



GAMEBC Model: Gamification in Health Awareness Campaigns to Drive Behaviour Change in Defeating COVID-19 Pandemic

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ABSTRACT

Game designers need a precise model to design and develop a gamification application significantly when it drives to behaviour change. This situation is vital when we debate about implementing the gamification approach. However, there is a lack of guidelines or models regarding the gamified model to drive behaviour change in health awareness campaigns. This condition is real, especially the health awareness campaigns in defeating Coronavirus (COVID-19) pandemic. Concurrently, past research still lacks the theoretical foundations of gamification specifically to drive behaviour change in health awareness campaigns. Therefore, this concept paper reviews the frameworks and theoretical foundations, issues, and trends in the gamification models related to behaviour change. Finally, in this present paper, the researchers proposed a gamification model in health awareness campaigns to drive behaviour change named the GAMEBC Model. As Malaysia is very keen on promoting health awareness campaigns in facing the 'new normal,' this research significantly will contribute to Malaysia's six-pronged strategy in COVID-19's fight - resolve, resilience, restart, recovery, revitalize, and reform.

Key words: Coronavirus, COVID-19, Gamification, Self-Determination Theory, Behaviour Change

1. INTRODUCTION

Gamification is a current trend in research that intends to utilize game design elements in non-game context [1]. Previous studies showed the implementation of gamification in multidisciplinary domains such as in education [2,3], health and wellness [4,5], business [6,7], and sustainability [8,9]. Besides, gamification is progressively recognized by health area as an approach to encourage behaviour change [10–12]. One of the goals of implementing the gamification approach in the health area is as a supporter of positive behaviour change through engaging experience, especially as the strategy to a health awareness campaign to fight COVID-19. Previous research reported that the gamification approach has a potential impact on health awareness campaigns [13,14]. Health awareness campaigns and gamification are essential components to shape the motivations that lead to positive

behaviour change. The effectiveness of a health awareness campaign depends on the level of engagement experiences. The more engaged a person to the awareness campaign, the higher the chance to produce a better result. The awareness campaigns have all to improve from the potentials offered by gamification.

Game designers have limited guidelines to design and develop an application or system that is related to behaviour change in health awareness campaigns. Nevertheless, there are existing health awareness campaigns implemented in defeating diseases in Malaysia. Hence, this paper proposed the GAMEBC Model as a guideline to develop health awareness campaigns to drive behaviour change, especially in defeating the COVID-19 pandemic.

2. BACKGROUND STUDY

2.1 Gamification

Gamification is increasingly implemented as an approach when developing behaviour change applications or systems in the healthcare domain. The first operational definition provided by Deterding [1] defines gamification as "the use of game design elements in non-game contexts." According to Huotari and Hamari [15], gamification refers to the process of enhancing services with motivational for gameful experiences. Favourite game features used in gamification include points, badges, leader boards, and challenges [16]. Overall, gamification aims at supporting and motivating users towards the behaviour that the gamified system is targeting.

Behaviour change in domain health awareness campaigns seems likely to be the highest domain for gamification application and system. However, game designers lack a precise gamification model to drive behaviour change to refer. This situation causes them to just use pre-existing design elements by assuming it to give engaging experience and effect regardless of the different implementation conditions [17]. Identifying the elements that cater to user needs is essential for successful gamification design. Gamification in health awareness campaigns to drive behaviour change is defined as complex interventions, which involves an in-depth analysis of the context intervention and its components [18].

2.2 Behaviour Change

Behaviour change is defined as individual traits, characteristics, the pattern of behaviour, activities, and habit that are related to the person. Behaviour change is complex and challenging to predict [19]. Many factors contribute to behaviour such as emotion, social stimuli, or information about a health status [20]. The mission behind implementing a gamification approach is to inspire behaviour change in a person, whether that behaviour change will contribute to increasing performance, participation, or better agreement. A previous study [21] reported that the gamification could support the aim of behaviour change because it offered intrinsic values and focused on the needs and requirements of users in the design of an application or a system.

Moreover, behaviour plays an essential role in maintaining health, prevention, management, and treatment of diseases as well as disabilities. Typically, interventions that involve behaviour change are complex where it involves interacting components [22]. This complex intervention also provides a challenge to get to know the dynamic and outstanding components in it. Recognizing the active component is also needed in addition to replication, implementation, and synthesis in the intervention mechanism of behaviour change [23].

2.3 Health Awareness Campaigns

Health awareness campaigns are a type of campaign that is essential to engage the public to be responsible for their health. It includes a variety of activities that are taking on, such as encouraging mothers to do a vaccination check-up, educating kids to potty train, teaching kids to wash their hands properly, prevention to avoid junk food or to stop smoking. The combination of health awareness campaigns with the gamification approach is one of the alternative ways to drive behaviour change, especially during the COVID-19 pandemic. The gamified health awareness campaigns can deliver important COVID-19 messages, has the ability of a high-quality, entertaining game, and drive behaviour change to the public in defeating the COVID-19 pandemic.

Health awareness is the process of developing an understanding of one's health inevitably. It is also affected by many factors, including social and cultural factors, which have an impact on self-awareness and self-identity. There are a few factors that need to be considered during health awareness campaigns, including the COVID-19 pandemic. The factors do not only emphasize on physiological health variables, but also social and cultural factors that are affecting health on a variety of levels. Examples of individual behaviour and physiology factors are the relationship among family members, community and engagement with social networks, living and working conditions, and finally, political in the state, national, and global conditions.

The objective of the campaigns should be clear and straightforward, associated with a campaign logo or a consistent image, sustained over time, and part of a broader coordinated strategy. Awareness campaigns can be worked out through events, poster campaigns, websites,

documentaries, newspaper articles, social media mediums, radio, or TV programs. The creative and innovative campaign in sharing information with the community can increase the success of awareness-raising efforts [24]. The following sections discuss a few types of health awareness campaigns:

Behaviour modification campaign

This type of campaign educates people and the community to change their behaviours and lifestyles to prevent serious diseases. For example, smoking cessation campaigns [24,25] and preventing HIV campaigns.

Eradication of infectious disease campaign

Eradication is the reduction of an infectious disease's prevalence in the global host population to zero [26,27]. The campaign spreads information and prevention methods to the community through medication and vaccinations. Currently, several diseases are categorized under global eradication, including targeting poliomyelitis, malaria, measles, and rubella.

Organizations as campaign

This type of campaign is carried out by the organization itself to create awareness among the employees. An organization exists to provide health information or medical resources to anyone who requests them, such as in mental health campaigns [28], physical exercise training [29], and workplace health programs [30].

2.4 Case Studies on Gamification for Behaviour Change

Gamification is a relatively new trend that applies game elements to generate motivation that drives behavioural change. Many fields have taken advantage of this new trend, such as Business, Marketing, and e-Learning [31]. The following subsections discuss three case studies in the field of business, e-Learning, and health, respectively.

2.4.1 Robatiempos Project: A Case Study to Promote Effective Organization Meetings

Robatiempos project [32] was organized by a company called Cookiebox to fulfill the request by one Spanish International company to help change company culture to increase the efficiency of meeting and time management. The project took place for five months, which started in September 2015 and ended in January 2016. The primary purpose of conducting this project was to create a game using a gamification use case canvas [33] in the internal meetings among the workers in that Spanish Company to promote interest, improve communication, and reduce disappointment. In order to evaluate the effectiveness of the gamification approach for organizational behaviour in an internal meeting, three series of the workshop was conducted, which was 4 hours long for each series. The audience who took part in this evaluation were the board of directors, middle managers, and 40 other employees. This project had received positive feedback from the participants of the workshop. They found that the

gamification approach taken was exciting, and they were keen to change to make their company meetings more efficient. However, the detail analysis result was not discussed in the paper.

2.4.2 Gamified Educational System: A Case Study of Postgraduate Relation to Students’ Learning Aspect

The gamified educational system has been widely studied in the last few years. Some of the studies showed the benefits of students learning behaviour in terms of learning performance and motivation, but some did not. The case study in [31] provides an evaluation to determine whether the gamified education system has a more capacity to change student learning habits positively and indirectly, evaluating the effectiveness of gamified elements in the educational system.

There were nine Computer Science Postgraduate participants involved in this case study. Each of the participants was asked to use the system first before responding to the survey. Each participant was asked to use both gamified and non-gamified versions of the system. The quantitative analysis result of this study confirmed that the gamified educational system could provide positive students’ learning behaviour change in terms of their study-related habits such as spending more time on the educational system and interacting with peers.

2.4.3 Stepbystep: A Case Study with Undergraduate Students in Promoting Physical Activities

The “StepByStep” [31] is an application intended to change the behaviour of the user through participation in collaborative game-based apps. It is developed to evaluate the effectiveness of two two-game elements, which are virtual reward and social comparison, for promoting physical activities. The aim was to evaluate whether gamified elements will change their behaviour for physical activities, mainly routine walking activity. The evaluation of this study was conducted using an interview with 59 undergraduate students. There were 44 female and 15 male participants aged between 20 to 27 years old.

The main aim was to evaluate the participants’ walking behaviour determined by their daily goal, daily walking time, daily percent of goal reached, and the total number of days gold was reached. The study found that the gamification elements seemed to reflect interpersonal differences as some would be interested to see their ranking compared to another walker, and some just wanted to know how much they had walked. However, indirectly, the application had motivated them to achieve a walking goal for that day.

Overall, the case studies show that increasing motivation and creating awareness are the two significant benefits of implementing gamification in different sectors. Implementing gamification has provided an opportunity for a learner to learn in a fun way. The effective way of learning is for one to know

their learning scope and target. In that way, the learner will know what to find and achieve. However, the content of their learning material might not be interesting enough to motivate them to achieve their target. Implementing the game elements has been reported in the results of the case studies as positively increasing learners’ motivation to learn more because they have a target to achieve to the next level or scoring more points. Furthermore, the result of the case studies also has shown that implementing game elements could assist as an alternative to human assistants to create awareness among people about a particular campaign at all ages. Therefore, gamification has shown the positive influence of different sectors on different interests.

3. FRAMEWORKS AND THEORETICAL FOUNDATION

There are several existing theoretical foundations related to gamification to drive in behaviour change. They are Self-Determination Theory[34], Transtheoretical Model of Behaviour Change[35], Intrinsic and Extrinsic Motivation[36], Universal Design for Learning[37], User-Centred Design[37], Situated Motivational Affordance[37], and Situational Relevance[37]. All of these theoretical foundations implemented in gamification frameworks aim to create interventions and understanding of health behaviour change [21].

3.1 Self-Determination Theory

Self-Determination Theory (SDT) is a theory that explains how an individual can become so motivated and engaged in an activity that they want to grow. This concept has been implemented to a variety of domains, including education, work, parenting, exercise, and health. It is an important concept that refers to each person’s ability to make selections and accomplish their own life. People need to have specific criteria in order to have optimal engagement. They need a sense of *Competence*, *Relatedness*, and *Autonomy*. Some game mechanics can be mapping to the proposed GAMEBC Model with the needs of human motivation. Table 1 shows human motivation and game mechanics related to SDT.

Table 1: Human Motivation and Game Mechanics [34]

Human Motivation	Game Mechanics
Autonomy: People feel that they have control over when performing a task and confidence in them.	Profiles, avatars, macros, configurable interface, alternative activities, privacy control, notification control.
Competence: People believe that they can participate in challenges and feel competence and efficient.	Positive feedback, optimal challenge, progressive information, intuitive controls, points, levels, leader boards.
Relatedness: People believe they are experienced when a person feels connected to others.	Groups, message, blogs, connection to a social network, chat.

3.2 Transtheoretical Model of Behaviour Change

The Transtheoretical model is a psychological model to change human behaviour. There are four values used to change current human behaviour by reminding the importance and encourage behaviour change. Table 2 shows the values used in the Transtheoretical Theory:

Table 2:Transtheoretical Theory[17,38]

Values	Description
Informative	Offers sufficient information to help the user to make a better decision and support user choose a better strategy.
Empathetic	Is achieved and enhanced by adding a virtual character to a service. When a user takes care of a virtual character, he/she considers continuing using the service for a longer time.
Persuasive	Gives user feedback according to a current situation, and the feedback shows the future effect of a user’s current activity.
Economic	The user is given a sense of ownership, especially physical tangibility. It also describes the user’s feelings and attachment to the object and how the user’s daily life has changed after he/she owns the object.

3.3 Intrinsic and Extrinsic Motivation

Intrinsic motivation is involved in doing something because that is internally rewarding. We may do it because it is fun, enjoyable, and satisfying. Table 3 shows how intrinsic works. Goals come from within, and outcomes satisfy the basic psychological needs for autonomy, competence, and relatedness. In contrast, extrinsic motivation involves doing something in order to get an external reward in return. The goals involve external gains such as money, power, or avoiding punishment. If there is an available reward tied to the task, we may be extrinsically motivated to complete the task, such as competing in sports for trophies, completing coursework for grades.

Table 3:Factors of how intrinsic motivation works[17,38]

Factor	Description
Curiosity	Pushes us to explore and learn for the sole pleasure of learning and mastering.
Challenge	Helps us work at a continuously optimal level work toward meaningful goals.
Control	Comes from our basic desire to control what happens and make decisions that affect the outcome.
Recognition	We have an innate need to be appreciated when our effort is recognized.
Cooperation	Cooperates with others satisfies our need for belonging.
Competition	Poses a challenge and increases the importance we place on doing well.
Fantasy	Involves using mental to stimulate behaviour.

3.4 Universal Design for Learning (UDL)

Universal Design for Learning (UDL) comes from the field of education, and it is appropriate for diverse kinds of learners. Table 4 shows three strategies in creating the contents of learners.

Table 4: Strategies of UDL [37]

Strategies	Content
What	Think of different ways to present the content.
How	Think in providing different activities for the learner in exploring and demonstrating the content.
Why	Give learners different ways of internalizing the content to become engaged and motivated.

3.5 User-centred Design (UCD)

User-centered design (UCD) is the theory of ensuring the user’s needs and goals are considered. The purpose is to help the designer avoid meaningless or harmful gamification. All elements in UCD must be meaningful to the user, and it should be effective in turning the user’s mindset into positive thinking. Another component of UCD is making a game more transparent information. Justification is needed for any suspicious matter so that the user has the information needed to make a decision.

3.6 Situated Motivational Affordance

According to Deterding[39], Situated Motivation Affordance is designed to motivate a user to engage with the system with the gameful experience. There are ten types of motivational affordance used in gamification. Table 5 shows the taxonomy of motivational affordance types and their corresponding needs and design principles.

Table 5: A taxonomy of motivational affordance types [39]

Motivational Affordance	Corresponding motivational source	Design principles
Points, Badges, Level, Clear goals, Feedback, Progress, Challenges, Rewards	Cognitive: Competence and achievement	The system provides various challenge level or immediate performance feedback
Leaderboard	Social and Psychological: Leadership and followership	The system facilitates one’s desire to influence others or influenced by others.
Story/Theme	Emotional: Affect and emotion Psychological: Autonomy, the self	Systems induce intended emotions via interaction with the system or promote creation and representation of self-identity
Rewards	Extrinsic motivators	Systems provide incentives for certain actions.

3.7 Situational Relevance

Situational Relevance is an essential aspect of gamification. The goals created in gamification must be relevant to a user’s background, interest, and need. Hamari *et al.* [40] reported that the effects of gamification depend on the users and the context. In some cases, the same aspect of gamification is considered relevant by some users and may not be relevant to other users. As we need information, we need to find the relevant documentation to support the information needed.

4. GAMIFICATION ISSUES IN BEHAVIOR CHANGE

The previous studies reported that gamification as a supporter to encourage and persuade people to change behaviour to be more positive and behave. However, experts working in the health behaviour change field often complain that the behaviour change is difficult to achieve, expensive, and the impacts are often short-lived [19]. A person’s intrinsic motivation level is different from one person to another.

Meanwhile, gamification focuses more on extrinsic motivation. Based on a previous study [41], different individuals have a different effect on motivation, even using the same gamification elements. Thus, there is a need to balance the intrinsic and extrinsic motivation in designing the software of gamification to ensure the behaviour change happens. A study by F. Filomena and R. Maria [42] suggested that gamification design should customize according to the level of the individual. Another issue is the impact, and the role of gamification is changing health behaviours is still questionable.

According to [43], physical activity is getting more attention as this activity is more natural to measure compared to non-physical activities, such as recording healthy eating habits. Since activities such as reporting healthy eating habits tend to be cheated, this may affect the positive behaviour change. Meanwhile, a study by J. Koivisto and J. Hamari [44], found that young people are a more manageable group to adapt to gamification technology. This situation led to more studies focusing on young people than in the older generation. Therefore, the study of the effects of gamification on the elderly still needs to be explored.

5. THE PROPOSED CONCEPTUAL MODEL OF GAMEBC

The previous studies discussed how to apply a gamification approach to drive behaviour change. However, this study intends to develop a conceptual GAMEBC Model based on Self-Determination Theory in gamification to drive behaviour change for a health awareness campaign. We implement the original theory’s elements together with a new element, which is *Engagement*, to drive behaviour change in gamified health awareness. The conceptual model proposed is presented in Figure 1.

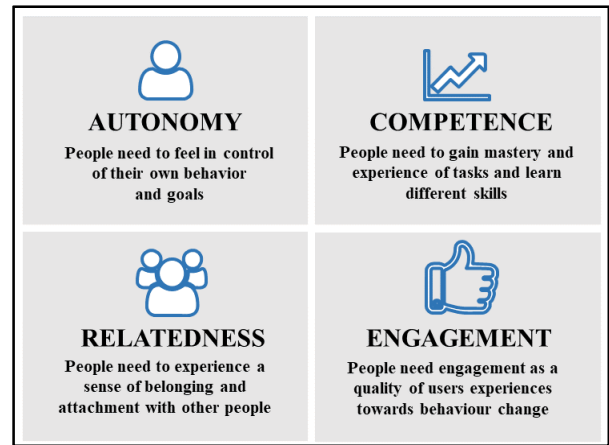


Figure 1: Four elements in the proposed GAMEBC Model

Table 6 shows the details of the individual elements and criteria for the proposed GAMEBC Model. We proposed the elements of *Autonomy*, *Competence*, *Relatedness*, and *Engagement* into GAMEBC Model. *Autonomy* refers to people who need to feel in control of their behaviour and goals; *Competence* refers to people who need to gain mastery and experience of tasks and learn different skills. Besides, *Relatedness* in GAMEBC Model defines as people need to experience a sense of belonging and attach with other people. The new proposed element is *Engagement*, which describes as people need engagement as a quality of user experience towards behaviour change.

Table 6: Proposed elements and criteria for the GAMEBC Model

Element	Criteria
Autonomy	I can create a customization profile I can choose the activity in the game I can control interactions in the game I can control interface game I have a sense of control over the game I freely play the game the way I want
Competence	I have a different level of challenge I have received feedback on the progress I can refer to the performance bar I have a badge as a reward for achievements I can get the point as a reward system I can refer to the leader board
Relatedness	I can involve in social network interactions I can share the information through a social network I can join the game community I have experienced various types of social interactions I feel cooperative toward other users I can collaborate with other users
Engagement	I feel a state of curiosity I feel a state of flow in gameplay I feel intense sensations of success I understand the game content I feel a positive emotion in a learning experience The game is compliant with treatments

5.1 Autonomy

Autonomy is an essential component of a positive gamer experience. For a player to change behaviour, the game must offer to choose a preference profile [45] and control the activity freely [13]. Besides, the game should allow the player to control the interaction, the game interface [46], and the player can feel a sense of control over the game [47]. The study by [48] has stated that the player must feel free to play the game the way they want to expand the autonomy element, which the intrinsic motivation of persons.

5.2 Competence

A game has to have a competitive element to contribute to behaviour change. The more competent a player in a task, the more feelings of engaging and changes in well-being, including behaviour change [48]. The player should have a different level of challenge and receives feedback on the progress [45]. Besides, the competence elements that contribute to behaviour change in health awareness campaign is more related to gamification features such as performance bar, badges, point, and leader boards[13].

5.3 Relatedness

Relatedness in this study is defined as people needing to experience a sense of belonging and attachment to other people [48,49]. In the proposed GAMEBC Model, relatedness covered by the player can involve in social network interaction and can share their information through an online social network [13]. Moreover, the player can join the online game community and may experience various types of social interaction [50]. The feeling of cooperative and collaborative with other users in games is one of the criteria in reinforcing enjoyable behaviour change [47].

5.4 Engagement

The player should experience Engagement to contribute to behaviour change [51]. The engagement has been defined as the degree of usage and an individual experience produced by attention, interest, and effects [52]. The player should be into a state of curiosity and feel the flow in gameplay [53]. The game that is full of engagement for behaviour change should comply with treatments for successful gamification [54]. Providing understandable content is one of the steps to raise awareness and support people to make behaviour changes [18]. Lastly, the game should offer a learning experience with a positive emotion [55].

6. CONCLUSION

Gamification has progressively been used as a crucial part of today's system and application to engage users, as well as to trigger behaviour change. The reason behind the phenomenon of gamification is because of the intrinsic needs offered by the approach. In this study, we reviewed the frameworks, theoretical foundations, issues, and trends in the gamification models related to behaviour change. In conclusion, we have proposed the GAMEBC Model as a guideline to develop awareness to drive towards behaviour change, especially in defeating the COVID-19 pandemic. Based on the

self-determination theory, we described the elements, including *Autonomy, Competence, Relatedness, Engagement*, and 24 criteria, that should be integrated into this model in order to achieve the behaviour change.

7. FUTURE WORKS

The proposed GAMEBC Model is yet to be validated. We will be applying the GAMEBC model to a prototype game about health awareness in defeating COVID-19 of which target users are young adults. After that, the game will be validated using statistical analysis. These are left for future work.

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REFERENCES

1. S. Deterding, D. Dixon, R. Khaled, and L. Nacke. **From Game Design Elements to Gamefulness: Defining "Gamification"**, in *Proc. 15th International Academic Mindtrek Conference: Envisioning Future Media Environments*, 2011, pp. 9-15.
2. S. Hakak, N.F. Noor, M.N. Ayub, H. Affal H, N. Hussin, and M. Imran. **Cloud-Assisted Gamification for Education and Learning - Recent Advances and Challenges**, *Computers & Electrical Engineering*, vol. 74, pp. 22-34, Mar. 2019.
3. N. Hawari, N.H. Zain, and A. Baharum. **The Need of Gamified Assessment for Engaging Learning Experience**, *Bulletin of Electrical Engineering and Informatics*, vol. 9, no.2, pp. 722-728, Apr. 2020,
4. S.P. Mishra, D. Kulshreshtha, A.K. Srivastava, A.K. Gandhi, and M. Rastogi. **Gamification to Promote the Engagement in Healthcare and Wellness of Patients Under Therapeutic Care: Gamification and Healthcare**, in *Application of Gaming in New Media Marketing*, P. Mishra, S.O. Dham, IGI Global, 2019, pp. 244-269.
5. G. Wang, H. Kristian, and P. Weniko. **Gamification for Better Patient Experience in Queue at the Hospital**, *International Journal of Advanced Trends in Computer Science and Engineering*, vol. 9, no.1, pp. 477-479, Feb. 2020.
6. L. Gatti, M. Ulrich, and P. Seele. **Education for Sustainable Development Through Business Simulation Games: An Exploratory Study of Sustainability Gamification and Its Effects on Students' Learning Outcomes**, *Journal of Cleaner Production*, vol. 207, pp. 667-678, Jan. 2019. <https://doi.org/10.1016/j.jclepro.2018.09.130>
7. M. Rizki, R. Dwi, F. Rahman, and G. Wang. **Architecture of Social Media Marketing Using**

- Gamification**, *International Journal of Advanced Trends in Computer Science and Engineering*, vol. 8, no.6, pp. 2817–2820, Dec. 2019.
8. B. Cardoso, M. Ribeiro, C. Prandi, and N. Nunes. **When gamification meets sustainability: A pervasive approach to foster sustainable mobility in madeira**, in *Proc. 1st ACM Workshop on Emerging Smart Technologies and Infrastructures for Smart Mobility and Sustainability*, 2019, pp. 3-8.
 9. K. Koroleva, and J. Novak. **How to Engage with Sustainability Issues We Rarely Experience? A Gamification Model for Collective Awareness Platforms in Water-Related Sustainability**, *Sustainability*, vol. 12, no. 2, pp. 712, Jan. 2020.
 10. M. Altmeyer, P. Lessel, L. Muller, and A. Krüger. **Combining Behavior Change Intentions and User Types to Select Suitable Gamification Elements for Persuasive Fitness Systems**, in *International Conference on Persuasive Technology*, 2019, pp. 337-349.
 11. C.Y. Chow, R.R. Riantiningtyas, M.B. Kanstrup, M. Papavasileiou, GD. Liem, and A. Olsen. **Can Games Change Children’s Eating Behaviour? A Review of Gamification and Serious Games**, *Food Quality and Preference*, vol. 80, 103823, Mar. 2020.
 12. L. Priesterroth, J. Grammes, K. Holtz, A. Reinwarth, and T. Kubiak. **Gamification and Behavior Change Techniques in Diabetes Self-Management Apps**, *Journal of Diabetes Science and Technology*, vol. 13, no. 5, pp. 954-958, Sep. 2019.
 13. D. Tolks, M. Sailer, K. Dadaczynski, C. Lampert, J. Huberty, P. Paulus, and D. Horstmann. **ONYA - The Wellbeing Game: How to Use Gamification to Promote Wellbeing**, *Information*, vol. 10, no. 2, pp. 58, Feb. 2019.
 14. T. Respati, E. Nugroho, and G.W. Setijono. **Promoting Health and Brand Awareness-An Overview of Integrated Gamification Approach on Corporate Sector**, *Pertanika Journal of Social Sciences & Humanities*, vol. 26, pp. 113-124, Apr. 2018.
 15. K. Huotari, and J. Hamari. **Defining Gamification: A Service Marketing Perspective**, in *Proc. 16th International Academic MindTrek Conference*, Tampere Finland, 2012, pp. 17-22.
<https://doi.org/10.3390/info10020058>
 16. S. Deterding. **Gamification: Designing for Motivation**, *Interactions*, vol. 19, no. 4, pp. 14-17, Jul. 2012.
 17. J. Hamari, J. Koivisto, and H. Sarsa. **Does Gamification Work? – A Literature Review of Empirical Studies on Gamification**, in *Proc. 47th Hawaii International Conference on System Sciences*, Waikoloa, 2014, pp. 3025-3034.
 18. D. Rojas, B. Kapralos, and A. Dubrowski. **The Missing Piece in the Gamification Puzzle**, in *Proc. of the 1st International Conference on Gameful Design, Research, and Applications*, Toronto Ontario Canada, 2013, pp. 135-138.
 19. B. Cugelman. **Gamification: What It Is and Why It Matters to Digital Health Behavior Change Developers**, *JMIR Serious Games*, vol. 1, no. 1, Dec. 2013.
 20. S. Michie, M. Johnston, C. Abraham, R. Lawton, D. Parker, and A. Walker. **Making Psychological Theory Useful for Implementing Evidence Based Practice: A Consensus Approach**, *BMJ Quality & Safety*, vol. 14, no. 1, pp. 26-33, Feb. 2005.
 21. K. Seaborn, and D.I. Fels. **Gamification in theory and action: A survey**, *International Journal of Human-Computer Studies*, vol. 74, pp. 14-31, Feb. 2015.
 22. P. Craig, p. Dieppe, S. Macintyre, S. Michie, I. Nazareth, and M. Petticrew. **Developing and evaluating complex interventions: the new Medical Research Council guidance**, *BMJ*, vol.29, pp. 337, Sep. 2008.
 23. E.A. Edwards, J. Lumsden, C. Rivas, L. Steed, L.A. Edwards, A. Thiyagarajan, R. Sohanpal, H. Caton, C.J Griffiths, M.R. Munafò, and S. Taylor. **Gamification for Health Promotion: Systematic Review of Behaviour Change Techniques in Smartphone Apps**, *BMJ Open*, vol.6, no.10, Oct. 2006.
 24. N.A. Rigotti. **Strategies to Help A Smoker Who Is Struggling to Quit**. *JAMA*, vol.308, no.15, pp. 1573-1580, Oct. 2012.
<https://doi.org/10.1001/jama.2012.13043>
 25. L.F. Stead, P. Koilpillai, T.R. Fanshawe, and T. Lancaster. **Combined Pharmacotherapy and Behavioural Interventions for Smoking Cessation**, in *Cochrane database of systematic reviews*, Cochrane Tobacco Addiction Group, John Wiley & Sons, 2016, pp. 1-96.
 26. W.R. Dowdle. **The Principles of Disease Elimination and Eradication**, *Bulletin of the World Health Organization*.vol.7, Suppl. 2, pp. 22 - 25, 1998.
 27. W.R. Dowdle, S.L. Cochi. **The Principles and Feasibility of Disease Eradication**, *Vaccine*, vol. 29, Suppl. 4, pp. D70-D73, Dec 2011.
 28. D. Leyk, U. Rohde, N.D. Hartmann, P.A. Preuß, A Sievert, and A. Witzki. **Results of a Workplace Health Campaign: What Can Be Achieved?**, *DeutschesÄrzteblatt International*, vol.111, no.18, pp. 320, May 2014.
 29. T. Dalager, J.B. Justesen, M. Murray, E. Boyle, and G. Sjøgaard. **Implementing Intelligent Physical Exercise Training at The Workplace: Health Effects Among Office Workers - A Randomized Controlled Trial**, *European Journal of Applied Physiology*, vol. 116, no. 7, pp. 1433-1442, Jul. 2016.
 30. M.Crane, E. Bohn-Goldbaum, B. Lloyd, C. Rissel, A. Bauman, D. Indig, S. Khanal, A. Grunseit. **Evaluation of Get Healthy at Work, A State-Wide Workplace Health Promotion Program in Australia**, *BMC Public Health*, vol. 19, no. 1, pp. 183, Dec. 2019.
 31. L. Sardi, A. Idri, and J. L. Fernández-Alemán. **A systematic review of gamification in e-Health**, *J. Biomed. Inform.*, vol. 71, pp. 31–48, 2017.
 32. I. Dulskaiia, F. Bellini, R. Zabal, O. G. Pañella, and F. D’Ascenzo. **Gamification as an instrument for organizational behaviour change during the meeting: case study «ROBATIEMPOS»**, in *Proc. International*

- Conference on Business Excellence*, 2017, vol. 11, no. 1, pp. 359–367.
33. D. Gears and K. Braun. **Gamification in business: Designing motivating solutions to problem situations**, in *Proc. CHI 2013 Gamification Workshop*, 2013.
 34. A. F. Aparicio, F. L. G. Vela, J. L. G. Sánchez, and J. L. I. Montes. **Analysis and application of gamification**, in *Proc. 13th International Conference on Interacción Persona-Ordenador*, 2012, pp. 1–2.
 35. M. Sakamoto, T. Nakajima, and T. Alexandrova. **Value-based design for gamifying daily activities**, in *International Conference on Entertainment Computing*, 2012, pp. 421–424.
 36. I. Blohm and J. M. Leimeister. **Design of IT-Based Enhancing Services for Motivational Support and Behavioral Change**, *Business & Information Systems Engineering*, vol. 5, pp. 275–278, 2013.
 37. S. Nicholson. **A User-Centered Theoretical Framework for Meaningful Gamification**, in *Proc. Of Games+Learning+Society*, Madison, USA, 2012, vol. 8, pp. 223–229.
 38. P. Zhang. **Technical Opinion Motivational Affordances: Reasons for ICT Design and Use**, *Commun. ACM*, vol. 51, no. 11, pp. 145–147, 2008.
 39. S. Deterding. **Situated Motivational Affordances of Game Elements: A Conceptual Model**, *A workshop at CHI in Gamification: Using game design elements in non-gaming contexts*, vol. 10, No. 20354, pp. 8 – 10, May 2011.
 40. J. Hamari, J. Koivisto, and H. Sarsa. **Does Gamification Work? - A Literature Review of Empirical Studies on Gamification**, in *Proc. 47th Hawaii International Conf. On System Sciences*, 2014, pp. 3025-3034.
 41. L. Reynolds, V.S. Sosik, and D. Cosley. **When Wii Doesn't Fit How Non-Beginners React to Wii Fit's Gamification?**, in *Proc. of the First International Conf. on Gameful Design, Research, and Applications*, Canada, 2013, pp. 111-114.
<https://doi.org/10.1145/2583008.2583027>
 42. F. Faiella, and M. Ricciardi. **Gamification and Learning: A Review of Issues and Research**, *Journal of e-Learning and Knowledge Society*, vol.11, no.3, pp. 13 – 21, Sep 2015.
 43. M. Schmidt-Kraepelin, S. Warsinsky, S. Thiebes, and A. Sunyaev. **The Role of Gamification in Health Behavior Change: A Review of Theory-driven Studies**, in *Proc. of the 53rd Hawaii International Conf. on System Sciences*, Hawaii, 2020, pp.1256 – 1265.
 44. J. Koivisto, and J. Hamari. **Demographic Differences in Perceived Benefits from Gamification**, *Computers in Human Behavior*, vol. 35, no. 1, pp. 179-188, Jun 2014.
 45. N.H. Zain, A. Jaafar, and F.H. Razak. **Enjoyable Game Design: Validation of Motor-Impaired User Gameflow Model**, *International Journal of Computer Theory and Engineering*, vol.8, no.2, pp. 116 – 121, Apr 2016.
 46. P. Sweetser, and P. Wyeth. **Gameflow: A Model for Evaluating Player Enjoyment in Games**, *Computers in Entertainment (CIE)*, vol. 3, no. 3, pp. 1 – 24, Jul. 2005.
 47. F.L. Fu, R.C. Su, S.C. Yu. **EGameFlow: A Scale to Measure Learners' Enjoyment of E-Learning Games**, *Computers & Education*, vol. 52, no. 1, pp.101-112, Jan. 2009.
 48. R.M. Ryan, C.S. Rigby, and A. Przybylski. **The Motivational Pull of Video Games: A Self-Determination Theory Approach**, *Motivation and Emotion*, vol.30, no. 4, pp. 344 – 360, Dec. 2006.
 49. R.M. Ryan and E.L. Deci. **Self-Determination Theory and The Facilitation of Intrinsic Motivation, Social Development, And Well-Being**, *American psychologist*, vol. 55, no. 1, pp. 68, Jan. 2000
 50. N. Xi, and J. Hamari. **Does Gamification Satisfy Needs? A Study on The Relationship Between Gamification Features and Intrinsic Need Satisfaction**, *International Journal of Information Management*, vol. 46, pp. 210 – 221. Jun. 2019.
 51. S. Michie, and R. West. **A Guide to Development and Evaluation of Digital Behaviour Change Interventions in Healthcare**, United Kingdom: Silverback Publishing, 2016.
 52. O. Perski, A. Blandford, R. West, and S. Michie. **Conceptualising Engagement with Digital Behaviour Change Interventions: A Systematic Review Using Principles from Critical Interpretive Synthesis**, *Translational BehavioralMedicin*, vol. 7, no. 2, pp. 254 – 267, Jun. 2017.
 53. T. Zhou. **Understanding the effect of flow on user adoption of mobile games**, *Personal and Ubiquitous Computing*, vol. 17, no. 4, pp. 741 – 748. Apr. 2013.
 54. T. Alahäivälä, and H. Oinas-Kukkonen. **Understanding Persuasion Contexts in Health Gamification: A Systematic Analysis of Gamified Health Behavior Change Support Systems Literature**, *International Journal of Medical Informatics*, vol. 96, pp. 62 -70, Dec. 2016.
 55. J.K. Mullins, and R. Sabherwal. **Gamification: A Cognitive-Emotional View**, *Journal of Business Research*, vol. 106, pp.304 -314, Jan. 2020.