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Mobile Gaming Health Apps: Learning About Healthy Behaviors the Fun Way

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Abstract—*The world over, multiple agencies and Governments are coming together to promote and encourage healthy lifestyle choices and proper nutritional intake. While there are multiple sources of information for adults, there is an urgent need for well researched and attractively packaged health information that will appeal to children. Generally, children tend to be put-off by serious health messages that are delivered via lectures or educational videos. The solution therefore is to infuse entertainment into the presentation of health content, which is then delivered through a means that is accessible, and in a form that is familiar to a child. This will increase the chances of children accepting the health message and implementing it in their lives. This paper suggests that by taking inspiration from video games and existing mobile apps, simple games that talk about healthy practices can be developed. Today, the proliferation of mobile phones into homes has seen children becoming attracted to the highly interactive device. Their fascination for playing games on the mobile or tablet can be harnessed to teach them healthy habits in a manner that is both effective and enjoyable. By placing children as the lead characters in the game that they are playing, which is set in the background of a highly engaging story, they are more likely to adapt the positive behavior that their characters display in the game. While there are many video games and mobile apps that focus on promoting good health, this paper reviews existing research to show how by understanding what make video games so popular and influential, and by incorporating behavioral theories, effective gaming health apps can be developed. Ultimately, the goal is to make children become actively involved in the process of staying healthy.*

1. INTRODUCTION

The children of India constitute a significant part of the total population. With over four hundred million children to look after [1], the onus is on families, schools, the community and the Government, to ensure that every child leads a healthy life. Lessons on what is 'healthy' and 'what is not,' starts at a very young age and does not even end when the child becomes an adult. Yet, India is not disease free. A lot of diseases are outcomes of unhealthy lifestyles. Today more and more younger children are being afflicted by diabetes and obesity. The modern day lifestyle of a child is more sedentary in nature and the choice of nourishment is increasingly veering towards unhealthy junk food.

For a child to start making healthy choices, he/she needs to be convinced about the benefits of the new behavior that he/she is adopting. To deliver this information, we need to first capture his/her attention. With each child being different, a single means of intervention cannot be applied to all. Therefore, there comes a need to use a variety of media and to tailor make the message to suit each child. We review existing studies to show how gaming apps on mobile phones can be used to successfully change children's eating habits and lifestyle; prepare them for a visit to the doctor/dentist/hospital; allay their fears over surgery and teach them hygiene.

2. PENETRATION OF MOBILE PHONES

A large majority of people in the world today possess mobile phones. The penetration of mobiles is such that countries with middle and low level incomes have more mobiles than paved roads [2]. It is therefore not surprising that out of the seven billion mobile subscribers in the world [3], India has the second highest number of subscriptions. With over 960.58 million subscribers [4], India can no longer fail to tap into the benefits of using this medium to sell healthy behavior. But our focus here is not on adults who are the primary users of mobiles but rather on the children in their families who are the secondary users. Children gain access to mobiles via the 'pass-back' effect. This occurs when an adult 'passes' on his/her mobile to a child so that he/she can play with it. This is a common occurrence in most houses, as children are enamored with the mobile nature of the device that lets them do so much on a relatively small screen [5]. Today, in addition to the basic mobile phones, smartphones are becoming very popular. Smartphones are essentially better, high level performance devices. The low-cost of smartphones and cheaper data plans is ensuring that India which is currently the 3rd largest smartphone market in the world, is on track to reach around 314 million mobile internet users by 2017 [6-8]. This now opens up further possibilities as to how the best of wireless communications technology can be used to revolutionize the delivery of health literacy skills [9, 10].

3. CHILD-MOBILE INTERACTION

A child's interaction time with a mobile is relatively short when compared to other media. It ranges from around five to twenty minutes on an average [5]. Despite the short amount of time, spent on a daily basis, children are quite adept at using a smartphone. Even children, who get initial help from an experienced user, quickly master the skills required and become independent users. Children use mobiles to look at pictures and videos; listen to music; play games and even explore the ever growing world of apps [8]. Applications (apps) are essentially software that can be downloaded onto your smartphone [7] from any major app store. An online survey of parents of children aged 0-14 showed that games were the most downloaded apps. On an average, there are ten gaming apps in devices that children had access to and 99% of the children tend to reuse the gaming app more than once [11].

One of the reasons why games are so popular is because of the touch screen interface which is very kid friendly [8]. Children experience pure delight when they see how a game responds to every touch and swipe of their finger [12]. The gaming experience therefore moves to another level. The portable nature of mobiles provides kids with the opportunity to play games literally anywhere. The various benefits that smartphones offer gamers, has seen video games migrating from personal computers and consoles to the mobile platform [13]. In such a scenario, it makes sense to use games as a tool to disperse health skills and knowledge.

4. MAKING LEARNING FUN

There are many reasons as to why games should be used as a means to impart learning. Games are therapeutic and help to uplift moods [14, 15]. Another popular argument is that games have the ability to easily capture the attention of a child and totally engage him/her. Parents and educators believe that this aspect should be exploited to increase the appeal of the learning process. For learning to occur, it has to first become irresistible [16]. Learning should be the byproduct of fun and not fun the byproduct of learning [14]. Health information should not be boring [17]. Therefore, by packaging messages on health within the context of a game, we meet three very important objectives – exposing kids to the message, improving their comprehension of the message and finally ensuring that they accept the message [13]. The gameplay within a game plays a vital role in realizing these objectives. For a child to score and do well [16], it becomes necessary that he/she totally immerses himself/herself in the game. A child's cognitive development starts very early in life and exposure to high quality educational media like digital games, will have long-term benefits like accelerating the rate of learning and sharpening attention skills [8, 18].

5. THE SUCCESS OF SERIOUS GAMES

The concept of using gaming for educational purposes is not new. It has existed since the 1970s where early attempts to create a learning software [15] slowly bloomed into a unique genre of videogames called 'serious games' or 'games for health.' The defining factor of serious games is that they are created with a social purpose and intend to change behavior [19]. Games like 'Germinator' which promote hygiene and 'Flavor Monsters' which promote anti–tobacco attitudes have been successful in changing behaviors. Sesame Street's 'Color Me Hungry' is another game which has effectively encouraged food and vegetable intake. One popular educational video game called 'Ninja Kitchen' was successful in effectively changing children's handwashing and food handling behavior while another 'Creature-101' succeeded in reducing the intake of processed food and sweetened beverages. Games are now also helping in asthma management (e.g. Asthma Files) and education of cancer patients (e,g, Re-Mission) [13, 20, 21].

6. ARGUMENTS AGAINST USING MOBILE GAMES

Despite the above listed benefits, there are many parents and educators who argue that games do not have the potential to be used for educational purposes. Trials though have showed that in comparison to children who do not play games or who got their health information from a website; children who learnt healthy eating via playing games consumed significantly higher servings of fruits and vegetables [22]. Parents also feel that mobile devices do not contribute as much to educating their child when compared to television and other platforms. A survey of 1,577 parents of children aged between two and ten years in the U.S, found that only 9% of respondents had children who played educational mobile games daily against 27% whose children watched educational television/DVDs [5]. This preference for educational television content may be because as an older medium, television consists of better, well researched shows that are a hit with children. Alternatively the argument could be that children themselves use mobiles more for non-educational purposes. Hence, parents need to show their children that the mobile is not just another distraction device but rather a tool that can aid in self-development [23]. It is important to realize that we should not simply dismiss any technology just because it does not fall within our frame of understanding of what's educational or what's not. Any new technology should only be defined by the content it produces and the context in which it is used [24]. Therefore if mobiles are used to make a positive difference in the lives of children, they should be judged based solely on the extent to which they can deliver on their promises.

The survey mentioned above also showed that only 9% of parents felt that their child acquired healthy habits by playing mobile games. This shows that there is a significant crunch in the availability of high quality gaming health apps [5] or a lack of awareness on which apps are good. The solution would be to have all gaming health apps formally tested and evaluated. An efficient filtering mechanism, rating system or certification process will then ensure that parents and educators can access the best apps [25, 26]. Another bone of

contention is that children don't spend enough time with mobiles to be positively affected. While it is true that children tend to use mobile phones for short bursts of time, gaming health apps on mobiles need not aim to ensure that a child plays for extended periods of time in order to absorb the intended lesson. Rather the game should be episodic in nature whereby playing even for short duration will ensure exposure to one target health lesson [23]. Repeated exposure at different times will either introduce new skills or reinforce what has already being learnt. This can lead to subtle improvements in health behavior, and eventually create a healthier individual in the long run [22]. Finally, one of the reasons why mobile educational games are not popular may be because they are not effective enough. They may have well designed graphics and easy game play but if they are not well researched or have other distracting elements that divert from the purpose of the game, the entire exercise might be a failure. Game designers need to identify the factors that have a causal effect on the targeted health behavior [19] and find the right combination of elements that will deliver results.

7. DESIGNING A GAMING HEALTH APP INTERVENTION

Now that we have identified that games are an effective delivery mechanism to talk to kids about health, we can move into the next step of planning the actual intervention. The widespread ability of mobiles have made it an apt means of providing tailor made interventions to large groups of people at the same time [27]. There is also evidence to show that health-related behaviors are influenced by interventions delivered via mobiles [10]. This paper does not suggest that gaming apps alone are the panacea for all ills. Rather it suggests that mobile gaming apps be considered as just another means by which we can engage effectively with the target audience. In order to achieve any particular learning objective, it is best to use mediums that would satisfactorily help you fulfill that objective. With mobiles being widely accessible and children already being established gaming app users, it would seem irrational not to utilize this option to reach out to a child.

Creating any game with large doses of health information and putting it on a mobile device is not what needs to be done. Rather to develop an effective gaming health app, we require three things:

1) The right psychological theory that will act as a guide to ensure that the game induces behavioral change
2) Gaming Elements to ensure that we have an entertainment quotient
3) Well researched health information that makes up the content to be communicated

7.1. Understanding Theory

An understanding of various behavioral change theories is necessary to help identify the behavioral variables that influence the acceptance of a positive health behavior. Once, game designers understand the psychology behind how people absorb information and make decisions; or are able to identify the type of environment they need to create within a game to facilitate learning; or are able to know how best to influence attitudes and beliefs, they can then design effective games that successfully change target behaviors or teach new skills [19]. Given below is a brief overview of some of the main theories that can guide game design decisions [28].

7.1.1. Rational Choice Model. When confronted by a new behavior, people tend to rationally evaluate the costs and benefits before taking a decision on whether to adopt it or not. Within a game, we can show how a character who eats healthy and exercises regularly, transforms into a superhero and is able to outrun villains with ease. The same superhero can also be shown to lose his superhero status, once he engages in unhealthy behavior.

7.1.2. Classic Conditioning and Conditionality Theories. Classic conditioning deals with how a stimulus develops the ability to elicit a response that is normally only evoked in response to another stimulus. An anti-tobacco game can help break stereotypes promoted by cigarette companies that all 'cool' people smoke or that smoking is a 'classy' affair. Conditionality theories on the other hand focus on how rewards and punishments can be used to reinforce or discourage behavior. Games already use an incentive system, where players are rewarded with virtual prizes for achieving a goal.

7.1.3. Cognitive Consistency Theory. People are motivated to change their behavior when confronted with stress that arises out of their behavior conflicting with their values and beliefs. Games can ask children to make pledges that they will always wash their hands with soap before eating and reward them every day for successfully doing so. Children will then feel more responsible towards fulfilling their pledge truthfully.

7.1.4. Social Cognitive Theory. Personal and environmental factors interact to influence behavior change. Games can help boost the self-efficacy of a child by setting goals, using reinforcements, monitoring progress and by providing support.

7.1.5. Self-determination Theory. When playing a game, a child displays extrinsic motivation when he/she is trying to win the game for the sake of a reward or recognition. In contrast, intrinsic motivation would refer to a child performing tasks just for the sake of internal satisfaction or the pride it brings.

7.1.6. Behavioral Inoculation Theory. Games can teach children how to resist temptations by preempting the threat and mentally preparing themselves to overcome it.

7.1.7. Elaboration Likelihood Model. The ability to process a message and the motivation to act on it enhances information processing. Games can personalize information in

order to increase its relevancy, so that a child becomes more likely to adopt a behavior.

7.2. Incorporating Gaming Elements

7.2.1. Engaging Story & Characters. The plot provides the backdrop of the game and it is the element that first draws the user in. It should enthrall and intrigue. Place the storyline in settings that are either creative or familiar. Medieval lands, space, the local supermarket, inside a giant monster, the school, exotic countries or even during the age of dinosaurs. A good story requires a strong protagonist who models or champions a positive health behavior and a challenging villain who will go to any lengths to ensure that the hero fails in his mission [29]. When we make the child a hero of the game, we transform him from a passive listener to an active participant in the game. The desire to know what happens next in the story will make the child willingly clear one obstacle after another till he/she reaches his/her 'happy ending' [20].

7.2.2. Virtual Avatars. A graphical representation of the player or the player's character in the game allows the player to become emotionally invested as he/she identifies himself/herself more closely with the story unfolding on the screen. In a health game, avatars can be used to depict what could happen to the individual when the wrong health choices are made. Avafeed, a gaming app has shown how a virtual avatar can be used effectively to get children to eat healthy. Here children were responsible for keeping the avatar thin and healthy, by making the right food choices [22].

7.2. 3. Challenges. A game should challenge a child to perform his/her best but not challenge him/her beyond his/her abilities. As the game progresses, it needs to progressively become more challenging. A lot of learning actually takes place during the process of reaching the goal [20]. Therefore there should be scope for the goal to be reached via multiple ways. Successfully overcoming a compelling challenge is the key to improving a child's self-efficacy.

7.2.4. Rewards. Use a reward or point system along with incentives (e.g. gold coins, trophies) to motivate the child [18] and keep him coming back for more. A simple yet effective way to change eating behavior would be to add points when a nutritious meal is chosen and subtract points when an unhealthy option is selected [22].

7.2. 5. Interactivity and Feedback . What makes games an exciting way to learn when compared to learning from a book, is its highly interactive nature. Information is not given, rather a child is led to 'discover' the information as he/she explores the game. He/she is then encouraged to use this new found information to successfully overcome obstacles [20]. Instantaneous feedback helps to immediately refine, reinforce or enhance the knowledge obtained till then [29].

7.2.6. Easy Game Play. Games should be simple to play in order to ensure that the player does not focus too much on learning how to play but rather focusses on learning the health information. Games that seem relatively simple are in fact the most complex but well-designed games. These games teach one action at a time and over time the player's reactions in the game slowly become intuitive, leaving him free to focus all his attention on the content [23].

7.2.7. Fun & Humor. Gaming health apps should be on par with commercial non-educational games, if they are to reach their target audience [15]. The element of fun can be infused by adding humor, providing a challenge to be overcome or by simply creating an engaging environment to explore.

7.2. 8. Sound Effects. Background music, sound effects and sensory cues add to creating the mood of the game. Characters within the game can also converse in order to provide instructions or to help take the game forward.

7.3. Planning the Health Content

Even though it may seem that high end graphics and fancy reward systems are the highlights of mobile gaming apps, the real star should be the actual content of the game i.e the health information that is to be communicated. The medium is not the product but the tool through which the content is being delivered [24]. Therefore efforts should be focused on promoting what the game has to offer in terms of the targeted healthy behaviors and behavior change interventions. When planning the content, it is important to understand what people think about the health behavior in question and to identify the challenges they face in adopting that behavior in their lives. Only then will we be able to devise an effective intervention strategy [29].

8. GUIDELINES FOR DESIGNING GAMES

i) Identify the Right Game Type – Designers can choose from a large range of game types that include role-playing, strategy, puzzles, drill and practice [23]. It is important to find the right fit for the target audience as each health message may work best with a certain type of game. **ii) Design Developmentally Appropriate Games -** This entails ensuring that content is relevant for the chosen age group, supplements lessons that are already being learnt and matches their evolving motor skills. **iii) Have a Simple User Interface –** Make it easy to navigate. Use simple menus and place them prominently. Kids use big gestures and therefore require larger touch zones. Large, colorful icons can be used to help a child tap accurately [30, bi]. **iv) Balance Engagement and Learning -** Gameplay should serve to optimize the delivery of the message in an entertaining manner. **v) Clearly Define the Goal –** Children are more likely to keep playing when they see that their progress is taking them closer and closer to the end goal. **vi) Keep Wait Times Short -** The best way to increase the user experience would be to drop the user directly into the game [8]. Avoid long loading times especially while playing the game. **vii) Offline Gaming -** Games should not be dependent on the internet. Once downloaded, it should be accessible even offline.

9. DELIVERING THE HEALTH INTERVENTION

Once we have designed the best possible gaming health app, we need to define when it will be used, how it will be used and for how long it will be used. The American Academy of Pediatrics has recommended limiting the amount of hours that a child should spend before a screen to around two hours per day [23]. Therefore, we need to devise a plan as to when children can be encouraged to play health games on a mobile device, without becoming addicted. Parents who set time limits for playing are invariably helping their child develop self-regulation skills [31]. Parents can create a routine with their child, where the time allotted for playing with mobile devices is clearly specified. For example, children can be allowed to play while they are traveling, during playtime or before bedtime. Gaming apps today are capable of engaging a child both for short and long durations of time. Therefore, even if there is little time, kids can still have a delightful, learning experience. Parents can also become more actively involved by either explaining concepts in greater depth to their child, or by motivating them to perform better or by challenging their child to a friendly competition. Parents should also monitor the child's progress in the real world and when required, reinforce the message learnt from the game with real life activities.

10. CONCLUSION

Changing the health behavior of a child is a daunting task, yet every effort counts. Games capitalize on the natural inclination of a child to play and discover new things [32]. By 2017, analysts predict that gaming apps will be downloaded nearly 64.1 billion times [33]. Despite this impressive figure, we are still looking for that elusive gaming health app that can achieve the reach of games likes Angry Birds, which are successful in drawing both repeat and new users everyday [5]. The world is now moving from serious games to gamification, a well-established discipline that involves the application of game mechanics in traditional non-play areas [34]. Taking advantage of such innovations, India should explore how best it can incorporate gaming health apps in intervention efforts.

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