

Gamification of Mobile Fitness Applications for Newly Diagnosed Multiple Sclerosis Patients

Brian Coupe

SUNY Polytechnic Institute

SUNY POLYTECHNIC INSTITUTE
DEPARTMENT OF COMMUNICATIONS AND HUMANITIES
CERTIFICATE OF APPROVAL

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Date

Russell Kahn, Ph.D.
First Reader

Ibrahim Yucel, Ph.D.
Second Reader

Abstract

We can think of our life with mobile technology as a constant classroom and learning environment. Mobile Fitness is a prototype application which will be used by newly diagnosed Multiple Sclerosis patients. The application uses the theory of fun and engagement to keep the user interested and motivated to complete daily workouts. Mobile Fitness uses these game based learning characteristics and human centered design to better suit the user. Recreational therapy also integrates well with gamification because both can be considered with the same end goals in mind. Successful completion of tasks with a reward.

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This thesis project is dedicated to our family members or friends of friends who struggle with a debilitating disease such as Multiple Sclerosis. Everyday each individual lives his or her life in the best way they currently can. They continue to stay strong for us because we continue to stay strong for them.

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Introduction

Fitness applications can be used to keep track of progress or provide advice. The application is essentially a learning environment. What was once pencils, paper, chalkboards, or dry erase boards, is now entering the digital age. Patients diagnosed with Multiple Sclerosis will undergo many lifestyle changes in future years in regards to mobility and strength. A gamified application can provide motivation and a record of completion for required daily exercises. Positive results can be achieved when the mobile application is integrated with a mobile technology such as FitBit. The digital teaching techniques coupled with recreational therapy allow for a safer and more enjoyable fitness environment.

About the Project

My fitness application titled: “Mobile Fitness” has specific gamification goals in mind. There are many fitness applications out on the market for individuals seeking an active lifestyle. However, for patients newly diagnosed with the disease of Multiple Sclerosis (MS), there will be newfound issues in lack of motivation and possible hopelessness or desire to complete tasks. In Mobile Fitness, the user is able to choose daily quests for body movement. An integration of weekly fitness tasks with healthy lifestyle changes. Education about muscle groups can stimulate a seeking of knowledge by the game player researching and understanding their own fitness tasks. Learning tasks now incorporate different approaches such as cognitive, behavioral, and constructive theories. Mobile Fitness is a gamified application which utilizes the theory of fun and engagement and the instructional methodology of educational games. The application also enhances intrinsic motivation by incorporating Malone’s motivation theory: challenge, curiosity, control, and fantasy. User centered design elements to assist and allow users with physical disabilities or limitations also are used in the application.

Literature Review

Modern mobile technology incorporates easily into learning spaces to achieve better results. I wanted to create an application which integrates learning how to use Fitbit flex wristband technology for a specific target audience. The target audience for the learning space is individuals who have been recently diagnosed with Multiple Sclerosis. The presentation is to become more familiar with Fitbit wristbands and how to use it as a starting point to maintaining the active lifestyle while living with Multiple Sclerosis. This disease can affect people of all ages and the Fitbit technology is accessible at relatively low cost. Touchscreen technology on the mobile fitness application allows greater usability to users with limited hand control for no physical buttons to press. The application can include workouts which fit the needs of the individual as the disease progresses and less movement ability is present.

Problem Statements and Questions

What advantages does an application have when compared to traditional printed or mass market therapy media? Do learners actively seek out interactive applications over traditional gym therapy outings because of ease of use and the features provided? How does user centered design come into play when understanding how to engage the audience of a gamified application? A final goal of the gamified fitness application is to motivate and inspire individuals with Multiple Sclerosis, while making the fitness and required movements fun and rewarding.

Theories and Methodologies

It's important to note the theories and methodologies used in fitness applications to maintain and keep an educational focus in mind for the design phase. Mobile Fitness utilizes the theory of fun and engagement and the instructional methodology of educational games. The game is designed to require learner actions and act on them (Alessi and Trollip, 2001). Fun and engagement come into play for audiences who are eager to get fit, stay fit, and are looking for a motivational way to do so. A game which keeps the player interested in sticking around requires easy to use functions and layout otherwise there will be a loss of interest (Koster, 2005). Another way to engage the user is to integrate an educational aspect to the application. Here the player can visually learn about muscle groups, learn proper form and customize their fitness. Game based learning can be designed from the ground up to better suit all types of learners (Schaffhauser, 2013).

Engagement also takes place with the reward system. A virtual trophy badge area to compare with other individuals and have a friendly competition is all within game. Three main principles are relevant to perception and attention. (1) Information (visual or aural) must be easy to receive. (2) The position (spatial or temporal) of information affects our attention to and perception of it. (3) Differences and changes attract and maintain attention (Alessi and Trollip, 2001). This instructional methodology is important because a game designer wants a user to stay focused on the tasks and he or she excited to come back for more. Using different types of media such as video and graphics in a well-designed layout gives a user information which is easy to follow and retain.

The application enhances intrinsic motivation by incorporating the essential factors of Malone's motivation theory: challenge, curiosity, control, and fantasy (Alessi and Trollip,

2001). Motivation also needs to find a challenge balance so the user does not become frustrated. The user can lower difficulty levels to make sure they aren't harming their body or working out beyond their abilities.

Description of Objective for Fitbit Integration

The individuals will use the learning space within the application to learn more about Fitbit and also learn how to research and choose fitness appropriate exercises for those with Multiple Sclerosis to get their heart rate up and muscles moving safely. The Fitbit wristband is a gamification of fitness and makes learning about fitness activities / working out fun. The gamification also allows the user to set achievable goals each day and staying there with rewards for success.

After completing the learning space, the learner will be able to:

- 1.) Know how to setup and use a Fitbit wristband.
- 2.) Understand how activity helps to lower the health risks involved with Multiple Sclerosis.
- 3.) Learn about different types of activities which are safe to perform and complete with the Fitbit wristband.
- 4.) Explain the activity significance and what muscle groups or stretches are being used.
- 5.) Identify and describe how being motivated to continue using the Fitbit wristband contributes to a healthy lifestyle by sharing the knowledge with others.
- 6.) Create their own weekly fitness activities and monitor progress with the use of Fitbit.

Description of Learning Space

The learners can be in a small group setting. The group is for individuals with Multiple Sclerosis interested in a way to exercise with technology for motivation and tracking progress. Small group instruction with videos, online research, evaluations and setting goals are all incorporated into the learning space.

Description of Student Interaction

The whole purpose of the Fitbit worn on the wrist is to enhance the intrinsic motivation. "...games are used to make learning more enjoyable; learning becomes more than something we are required to do or need to do to obtain some reward, such as a good grade" (Alessi & Trollip, 2001 p. 271). Maintaining student interest is not just for health benefits but can also be achieved by using different types of media such as videos, thinking of different ways to exercise and applying the knowledge. The learner recalls the information from memory to demonstrate the understanding of using Fitbit. "Having perceived and encoded information we must also be able to retrieve it and use it at a later time" (Alessi & Trollip, 2001 p. 22). Now knowing how to use the technology and completing the fitness tasks allows for a reflection and self-assessment to take place after each session. The learner is responsible for their own success.

Description of how the learning space covers the five learning styles

Remembering: The learner will purchase their Fitbit flex and have it at the ready. The included Fitbit documentation is reviewed for the initial meeting of user and technology followed by a YouTube video: FitBit Flex Fitness Band - First Look, Unboxing, Setup and Features. Youtube video shown as a visual for initial setup. A quick quiz of the Fitbit functions.

COUPE Gamification of Mobile Fitness Prototype Application

Understanding: The learner will demonstrate an understanding of the Fitbit technology documentation and how to sync with a computer and check on progress. The learner will complete a 2-minute walk to have an activity to sync and refer to.

Applying and Analyzing: The learner will research fitness activities to incorporate into their weekly schedules. Search engines such as google can be used to find activities but a primary focus will be on the Multiple Sclerosis webpage and the recommended types of activities for what ailments each learner may have.

Evaluating: The learner Fitbit profile will be created and keep a record of daily, weekly, and monthly sections. Progress is monitored and ways to improve are noted.

Creating: The learner will create a weekly fitness schedule on their own, tailored to their own needs and goals. The fitness schedule will be used from then on by the learner as a living document which can be changed up depending on new needs or fitness improvements over time.

User Centered Design Elements

“Information designers prepare information for efficiency and effectiveness.” (Kahn, 2014, Online Presentation). Mobile application based learning can be designed from the inception to better suit all types of learners. Characteristics of human centered design which apply to gamified applications are:

Coherence – An application should have a simple, initial home page with clearly presented options. “...highly visible to what is going on and what is possible” (Cooley p. 68). Once the user is within the main page everything is clearly labeled and available to move to another section if desired. The san-serif fonts should be clean and legible.

Engagement – Gamified applications must offer engagement to the user. While moving along the exercise a user can choose to click the different links within the paragraph for further insight or facts. The visual journey is exciting to view and learn more about. Mixed use of different information technologies such as video, audio and text maintains the users' attention. The three dimensional world has lots to see and explore in full color and provides a positive learning experience where knowledge is retained. The user is “invited to participate in the process which creates a feeling of empathy” (Cooley p. 68).

Purpose – Throughout the experience there are numerous opportunities for the user to check out additional links beyond what is being presented. They may be highlighted as links or text which can be hovered over. As Cooley states: “The system is capable of responding to the purpose the user has in mind and then encouraging him or her to go beyond it” (Cooley p. 70).

Recreational Therapy

Any debilitating disease can wreak havoc on not only the body but also the mind. “Recreation therapists use a patient-centered approach to reduce barriers and identify facilitators for physical, mental and social well-being” (Svarich, p.1). This type of therapy integrates well with gamification because both can be considered with the same end goals in mind. Successful completion of tasks with a reward.

Prototype Application Example

Figure 1. Start up Page



Mobile Fitness start up page for log in, account creation, and FitBit pairing.

Figure 2. Mobile Fitness Home Screen



Mobile Fitness Home Screen showing the four fitness choices and the rewards, calendar, and settings options.

Figure 3. Daily Quest Screen



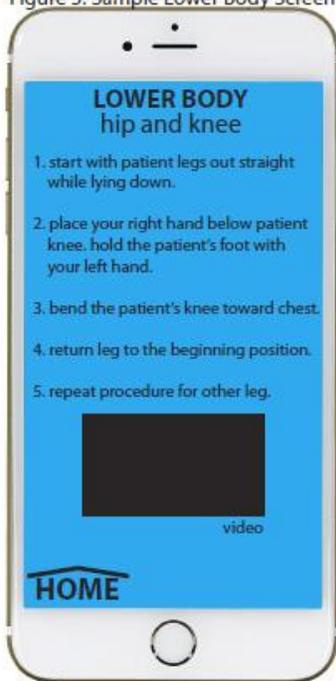
Sample screen showing the quest options if daily quest is pressed from the home screen.

Figure 4. Sample Upper Body Screen



This figure is showing a sample upper body workout and the steps to complete. A video is also available to visually show the user proper motions and technique.

Figure 5. Sample Lower Body Screen



This figure is showing a sample lower body workout and the steps to complete. A video is also available to visually show the user proper motions and technique.

User Centered Design Elements

Touchscreen navigation provides an ease of use to individuals with mobility issues.

Mixed use of different information technologies such as video, audio and text maintains the users' attention.

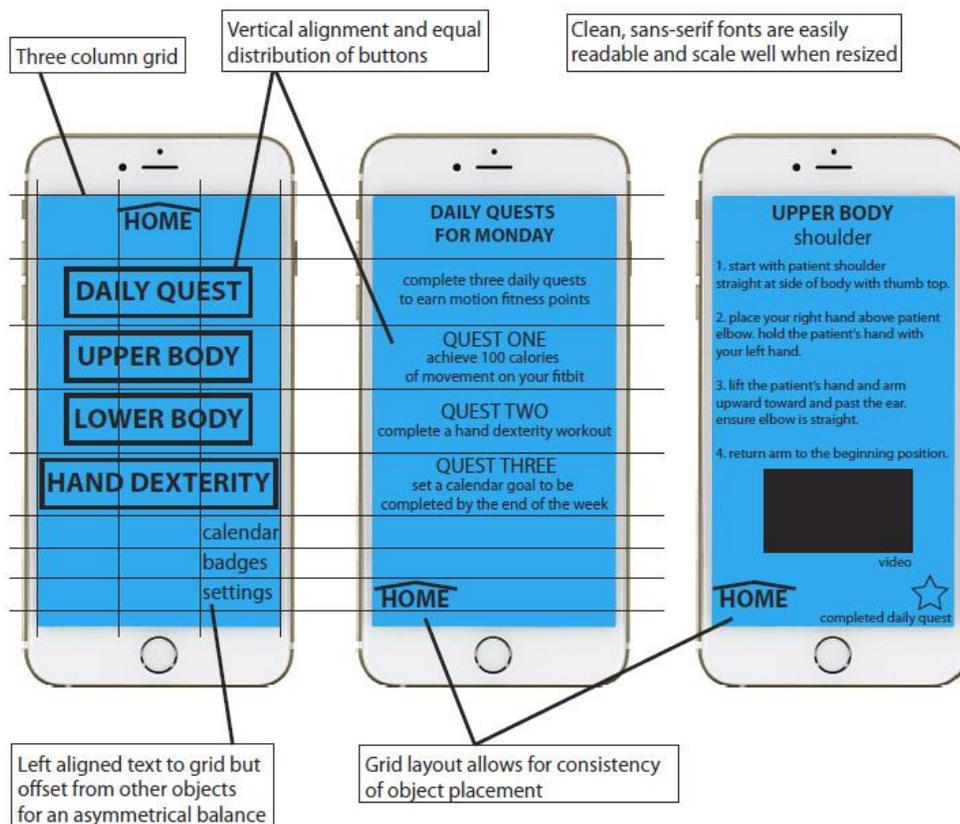
The san-serif fonts are clean and legible.

Everything is clearly labeled and available to move to another section.

An application should have a simple, initial home page with clearly presented options. "...highly visible to what is going on and what is possible" (Cooley p. 68).

Graphic Design Elements

Visual consistency depends on typographic style, adhering to a grid and column structure, and margins” (White, 2002, p. 115). A grid system is a structure used to help make balanced, well planned designs. It is an overlay of sorts to the object or within the dimensions of a layout. Grid systems are important in design to ensure the design is visually appealing and not too “overweight” on one side or another. Design layout can be considered as if it were sides of a scale. For example: If too much text or graphics are on one side of the page, then that side is deemed too “heavy”. It should be noted that these graphics and text can also be balanced out by white space. Use of a grid system assists in this balance. As the project progresses into its final stages the elements within the grid system will need to be refined.



“Typography: applying type in an expressive way to reveal the content clearly and memorably with the least resistance from the reader” (White, p. 149). Typography can make or break a document. “Graphic designers who can scrutinize and describe type’s nuances are better equipped to pick the right tool for the job and discuss those choices with colleagues and clients” (Coles, 2012). Content creators must be knowledgeable of font choices and methods to use. If too many fonts are used the design loses its cohesiveness and structure. It will simply become letters on a page.

Differences from other Fitness Applications

Mobile Fitness has what can be considered a major difference when compared to other fitness applications on the market. With gamification in mind, the user is able to level up their fitness repertoire when completing the weekly tasks. It is a somewhat unique element to fitness type games and that is the ability to unlock new and different types of workouts.

Reward and Level up System

The user has completed various upper body stretches and can now incorporate more advanced methods into their weekly schedules. The user can also view a video of the new unlocked workout and can decide if they are ready for it now or can decide to use it at a later date. This gives the user a goal to strive for and complete (Koster, 2005).



image capture from: <https://youtu.be/GKDU6pPH4lo>

Most applications on the market also are very straightforward with tasks to complete and not very much learning outside of the box taking place. Mobile fitness as mentioned in the theories and methodologies section of this paper integrates an educational portion so users can learn about the muscle groups and tailor make their own fitness routine after completing research with their own needs in mind, within game.

The use of a points system can also be considered an advantage within a gamified application. The motion points are awarded from the completion of daily quests. Completing all three daily quests gives a slight bonus to total. Motion points can also be banked and saved up. This can assist the user who may not be able to complete any fitness tasks for the day due to the multiple sclerosis disease having a flare up and causing pain. Motion points can be spent to

ensure the avatar stays “healthy” and the user can proceed the next day with their goals without avatar damage. Intrinsic motivation can be enhanced by incorporating the essential factors of Malone’s motivation theory: challenge, curiosity, control, and fantasy (Alessi and Trollip, 2001). Challenge can be given to the user via a step up from basic workouts to more complex as the user becomes more comfortable with fitness workouts. "Varying the difficulty of material as learner performance improves maintains challenge throughout the lesson" (p. 25).

Curiosity can be provided in many forms but the Mobile Fitness application uses video to not only provide information to the user in an easy to use format but also creates the desire to click. "Sensory curiosity is aroused by visual or auditory effects that are surprising or attract attention" (p. 25).

As stated in Alessi and Trollip, "Lessons which give feedback as a function of specific responses or which follow different paths through the content based on learner performance, follow the contingency rule" (p. 25). Being able to choose a daily quest or complete a workout or two allows the user control and decision making. Motivation to complete tasks is higher when a learner is more involved in the process.

The in-game avatar is a form of fantasy within Malone's Motivation Theory. "In any lesson, it may be valuable to encourage learners to envision themselves in a situation where they can really use the information they are learning" (p. 26).

Design: Games vs. Gamification

The design of an educational application can be tailored to its audience. Gaming vs. Gamification (2013) states: “Any discussion of gaming in education has to address game playing

versus gamification – the latter term that has picked up a lot of attention the last few years” (p. 33). I agree with the statement because often when people hear the word “game” they immediately think of a game such as Monopoly or checkers and are not aware of the term “gamification”. Gamification breaks down the framework of a game into design elements such as rules, dynamics, and fun or engagement. When a game is designed from the beginning as a learning game various elements such as rewards can be incorporated to retain the interest of the learners. Krisen DiCerbo “...suggests that game-rewards structures are really “behaviorism in a disguised form” (p. 33). DiCerbo presents the viewpoint of “games are more likely than gamification to succeed in the classroom” (p. 33). I think gamification is important to educational games because it requires a knowledge of the game mechanics, design, and aesthetics in order to better understand and apply knowledge from the educational learning experience. I do agree though with Blanco, Torrente, Marchiori, Martínez-Ortiz, Moreno-Ger, Fernández-Manjón (2012) on how “...games offer new opportunities for education but, at the same time, they can be disruptive and require additional work” (p. 309) Games can be designed to be a supplement of existing lesson plans. “The combination of games with other contents and tools can provide educators with further control mechanisms over the learning flow by considering the information gathered from both the game and other activities in the lesson design” (p. 308). Brunzell & Horejsi (2013) agrees in that “Students work through carefully crafted challenges at their own pace as they master increasingly complex content” (p. 8).

Advantages

Gamified educational applications can provide learning advantages to users when compared to traditional instructional methods. Dian Schaffhauser (2013) mentions in her article "...the sweet spot for gaming in education is helping students grasp concepts that are tough to learn out of a book" (p. 28). There are many different types of learners and an educational application can be created to relate to a wide variety. Brunsell & Horejsi (2013) note how "students work through carefully crafted challenges at their own pace as they master increasingly complex content" (p. 8). "Failure is not an endpoint but an opportunity for additional coaching from the teacher" (p. 8). Conati & Kardan (2013) discuss how intelligent tutoring systems can "...provide instruction personalized to the specific needs of each learner, as good human tutors do" (p. 13). Boeker, Andel, Vach, & Frankenschmidt (2013) conclude game based learning results in higher outcome performance of students compared to a traditional script-based instructional approach (p. 8). Their study "...shows that students...had a significantly higher cognitive learning outcome when compared with the students who learned the same material with a script..." (p. 8).

There are a variety of approaches which would interface well with the creation of a digital application. "Visual and verbal increases retention" (Kahn 2014). It's important to note the theories and methodologies used in applications or media to maintain and keep an educational focus in mind for the design phase. Perception and attention is a cognitive principle which comes into play when designing for digital media. "Ease of perception is the basis for many screen design considerations, such as the size and fonts used for text, the use of color, the size and level of detail used in pictures, and the volume and clarity of the audio" (Alessi and Trollip, p. 21). If the learner does not have the information presented in a legible and interesting

manner, then the information will not be retained. The application also utilizes the theory of fun and engagement and the instructional methodology of educational demonstration. The application is designed to require learner actions and act on them (Alessi and Trollip, 2001). A user of the interactive documentation must have a “want” to use mentality, not a “need” to use. What makes an interactive application so special above the others? If a user is gaining knowledge from it, there must be relatable material within.

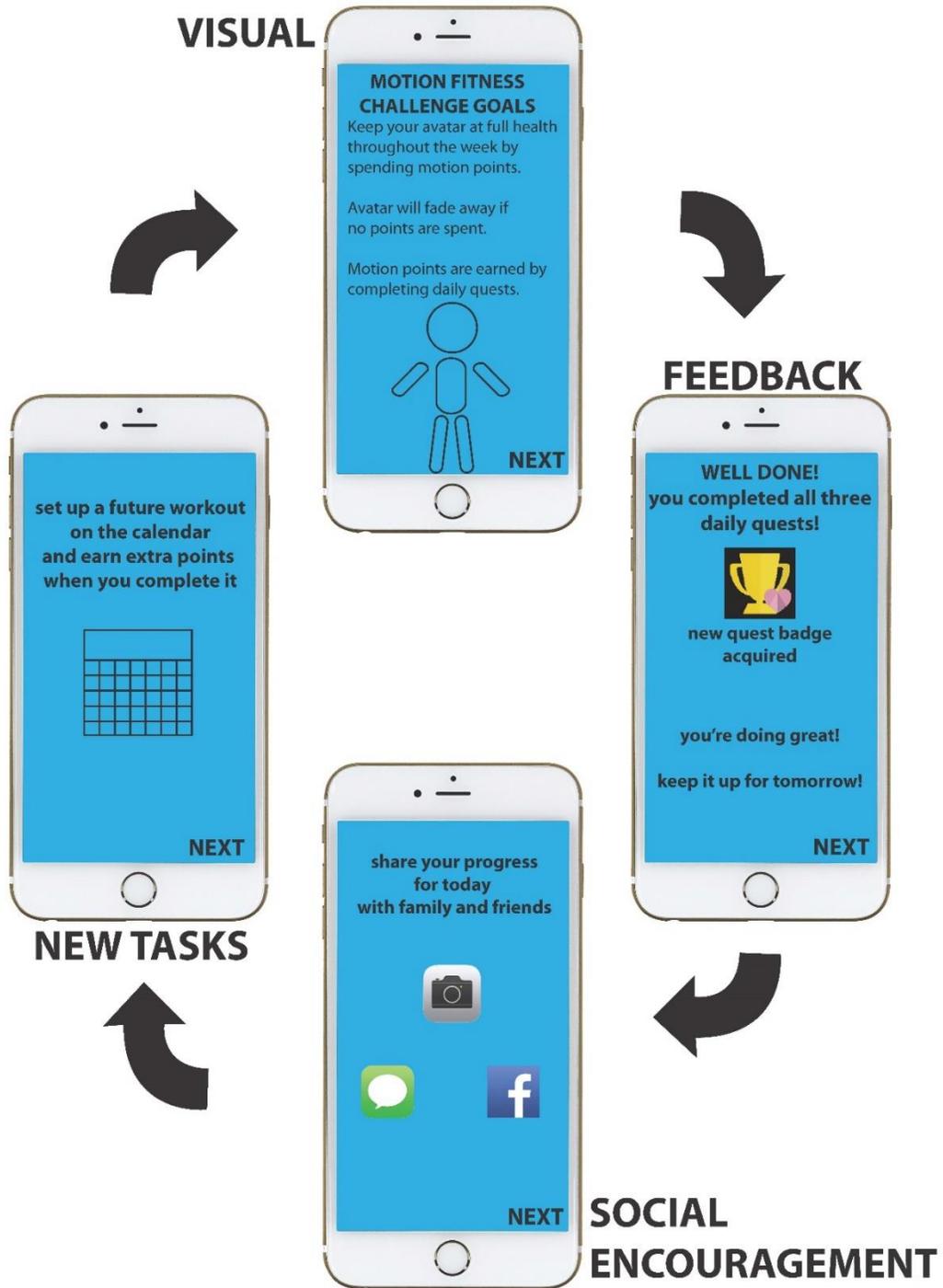
The visual and verbal language need to work in harmony here for an exciting experience. “Like good writing, good graphical displays of data communicate ideas with clarity, precision, and efficiency” (Katz, 2012, p. 37). The visuals are reaching out to the technology oriented audience of today who desire quality, well made products and experiences. “Use storytelling to engage an audience in a design, evoke a specific emotional response, or provide a rich context to enhance learning” (Lidwell, 2010). The video at the end of certain recipes reinforces what the viewer just scrolled and read through but now sees in motion.

Alessi and Trollip (2001, p.31) state “Although the principle of active learning is equally compatible with behavioral principles, the cognitive approach has put increasing emphasis on active learning and on learners’ activities being designed and selected to enhance transfer of learning.” A cognitive approach of learning combines different principles such as motivation, memory, comprehension, and transfer of learning.

Encouragement can be provided to the game user via an in game avatar. The avatar fades away during the week. The avatar requires the spending of motion points to stay intact. “...avatars are a way to express our true selves, our most heroic, idealized version of who we might become” (McGonigal, TED Talk).

Users can seek feedback from peers, family, or friends. When the fitness goals are completed the user can send a group message to family by selecting the appropriate icon within the application. "...recruiting "allies" among friends and family, they are taught to score their daily triumphs and aspire to "epic wins" – glorious victories over challenging odds" (Martin, 2015).

Positive Engagement Loop



Video tutorials within the application can use a visual and auditory method in narration of interactive media when presenting the information to the viewer. The viewer follows along with

the video to successfully complete their own task. The learner is motivated to create better end results and can pause the video to try the technique on their own before proceeding further. The learner can then use this knowledge in the future for new procedures to follow along with or create their own. A learning approach which reaches the widest number of audience members would be a better choice than one which only reaches a certain type.

Drawbacks

The Conati & Kardan (2013) article concludes that modeling student learning activities to games can be considered difficult because it “requires endowing a tutoring agent with the ability to understand a student’s states and processes relevant for learning from often limited and ambiguous information on how the student interacts with the target learning environment” (p. 23). The different methods of educational games such as interactive simulations or group projects “can be difficult to judge a priori which ensembles of user-interaction behaviors are conducive to learning and which ones indicate a suboptimal interaction with the system that warrants help from the tutor” (p. 14). Educational applications will only succeed in teaching a learner if they are correctly applied to a student initially by a teacher. Marzano (2013) mentions “Even if teachers make classroom activities interesting, students won’t be deeply engaged unless they think the content is important to their lives” (p. 82). “Question/answer games have limitations in fostering both long-term motivation to learn and in-depth learning strategies” (Zhong-Zheng, Yuan-Bang, & Chen-Chung, 2013 p. 209). An educational game cannot teach lessons entirely by itself. “Student engagement is strongly influenced by what teachers do in class” Marzano (2013) (p. 82).

Integration into the Fitness Environment

When we are pondering if a group fitness session at our local gym or rehabilitation center is right for us, we often might be hesitant to participate. A fitness application can help alleviate some of this pressure and still provide a user with genuine intrigue. Marzano (2013) mentions “Students are likely to stay interested if the game is structured so that students aren’t sure when and if they’ll be called on. If students believe that the teacher might ask any of them to participate at any moment, they will more likely attend to the activities at hand” (p. 82). If the teacher is genuinely excited about content, the tacit message to students is that it contains useful information (p. 82). The fitness application essentially becomes the teacher.

“Initially, students were more concerned with the motivational aspects of games, and some of the procedural aspects of managing games” (Ji-Eun & Jeong (2014) mention in their article “...after completing the judging process and actually playing the games, students found the games that required more challenging reasoning skills and open-ended thoughts were more attractive...” (p. 33). The students did not maintain an interest in games which were too easy. A more complex educational game was valued because of the challenge required to complete it. Boeker, Andel, Vach, & Frankenschmidt (2013) state “Game-based learning should be taken seriously into account as an alternative instructional method on topics where student motivation might be a problem (p. 8). Brunsell & Horejsi (2013) agrees with a classroom setting education game by “Applying game mechanics to your classroom provides an opportunity to increase student self-direction while focusing on student learning. Students’ progress at their own pace as they master content instead of moving together to the next unit – whether they understood the material or not” (p. 8).

Findings

What advantages does an application have when compared to traditional printed or mass market therapy media?

An application has several advantages when compared to traditional printed media. The first being, there is less to carry around or clutter a workout area. The application is self-contained and allows a user to quickly navigate user centered design elements using touchscreen technology. Video demonstrations can be streamed to the device instead of setting up a projector or television set to view a presentation.

Interaction with other users, friends, or family is also much more advantageous to an application. The almost instantaneous connection through mobile device contact lists or social media allows unprecedented communication possibilities.

Do learners actively seek out interactive applications over traditional gym therapy outings because of ease of use and the features provided?

Learners seek out interactive applications for the challenge and motivation to complete tasks on their own. Traditional gym therapy might not come fully paid for to all patients so an application allows a user to still get the required or recommended workouts at home on their own or with the assistance of a family member.

How does user centered design come into play when understanding how to engage the audience of a gamified application?

Gamified applications require quick recognition and ease of use. Proper design layout and adherence to a grid keeps the design in order and easy to follow. If a user becomes confused from poor design, then limited learning will occur.

Navigation through the application screens is straightforward and simple to make a choice using a finger touch. If the user desires to return to the “Home” screen, that option is available on all screens so a user will not become lost within the application.

The audience is engaged in completion of the workouts because of the application simplicity.

Do gamified fitness applications motivate and inspire individuals with Multiple Sclerosis, while making the fitness and required movements fun and rewarding?

Gamified fitness applications do provide motivation and inspiration to individuals with Multiple Sclerosis. Reward systems within game allows a virtual trophy area to compare with friends or show family members the progress within game. Engagement can take place by motivating to complete tasks unlock new workouts. Side quests or optional daily quests can provide helpful pointers or bonus points to a user. Players can visually learn about muscle groups, learn proper form and customize their fitness with the use of the in game video.

Conclusion and Expected Results

The landscape of learning from mobile applications is changing. An application is an excellent supplement to an existing regimen or can fully take the place of an instructor so a patient can work out on their own with less frequent office or personal visits. Patients recently diagnosed with Multiple Sclerosis may be able to complete all of their fitness tasks and stretches on their own in the beginning. As the disease progresses a partner or nurse may be required to assist with the workouts. The application will still provide gamified motivation and record of completion for the patient.

Gamified educational fitness applications can maintain a user's interest in learning while keeping the educational process moving forward from beginner level to increasingly complex tasks. Mobile Fitness incorporates fun and engagement with instructional methodologies to keep the user coming back and motivated.

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