-dense foods.

3. 2. Context and Target Audience

The Real Foodie mobile app is designed to be used in an informal learning setting with a self-directed learner. As most mobile applications is meant to be used anywhere with a cellular reception such as the grocery store, home, school, etc. It is not designed to be used in formal K-12 school environments, although it might be an interesting activity to work on with students with the right guidance and scaffolding.

The age range targeting with the Real Foodie application is mainly adults. According to one study, as children grow older, their eating habits become more similar to those of their parents (Birch, 1999). In addition, as young adults transition to living on their own and create their own lifestyle outside of their parents' home, new habits are formed and lay significant groundwork for future eating habits later in life (Birch, 1999). As a result, the application is hoping to support young adults during this crucial time in their lives by targeting users ages 18-35. Even though the target is young adults ages 18-35, the application is still appropriate for adults older than 35 and it could be useful for anyone trying to learn more about nutrition and changing their eating habits.

3. 3. Learner Needs

In exploring the nutritional research surrounding the target audience (ages 18-35), it was became aware of a study conducted by Deshpande, Basil and Basil (2009), which focused on the barriers to healthy eating that college students experience. Evidence from various other nutritional studies was cited that supports the need to establish healthy eating habits early on (Birch 1999). However, Deshpande et al. (2009), focused on what variables were best at predicting food selection in young adults. Specifically, how college students' health beliefs influence their eating habits. The study described how college is often the time at which young adults are transitioning to independent nutritional practices, and support for developing healthy eating habits is crucial. The behavioral model called the Health Belief Model (HBM) was studied as a model for determining eating behaviors in college students. The Health Belief Model (HBM) used by

Deshpande et al. (2009) took into account several features that were thought to be influential in student eating habits. All of these features operated within the psychographic understanding of perceived threat from a disease compared to perceived benefits from preventative health measures. The evidence from the study supports the understanding that the perception of healthy food benefits as compared to price, taste, ease of preparation, and convenience was far more effective at engaging students in a healthy diet. Deshpande et al. (2009) also suggested from their study that learners need to exercise a deeper understanding of certain foods, particularly the long term perceived threat or benefit, or else healthy habits may not form. Deshpande et al. (2009) concluded that it is not only important to make nutritional information accessible and understandable but it is also essential to provide activities, based in social strategies, that engage the learner in deeper understandings of nutritional content, preferably in contrast or active engagement with their peers.

Table 1.

Learner needs and scaffolding strategies to support those needs

Feature	Domain	Learner Needs	Scaffolding/Support Strategy
Personal Profile	Learners can struggle to reflect on eating habits or archiving digitally	Learner needs a space to set goals and track progress	Personal profile creates a space for the customization of goals and tracking of food behavior
Item Search and Scan	Learners often shop for food items without any support	Learner needs a tool for gaining access to resources with meaningful nutritional information	Item search and scan provides a quick and comprehensive way to pull up food resources
Food Snapshot	Nutritional labeling is confusing and learners do not understand it	Learner needs a space to gauge the holistic understanding of food items	Food snapshot creates a space to organize and understand complex real food information
Challenge	Developing new habits requires long-term motivation and support from peers	Learner needs a space to apply their real food knowledge and support for maintaining healthy lifestyle habits	Challenge feature creates a space for users to complete specific task against both the app and peers
Social	Engaging in complicated tasks with peers leads a deeper understanding of content	Learner needs a space to connect with content and collaborate in meaningful ways with their peers	The social platform in the app allows users to interact and connect with others using the app
Resources	Experienced users can maintain habits with access to additional resources	Learner needs a space to expand and access additional knowledge related to their interest	The resources section provides links to information outside of the app

Table 1 shows what learner needs are and how app designers and learning experience designers can support those needs in general with app features. When creating the design framework and deciding what features the app should have, Honebein (1996)'s seven goals for the design of constructivist learning environments, self-determination theory's principles in app design including supporting autonomy, belongingness, and competence (Deci & Ryan, 2008) and the behavioral model called the Health Belief Model (Deshpande et al., 2009) have been taken into account and were thought to be influential on young adults eating habits.

The following app features are recommended to scaffold/support learners in fulfilling their learning needs based on the theoretical framework discussed above.

4. App Features

The Real Foodie mobile app includes a variety of features to offer its users information and also scaffolds to support making healthy eating a habit. There are four key features in Real Foodie that are depicted in the screenshot designs in Appendix: barcode scan/item search, food snapshot, personal profile and social/challenges. These four main features also directly connect to the learning goals explained previously. In addition to these key features prototype designs are also provided to show additional Real Foodie application elements such as user log-in/account setup process, main application screen and resources section. All of the app features are explained below in the order of how a new users could move throughout the application.

4.1. User Login and Account Setup

Screenshot 1 shown in Appendix is the initial screen an individual would see after downloading the Real Foodie application from the store. If the individual is interested in making an account to use the Real Foodie application there are a few different options. The first option allows users to login using their current Facebook account. This will provide users the option of connecting with their pre-created network for the challenge and social features within the application. A user can also choose to create a new profile in Real Foodie separate of Facebook. These individuals may not have Facebook accounts or are not interested in using the application to connect with others. They might simply be interested in using the barcode scanner/search functionality to learn more about food items. The final option is for current Real Foodie users to sign in if they have previously created an account.

4.2. Real Foodie Main Screen

After completing the initial login, users will move into the application to view the main page, which is shown in screenshot 2 in Appendix. After the initial log-in for a new user, the Real Foodie character, shown at the bottom right of screenshot 2, will welcome users with an introductory message and a short explanation of a user's mission. It might display a message such as, "Welcome to Real Foodie! Your mission is to gain foodie points by adding items to your profile and winning challenges. Good luck!". This statement provides a brief explanation of real foodie points and the activity to accumulate points. Further instructions and basic application information can be found in the Resources section shown in screenshot 10.

In addition to offering a message to new users, the Real Foodie character also serves as a sort of a 'guide' whenever users visit the main screen. The character will give positive messages and grant rewards to users whenever they achieve certain pre-determined criteria, such as winning a challenge, scanning a streak of A+ items, gaining a certain number of points, and more. It will also deliver updates about Real Foodie, talk about news developments relating to real foods, and occasionally drop random suggestions about foods the user could try next. Poking his face will make him giggle and bounce with joy. The Real Foodie character exists to provide positive reinforcement and belonging to users and lends personality to the app.

The six white square graphics shown in the middle of the main screen serve as buttons to link to the six main options a user can take to move throughout the application. The first area is the user profile which serves as the main location for personal information and houses the history of scanned/searched food items. The second and third areas allow users to learn more about food items in the grocery store and around them. These two features are the item search and barcode scanning functionality. The final three areas in Real

Foodie include challenges, resources, and social. The challenge feature allows users to create, manage and complete challenges with themselves or others in their social network. The social feature is a news feed that shows all of the activity in your social network. Both of these social features are explained in more detail in the screenshots 7, 8, and 9. The resources section of the application is simply a listing of links for more "Real Food" information. This area would be helpful for experienced users or individuals that wanted to take a deeper dive in learning about real food and its benefits.

4.3. Personal Profile

After logging into Real Foodie, the user has the option to view their food history on the personal profile as seen on screenshot 3. Based on the nutritional value of the food, points are added to the user's food meter on their profile, and also detailed in their food history. Foods that contain higher nutritional content, in union with the "Real Food Manifesto", are given higher foodie points (FP) as seen on the food meter. Foods that are less nutritious are given little to no points. Receiving no points for a less nutritious food can be linked to a game- inspired learning principle known as "Productive Failure". Gee (2003) stated that productive failure is a crucial necessity for players or users to continue to stay motivated on the long-term goal. In many video games or apps, players make mistakes, but thanks to the productive failure mechanisms that many video games possess, the player continues playing and learns from his or her mistakes.

Similarly, the food history and food meter on the personal profile encourage this same sort of learning principle (Gee, 2003). In reality, many users may make mistakes while attempting to transition from a less healthy diet to a Real Foods diet. By combining learning principles from game theory into the personal profile history and food meter, the app design encourages users for good choices, but does not penalize for poor ones. The foodie points awarded for adding high-quality real food items to a user's personal profile or completing challenges exemplify conditioned reinforcers, offering positive reinforcement as part of the behaviorist learning theory perspective (Driscoll, 2000). Additionally, the algorithm used to award points would take into account appropriate weighting to not award users who attempt to cheat the point-system by eating homogenous foods in high quantities (ex: 3 or more granola bars in one day). This algorithmic weighting would eliminate the ability for users to abuse portion control and the Real Foodie game-inspired point system.

More importantly this point system would allow a user on Real Foodie can eat well on one day and receive corresponding points toward their food meter, and then make mistakes another day and learn from these choices. By including only positive points and showing detailed food history such as date, time, location and nutritional value in a brief text spot on the food history, the user is not discouraged by their mistakes but can instead contextualize how and why they happened and learn from these choices. The long-term nature of the food meter visual also encourages the user to stay focused on a long-term goal, whether it is a day, a week, a month, or a specific challenge.

4. 4. Item Search / Scan

The food item search option is one of the fundamental elements of Real Foodie, as seen in screenshot 4. The layout of the food search feature is consistent with other basic search bars which include recent search auto-fill options. Once a Real Foodie user types in a food name and hits the search button, a list of foods are shown and the user clicks on the one that best represents the food they searched for. After selecting the food item, a food snapshot is shown which details the food item's nutritional value with a letter grade (screenshot 5).

Similar to the item search functionality, a barcode scan feature is shown in screenshot 6 in Appendix. The layout of the barcode scanner is consistent with other barcode scanning applications. Upon focusing the

lens, the user can press the scan button and the barcode scanner takes a picture of the barcode and immediately links it with the food the barcode is associated with.

4. 5. Food Snapshot

After a user has searched for a food item or used the barcode scanner to identify an item of interest they are directed to the food snapshot screen (screenshot 5). A complex algorithm based on ingredients, food preparation, and "Real Food" legitimacy creates the letter grade each food item is given. Food grades are also color coded, green being a healthy choice, to red being a less healthy choice. Additionally, the food snapshot includes a simple overview of the food items ingredients, with harmful processed ingredients bolded with linking functions. In this way, a novice user may be able to obtain basic information and become familiar with common misunderstandings associated with food ingredients. However, the more expert user can also click on these bolded ingredients and receive more detailed research information on the ingredient if they so choose. The food snapshot (screenshot 5) is meant to scaffold real food information and make it accessible and easy to comprehend to various levels of users. This scaffolded information would be in agreement with effectiveness of the Health Beliefs model in college students as seen in research done by Deshpande et al. (2009).

Once a user has searched a food item, the "Add to Profile" button on the food snapshot allows the user to add the food to their history on their personal profile. This feature was designed with consideration to fostering autonomy, belonging, and competence (Ryan and Deci, 2000). In examining the best way to foster autonomy, it is found it easiest to cultivate learner autonomy by providing an option to add food history to a personal space in order to reflect on personal progress in the personal profile feature. Moreover, the design of the interaction between the food snapshot and the personal profile was also meant to be a landing page for the Real Foodie character to greet and encourage the learner when progress was made. This interaction between the food snapshot and personal profile cultivates the principles of self-determination theory by encouraging the learner to choose what foods they add to their profile, how they keep track of their progress, and how they become encouraged and engaged when making progress and interacting with the Real Foodie character.

Additional feature in the food snapshot is the "Suggested Alternatives". These smaller features compliment the functionality of the food snap-shot by providing contextualized information the user may not normally have access to. The "Suggested Alternative" links the searched food item from the food snapshot to healthier alternatives. This allows the users to become familiar with healthier options in a way that does not overburden the user. By giving healthier options juxtaposed against the personal choices of the user, Real Foodie uses the personal tastes of the user as a guiding function in transitioning the user to a healthier diet. These suggested alternatives are shown in screenshot 5 as green link so that a user can click to the product website to learn more about the items. Additionally, as Real Foodie becomes an established application with many users companies would be allowed to sponsor links to their products, thereby offering an income opportunity to support further development of the application. All of the features found on the food snapshot scaffold the nutritional information for the learner by including long-term effects of harmful processed ingredients, along with information healthful alternatives and their positive long-term benefits.

4. 6. Social and Challenge

Merely having access information is not enough to accomplish learning goal one and two. Not every user will be fully motivated to make long-term changes in their habits, nor do they have the time to sit down and consider their food choices. To further motivate users, the Social and Challenge features of the Real Foodie application focus on social media and gamification. These two areas allow users to import their pre-existing

contacts from Facebook and other social media sites into Real Foodie. Users can also choose not to opt into the social aspects of the application by clicking "No Thanks" as shown in screenshot 8.

As Deshpande et al. (2009) suggested in their research regarding the Health Beliefs model and young adult eating habits, the best method for influencing young adult's eating habits is through social marketing strategies that emphasize food benefits in relation to a learner's peers. Social feature is designed to provide a space for learners to interact with their peers within the real food content domain. This means that learners can voluntarily interact with peers through the language of real food content, in hopes of engaging the learners more effectively. The details of the social activity that it has proposed in the application is the combination of the news feed and the challenge functionality. The news feed shown in sketch 7 displays a possible list of updates that would show in a user's social application. The news would list when friends scan and add items to their personal profile or when they gain points for challenges. The social news feed also lists the amount of foodie points that individual users are gaining by scanning high-quality items or by participating in challenges.

Screenshots 8 and 9 depict the challenge feature. The challenges display options where users can put their real food skills to the test by completing time-sensitive tasks, individually or with other members of their social network. The app will input some pre-established challenges in the "View Real Foodie Challenges" link in addition to user-generated challenges can also be created or viewed. The challenges might be as simple as adding one A+ item per day to a user's personal profile for a week, or trying to be the first user to reach 1,000 foodie points.

The challenges have very few parameters or limits because users can create their own challenges and view other challenges currently occurring within the application. The ability to connect, track and challenge your social network within the Real Foodie application will hopefully serve as motivation for users to transition to a more healthy real foods lifestyle. These features closely align with the social change strategy by Deshpande et al. (2009) and will help support young adults in overcoming the barriers to eating healthy that many college students face.

By stimulating the interactions with nutritional content in gamified personal goal setting and peer-set challenges, Real Foodie will provide learners with the scaffolding they need to engage with nutritional content in a more intrinsically meaningful way (Ryan and Deci, 2000). Such a system will provide motivation for the user to continue healthy eating habits and ultimately, change them if they so desire. The activity embedded in the app functionality supports learning goal number two in an effort to modify users eating habits away from processed and unhealthy options, and toward more real, nutritionally-dense foods.

4. 7. Resources

The application feature titled "Resources" (screenshot 10) is simply a listing of real food nutrition information. These resources might include books, news, blogs, and a "real food index" with definitions with commonly used terminology. These resources are meant to support active users of the application that might want to further their exploration and research beyond Real Foodie. In the future, if the Real Foodie puts together their own blog this feature would also be a good avenue to share updates.

Table 2.

Connecting app features with the learning goals

Feature	Learning Goal 1: Users will be able to **tell the difference between** "real food" and other less healthy options	Learning Goal 2: Users will **demonstrate an effort to change** buying habits away from processed and unhealthy options to more real, nutritionally-dense foods.
Personal Profile		X
Item Search and Scan	X	X
Food Snapshot	X	X
Challenge		X
Social		X
Resources	X	

Table 2 shows us the connection between app features and learning goals of Real Foodie app. Based on Table 2, it can be said that if you want to design an app where your students/users tell the difference between "real food" and other less healthy options, you can use Item Search and Scan, Food Snapshot, and Resources features. On the other hand, if you aim your students/users to demonstrate an effort to change buying habits away from processed and unhealthy options to more real, nutritionally-dense foods, you need to use Personal Profile, Item Search and Scan, Food Snapshot, Challenge, and Social features in your design.

5. Conclusion and Suggestions

Chronic diseases such as heart disease, cancer, stroke, diabetes and asthma are commonplace in the world. In fact, chronic diseases cause 7 out of 10 deaths in the US and nearly 1 in 2 adults live with at least one chronic illness (U.S. Department of Health and Human Services, 2018). These statistics are not only striking they are also sad since everyone in the U.S. is either affected by a chronic illness themselves, or someone close to them has been affected. As Price documented in their groundbreaking research of traditional cultures, much of these chronic illnesses are due to an industrialized diet. In many western cultures nutrient-dense traditional foods have been replaced by processed items with harmful ingredients such as white flour and sugar. Companies in the food industry go to great lengths to promote their products as healthy using claims such as "all natural" on packaging, when these claims are far from the truth. This foundational problem led to the design of the Real Foodie application which seeks to calm many of the confusions surrounding diet and nutrition.

The Real Foodie mobile application offers many helpful features to users seeking to live a healthier lifestyle. By targeting young adults ages (18- 35), it is hoped to help these learners gain access to real food information and to support them in creating better eating habits. It is offered these supports through an item search/barcode scanner and the real food snapshot. Real foodie points are also awarded for adding high-quality foods to a user profile, which will hopefully motivate additional use of the application. The game-inspired point-leveling system of the application is one that the Real Foodie plans to expand in the future. Furthermore, the application offers social features such as a news feed and challenges to allow learners to connect with others interested in real food. It is a hope that once these habits are established they will put users on a path of healthier living to avoid chronic disease in the future.

Based on the theoretical discussion above, it can be said that if you want to design an app where your students/users tell the difference between "real food" and other less healthy options, you can use Item Search and Scan, Food Snapshot, and Resources features. On the other hand, if you aim your students/users to demonstrate an effort to change buying habits away from processed and unhealthy options to more real,

nutritionally-dense foods, you need to use Personal Profile, Item Search and Scan, Food Snapshot, Challenge, and Social features in your design. This can assist developers in creating more effective mobile apps.

6. Future Enhancements

During the development of Real Foodie, many features were considered for implementation. Currently, the Real Foodie design has a feature for users to challenge themselves and others, and ultimately to serve as motivation for individual users to accumulate foodie points. A global leaderboard is a planned enhancement for this feature which will display the usernames of healthy real food eaters worldwide with the most accumulated foodie points. The more competitive users of Real Foodie will be further incentivized to compete with others and gather the most foodie points so that they could appear in the "Top Ten" of the userbase.

It is also considered adding a 'badge' system to expand on foodie points feature. They would be icons that appear on the users' profile, representing certain milestones, levels, and goals the user has met through accumulation of foodie points and meeting certain criteria. Badges would range from the very basic— such as joining Real Foodie and accumulating your very first foodie points— to the mysterious and extremely arcane, where the exact criteria for earning those badges is unknown and hard to achieve. The badge system would give users more incentive to use the foodie points system.

The last enhancement includes a price locator tool. This feature, located under the Food Snapshot screen, would allow users a way to find real food at lower costs. This feature would use geolocation and available databases to search for the current food item and give users a list of additional places to shop for the food, and offer an instant price comparison. Shopping for real food can often be difficult, time consuming, and expensive. Such a feature would empower users to quickly make good food decisions and more easily support their habits over time.

Last but not least, this paper has proposed a design framework for learning technologist to design and develop a mobile learning app in the context of eating healthy. In other words, this study offers a number of theoretical and practical implications in the context of pedagogical factors that can assist developers in creating more effective mobile apps. For this reason, it is important to collect empirical data by implementing the mobile learning apps developed within this framework with the appropriate target audience.

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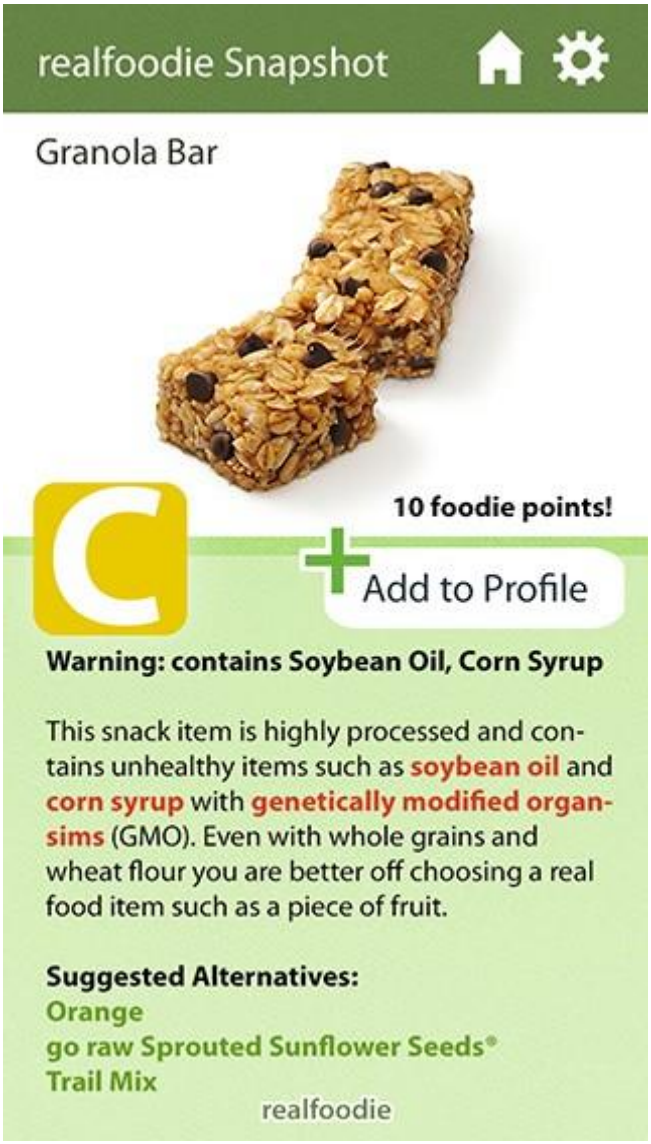
Appendix

Screenshot 1

Screenshot 2

Screenshot 3

Screenshot 4

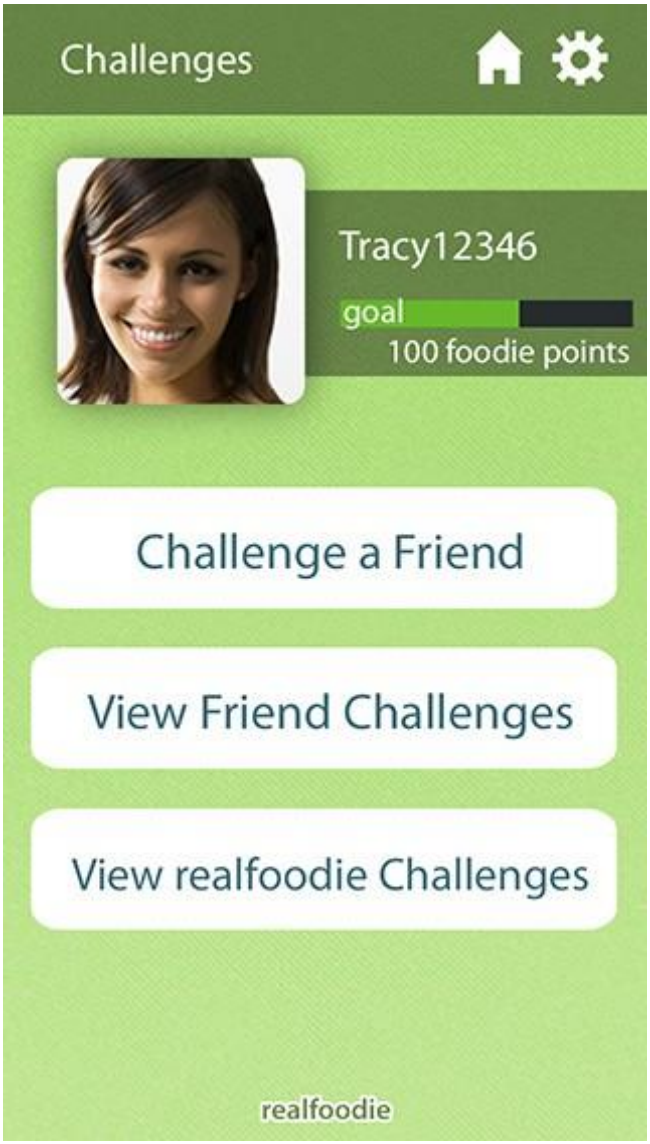


Screenshot 5

Screenshot 6

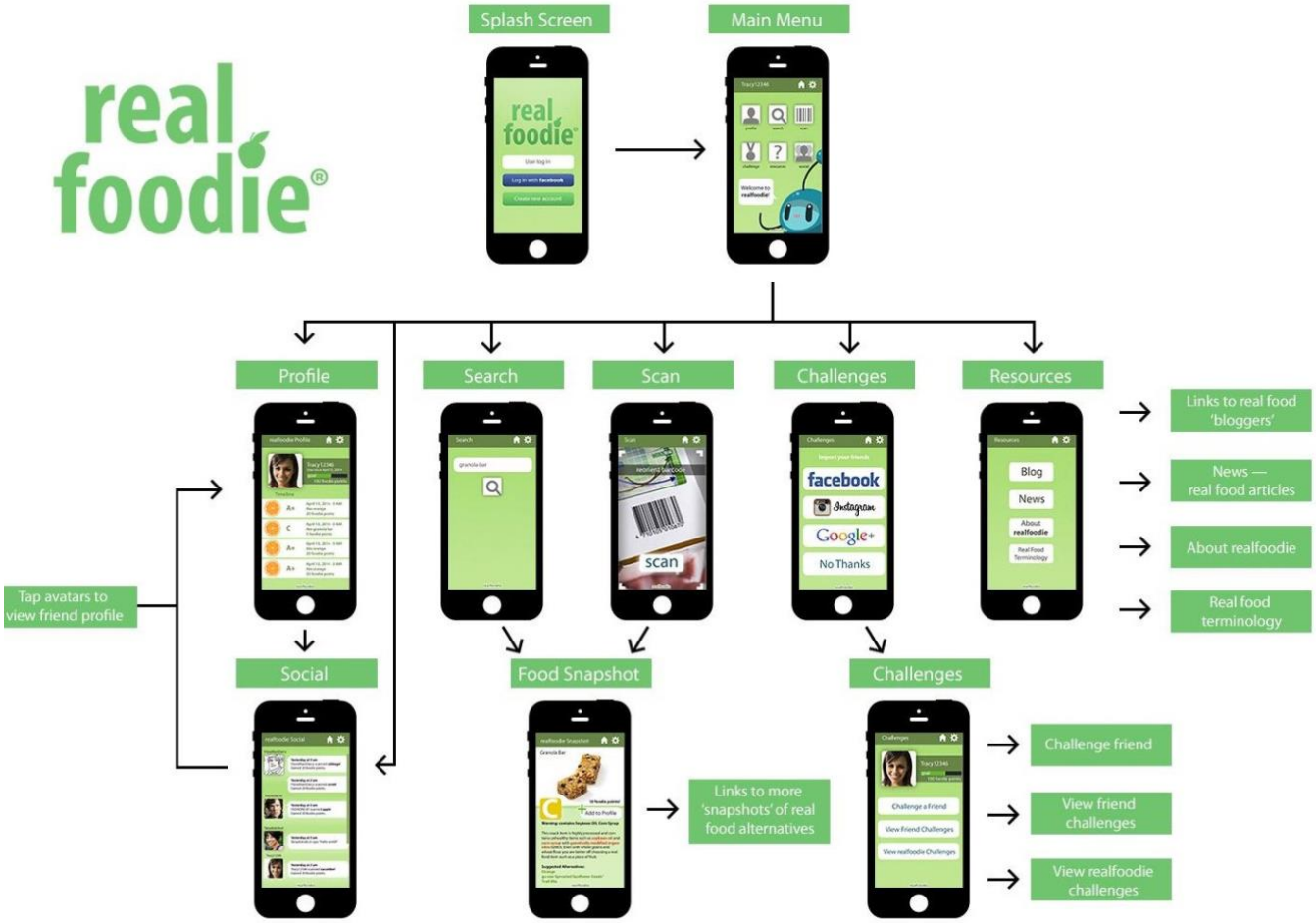
Screenshot 7

Screenshot 8



Screenshot 9

Screenshot 10



Screenshot 11