Volume 19 Issue 16
Originally issued as K4

Global Journal of Medical Research: K
Interdisciplinary
Volume 19 Issue 4 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

Gamification for Healthcare and Well-Being

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Abstract- Good health is one's greatest asset. There are many software solutions, developed to help improve the health, and well-being of people, along with them gamified software solutions are popular with their greatest effectiveness and experience compared to physical medication. While there are solutions, developed with the proper understanding of the scientific effect of such solutions to people, some are developed without any scientific analysis or proved results. This paper discusses the main health issues of humans identified within the past decade and what gamification solutions have been implemented to mitigate them and how feasible they have been. Moreover, this article discusses the future development and trends of such gamified solutions for healthcare. Compared to physical treatments and medication, gamification provides an immersive experience with the user's mind strongly connected with the gameplay, which is a great place to improve the health of a person using psychology. Many people enjoy games in their leisure time, and some use them to kill time, but games can be used for much more significant purposes connected with psychology and various functions of the human brain. Some health issues can be cured just by the perception of a person's mind since there are many hormones in the body, which reacts to countless feelings, thoughts, and sensations, that could even cure a person without medicine.

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GJMR-K Classification: *NLMC Code: W 84.4*



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Gamification for Healthcare and Well-Being

S.W.I. Udara [α] & A. K. De Alwis [σ]

Abstract- Good health is one's greatest asset. There are many software solutions, developed to help improve the health, and well-being of people, along with them gamified software solutions are popular with their greatest effectiveness and experience compared to physical medication. While there are solutions, developed with the proper understanding of the scientific effect of such solutions to people, some are developed without any scientific analysis or proved results. This paper discusses the main health issues of humans identified within the past decade and what gamification solutions have been implemented to mitigate them and how feasible they have been. Moreover, this article discusses the future development and trends of such gamified solutions for healthcare. Compared to physical treatments and medication, gamification provides an immersive experience with the user's mind strongly connected with the gameplay, which is a great place to improve the health of a person using psychology. Many people enjoy games in their leisure time, and some use them to kill time, but games can be used for much more significant purposes connected with psychology and various functions of the human brain. Some health issues can be cured just by the perception of a person's mind since there are many hormones in the body, which reacts to countless feelings, thoughts, and sensations, that could even cure a person without medicine.

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I. Introduction

In the 21st century, people live in a digital age where they always engage with automated systems in their day-to-day activities and sometimes they even work like such automated systems within their job roles and in their personal lives. With such a lifestyle, their diet patterns, incorrect posture, amount of stress in their job roles, family responsibilities, financial responsibilities as well as depression can affect a person's physical and psychological performance negatively [1]. And since people no longer have time to think about themselves and their health, people have started ending up with various health issues in their early ages. As people of the 21st century living in the digital era where most of our day-to-day activities are related to technology, there is a greater chance to improve our health and well-being with the help of gamification to make it more appealing, interesting and effective. Because playing games are one of the activities people of all ages enjoy, and people even tend to take some time off their busy schedules to play their favorite games, some are even addicted to playing them. When a person is playing a game, it is one of the rare moments where a person's brain has a steady connection with the game play, and it is an ideal time to speak to the brain for the goodwill of improving people's health. In many scenarios, positive thinking can help heal people or at least to achieve the best state of mind, which can be very helpful for physiological diseases such as Depression and Stress [2]. The main objective of the research is to understand the effectiveness, feasibility of gamification and to understand how well they have contributed to better health and well-being by analyzing the common health issues discovered in the last decade, also this research analyzes the solutions that have already been provided using gamification. Further, this research explore how the current and future developments of technology can contribute to this field and the future trends of gamified health solutions.

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II. Literature Review

Many health problems that are most common and most dangerous identified in the last decade was due to modern lifestyles. Among them, obesity and diabetes can be recognized as one of the most risky, which could lead to other major health issues. As mentioned above with the rushed lifestyles people no longer have time to consider the quality of food or what is in the food they consume. People mostly consider the convenience, taste, and the speed of consumption, which will kill their hunger. Such practices directly lead people towards unhealthy eating habits and junk food, which if consumed regularly, could cause obesity, digestive diseases, diabetes, and even strokes. Once a person is diagnosed with diabetic; there is no complete recovery, they can only maintain their blood sugar level with medicine and food for the rest of their lives. Large amounts of money need to be spent on medication to maintain the blood sugar levels, and they cause side effects to other organs such as liver, kidneys, eyes, etc.Obesity, along with diseases such as diabetes, cholesterol, and high blood pressure, could increase the chance of getting a stroke where a person could end up paralyzed or even dead.

Most of the processes, which had to be done manually with the effort of a person, have now been automated to make them more efficient. However, at the same time, they reduce the amount of healthy exercise a person can get within a day. Most of the time people spend 8-9 hours in front of computers and some does

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not even maintain the correct posture in their seats. In the long run, such practices cause spinal health issues and could negatively affect the person's productivity within the office and at home. Technology can help with such scenarios to remind people to take breaks and to suggest simple exercise and to motivate them to move about to reduce stress on the spinal cord. It is very rarely seen kids and youth engaging in sports activities or other leisure activities since now they spend most of their time in front of a computer or using their mobile phones, which does not give them with any workout. Gamification can help them get moving and at least to provide a walking exercise to start with, and achievements and daily goals will keep them motivated to improve their health even with their busy lives.

Obesity can cause Cholesterol and increases the blood pressure in a person's body along with a high risk of getting many other diseases as well. Obesity could also lead to heart diseases where the patient's life could even be at risk. People spend a lot of money on junk food, yet they also spend an equal amount of money for the gym to burn all the fat they consumed in the first place. This not only wastes people's money but also their valuable time, which could have been used to spend with their family and friends. No matter how many new inventions and technological breakthroughs humans achieve, if they still cannot live a healthy and a happy life, none of these creations does not serve a purpose.Moreover, there are deadly diseases such as cancer which causes thousands of deaths each year, after being diagnosed the patients have to go through painful medication such as chemotherapy, which can affect such patient's mentality negatively [3]. People of all ages, including kids, are diagnosed by various types of cancers every year. Some cancers types are caused due to bad habits such as the consumption of tobacco, alcohol, chewing beetle, etc.and some are caused without the control of the patient, such as breast cancers, leukemia, brain and spinal cord tumors [4], etc.where many women and innocent children have to suffer a lot from the tough medication. Using gamification to reduce their stress level and to keep their attention away from the pain would give them the strength to overcome the discomfort at least to a certain extent.

Furthermore, the increasing aged population has started to create issues for the governments and the economy. In 2012 population over 60 years of age was 2.5 million and these figures are expected to hit 3.6 million by 2021 [5] where the government will have to consider about acquiring more medicine in the coming years, cost of free medication, pensions & benefits for the aging population. Therefore, it is wise to keep them healthy as possible right from the early stages with the help of gamification to help them get used to interacting with the technology to help them stay active. Many aging health issues are due to lack of exercise and boredom and since their mentality stuck in a perception that they are old, but once they start to interact with technology at least their brain will keep functioning just like before. Once they become old and retire from their jobs most of them will end up doing nothing but watching TV and reading a newspaper, but with 30-40 years of valuable knowledge and experience, it is a waste to see if they are not used in anyway. Using technology, we should be able to gather their knowledge and experience to help technologies like AI systems to learn and enhance it and help the younger generation live a better and intelligent life.

Below the paper discusses on how the above health issues are addressed along with gamification, which refers to the use of game elements and game design techniques in non-gaming contexts [6] or as the application of game metaphors in real life, influencing the behavior, also increasing motivation and improving the engagement [7].

a) Obesity

Today, the most common method for obesity treatment includes a combination of dieting and physical exercises. Further, the usage of weight reduction drugs to reduce appetite or to reduce fat absorption is considered as a prompt method. Moreover, people tend to undergo surgeries to remove body fat and reduce stomach volume [8]. Especially youth obesity has become so prevalent. Thus, this is a much-needed area to be addressed. In this digital era, technology has the utmost potential to rehabilitate obesity. Among them, m Health [9] is considered as a medical and public health practice supported solution, which provides information on the quality of life, well-being, motivational messages and reminders [9] and extrinsically arose the users' motivation, which will result in positive outcomes. Technology also can cater to obesity rehabilitation by offering an engaging physical activity in the form of gaming, and thereby, providing the facility on behalf of measuring various player parameters such as energy intake and consumption [8].

As discussed above, any individuals initial thought about weight loss is dieting, and this has given rise to many gamified applications on calorie and dietary control, which assists users in the form of a virtual personal trainer for weight loss [9] to motivate nutritional and behavioral changes. This area of research has been conducted with the aid of gamification and game-thinking frameworks. E.g. My Fitness Pal [9], Fat Secret [9], Noom Coach [9].

While many attempts have been made to use gaming, technological gadgets, and sensor measurements to tackle obesity; no existing work has used pervasive gaming for this purpose [8]. The study in [8] suggests a multiplayer pervasive gaming system

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with the objectives of unveiling the hidden potential within obese youth, to improve their skills, physical activities to get them healthy by real-time monitoring of bio signals and suggesting the best possible actions to assist in the rehabilitation process by providing intelligent interfaces based on the fitness, limitations, and preferences to achieve effective treatments and to involve the therapists and specialists in the rehabilitation process by letting them analyze, + and generate reports for patient management and allowing them to add or update game levels based on analysis. This gaming system mainly focuses on the "Treasury Hunt Game" [8], since it involves a reasonable amount of both physical and mental activities. However, the game is not only about finding the treasure but also about making the moves such as walking, running, cycling, etc. This ubiquitous gaming system is evolved with the aid of WBASN system framework. E.g., Playmate! [8], NEAT-o-Games [8], Pokemon-Go.

When discussing obesity or even malnutrition, the nutrition intake is a vital factor of consideration. Therefore, all the games should focus on delivering information about nutrition or should at least educate the users what is good and what is bad [10] to observe the best behavioral changes with awareness in an interactive edutainment way. Eg., In CHIANTI [10], Nutrion Rush [10].

b) Digestive health

Moreover, the awareness among children on the food they consume and the results of it should be cultivated with the aid of gamification. This will pave the way to understand the digestive system and its process and the fact that anything consumed will give reactions [11]. This will make the user understand that they should carefully choose what they consume and should always try to avoid unhealthy food [11]. E.g., NomNom [11].

c) Stress

Stress is the most effective problem to the state of mind, which might even let them give up on their lives. Thus, people tend to go for counseling, relaxing, or meditation. Stress can be healed either by recovery [1], i.e., regaining the consumed energy or coping [1], i.e., being problem or emotion-focused. Many types of research have proposed solutions for the recovery of stress by using computer/video games, but a proper solution for coping stress along with the above technologies is not yet finalized. The study in [1] suggests that this can be overcome by focusing on the individual needs from the emotional perspective using a serious game with augmented/virtual reality techniques by residing on the flow theory. Here these technologies are used because they have engagement, interaction, and immersion incorporated in them. Since different people react in different ways, and different degrees for the same stressor, it is unlikely that a single serious game is effective in all cases for all people. Therefore, by creating individual profiles and analyzing using psychology techniques, the users can be given a game that can make them achieve the flow Zone.

When a patient is revealed about their diseases, and especially if it is deadly, the patient's depression is immeasurable. The study in [12] explains how "Mission Possible" has utilized gamification to help in managing the stress of cancer survivors. This application is proposed with two main objectives, i.e., to help improve survivors' moral and decrease their worries and to monitor their health conditions by letting them indirectly answer medical questions while playing the game. Collecting data indirectly is the turning point of this study, and they perform this by rewording and mapping. Moreover, the game alters the information flow in response to the player's reply to answers [12].

d) Stroke

Stroke gives rise to key disabilities such as impaired upper limb and body imbalance hindering one's independency of performing everyday tasks [13]. Therefore, rehabilitation through regular therapy is essential, but continuously visiting therapy centers is a burden, and if this cannot be done, then the performance of, the patient drops. Along with this, serious games based on therapy (theragames) are sprouting [14]. There is a tremendous increase in motion tracking for virtual rehabilitation and the reason for being famous is not only the ability to provide a more realistic interaction but also the rise in attention, motivation, pleasure by training with virtual reality games [15] E.g. Sony Play Station Move, and Microsoft Xbox 360 Kinect. However, these solutions are lacking reported functional, validation data, and proper exercise routines to convert from conventional training. Therefore, the study in [13] presents a kinetic-based virtual reality therapy named Durian Runtuh, which utilizes the Microsoft Kinect sensor. Here, the patient needs to select one of the four different types of isolated movements recommended by the therapists and the level of difficulty, to collect falling fruits but by avoiding falling axes. This rapidly increase the recovery process of survivors, mainly because it increases the amount of time for training even without direct contact with a physiotherapist, and this in return enhances the effectiveness of the system.

e) Posture health

Correct posture directly affects one's health. A high percentage of postural diseases are occupational diseases caused due to poor working conditions. A serious game is proposed in [16], which assists the identification of several postural risk factors, the posture correction of 3D characters, and the correct positioning of equipment in the environment [16]. Moreover, it allows the memorization, the practice of motion

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sequences for stretching the joints, respectively, through a puzzle and the Microsoft Kinect device, and generates warnings emphasizing the importance of taking regular breaks from work, aiming both physiological and psychological well-being of the individual [16].

III. Future Research

Unlike software solutions for other industries, the healthcare sector requires further research and knowledge regarding the effect of such gamified programs in the real world. Moreover, when it comes to the health care sector it is not the best income producing industry among others, therefore, a considerable sum of interest is not to be seen from game developers to invest on such solutions for the sole purpose of healthcare and well-being. Mainly because almost every single business organization concentrate on maximizing profits, and requirements like these are addressed only when they need to do public relations campaigns, other than that only a few companies focus on solutions for the healthcare sector.

It is clear that no matter how good and effective a gamified solution gets if it is not affordable and has a high cost involved, then there is no use in it. However, as time passes, humans get more unhealthier due to busy schedules, bad diets, pollution, junk food, etc. Thereby, people will realize the importance of such solutions to mitigate their health problems. Because until a person is effected from a bad health condition or a disease, they would not care.

Stilla few companies have taken steps ahead and have started developing such solutions in the name of humanity to create a healthy and prosperous future. In the future, the extensive use of augmented reality and virtual reality in such gamification solutions will be visible. Moreover, they will become less device oriented and more towards blending with people's daily routines, without realizing that they are intentionally playing a game developed for healthcare and well-being. Because more indirectly the game is used, more direct the benefits will be.

IV. Conclusion

No matter the amount of technology humans have developed in the past few decades, it can be safely concluded that such gamified solutions cannot entirely heal diseases or completely mitigate health issues but instead help to minimize the impact and as a preventive action for better healthcare and well-being. In the modern age, lack of exercise, food patterns, lack of sleep, stress are a few major causes for many of the critical health issues discovered, and there are already a few gamified solutions available, which will help reduce the impact of such problems as much as possible. Some solutions are intentionally made for better health and well-being, and some are not. For example, games such as Pokemon - Go was able to unintentionally motivate people to start moving around; walking, running, and jogging to discover and collect rewards in the real world, using the real world maps and locations. Games like just dance using Xbox Kinect where the players can dance using their body movements, which unintentionally started providing at least some exercise for teenagers, and people who did not have such exercise at all in their routines. Games are loved by people of all ages, all gender, all around the world, and it is more fun, and an interactive way to improve the health and to live a healthy life in the future.

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