

13. BÖLÜM / CHAPTER 13

HEALTH EDUCATION: GAMIFICATION, HEALTH LITERACY, AND THE NEW ERA; METAVERSE

SAĞLIK EĞİTİMİ: OYUNLAŞTIRMA, SAĞLIK OKURYAZARLIĞI VE YENİ DÖNEM; ÖTE EVREN

Ekrem KUTBAY*, Nilgün BOZBUĞA**

*Istanbul University, Institute of Science, Department of Informatics, Istanbul, Türkiye
E-mail: ekrem.kutbay@gmail.com

**Prof. Dr., PhD., Istanbul University, İstanbul Faculty of Medicine, Department of Cardiovascular Surgery,
Istanbul, Türkiye
E-mail: nilgun.bozbuga@istanbul.edu.tr

DOI: 10.26650/B/ET07.2022.013

ABSTRACT

Health is the combination of knowledge, attitudes, behaviors, values, and rules. In the development and protection of health, the participation of the owner of the health is necessary and one protects one's health best. Health literacy is the ability of the person to read, understand, and use health information to make effective and appropriate decisions about health. Health literacy is defined by the World Health Organization (WHO) as the cognitive and social skills that determine the motivation and ability of individuals to access, understand and use information through the means that help individuals maintain and contribute to their health. Besides, WHO suggests that individuals should make use of integrative education environments in which they can actively participate and benefit from developments, new concepts, and methods in the field of education in order to increase their health literacy levels. Gamified systems are examples of some methods that can be used for these purposes. Gamification is an innovative approach that provides opportunities to increase learner motivation by providing rewarding systems and competitive elements with digital game design techniques, providing more effective, productive, and attractive experiences in learning processes, providing a dedication to processes, facilitating deep learning and recall of important information with positive behavior changes, and increasing concentration. In gamification, rewarding systems and competitive elements used in games are used with digital game design techniques to make the learning process more efficient. Basic game mechanics such as feedback, reward, progress development, and socialization are used in gamification. Gamification should be considered as a new approach that can be used to ensure the sustainability of learners' motivation and learning concentration and learning experiences in e-learning processes that will enable learners to have more meaningful learning experiences by using motivation-enhancing strategies in ensuring health literacy. Gamification has started to be used in many fields, especially in education and industry, since the second half of 2010. However, its implementation in the field of health has accelerated as of 2014. Today,

it is possible to encounter examples of computer games specialized in a wide range of health-related areas. These areas include stroke, diabetes, Alzheimer's disease, cardiovascular diseases, oncological diseases (cancer), chronic diseases, epidemic diseases, rehabilitation, physical activity, diet weight loss, personal hygiene, hand washing, drug use, medical treatment, and mental health diseases. However, according to our research, it has been determined that there are no serious games and gamified systems focused on health literacy. On the other hand, especially during the pandemic, with the acceleration of Metaverse platform applications, the use of gamification in education started to come to mind more and provided a new perspective for online education. In this context, effective use of health services individually and enhancement of the quality of life, increase of the level of social health development, decreasing the difference with developed countries, reducing the cost of health services and increasing the quality of health services will be possible through the use of gamification elements, health literacy education and awareness-raising.

Keywords: Health literacy, health education, gamification, serious game, metaverse

ÖZ

Sağlık bilgi, tutum, davranış, değer ve kurallar bütünüdür. Sağlıkta geliştirilmesinde ve korunmasında sağlığın sahibinin katılımı gereklidir ve kişinin sağlığını iyileştirir. Sağlık okuryazarlığı, kişinin sağlıkla ilgili etkin ve uygun kararları verebilmesi için sağlık bilgilerini okuma, anlama ve kullanma yeteneğidir. Dünya Sağlık Örgütü (DSÖ, WHO) tarafından sağlık okuryazarlığı, sağlıklı olmayı sürdürme ve bu duruma katkıda bulunmayı sağlayan yollarla bireylerin bilgiye olan erişim, anlama ve kullanma yeteneği ile motivasyonunu belirleyen bilişsel ve sosyal beceriler olarak tanımlanmaktadır. Ayrıca DSÖ, bireylerin sağlık okuryazarlık düzeylerini artırmak için aktif olarak dahil olabildikleri bütüncü eğitim ortamlarından yararlanılmalı ve eğitim alanındaki gelişmelerden, yeni kavram ve yöntemlerden faydalanılmalı, önerisinde bulunmaktadır. Oyunlaştırılmış sistemler bu amaçlar için kullanılabilir yöntemlere örnek olarak gösterilebilir. Oyunlaştırma, ödüllendirme sistemleri ve rekabet unsurlarını dijital oyun tasarımı teknikleriyle kullanarak, öğrenme süreçlerinde daha etkili, verimli ve çekici deneyimler sağlayarak öğrenen motivasyonunu artırma, süreçlere adanmışlık sağlama, olumlu yönde davranış değişikliği ve konsantrasyon artışıyla derin bir öğrenme ve önemli enformasyonu hatırlamayı kolaylaştırma olanakları sunan yenilikçi bir yaklaşımdır. Oyunlaştırmada, öğrenme sürecini daha verimli hale getirmek amacıyla oyunlarda kullanılan ödüllendirme sistemleri ve rekabet unsurları, dijital oyun tasarımı teknikleri ile kullanılır. Oyunlaştırmada geri bildirim, ödül, ilerleme-gelişme ve sosyalleşme gibi temel oyun mekaniklerinden faydalanılır. Oyunlaştırma, sağlık okuryazarlığının sağlanmasında öğrenenlerin motivasyon artırmaya yönelik stratejiler kullanarak, öğrenenlerin daha anlamlı öğrenme deneyimleri yaşayabilmelerine olanak sağlayacak, e-öğrenme süreçlerinde öğrenenlerin motivasyon ve öğrenme konsantrasyonları ile öğrenme deneyimlerinin sürdürülebilirliğini sağlamak için kullanılabilir yeni bir yaklaşım olarak değerlendirilmelidir. Oyunlaştırma 2010'ların ikinci yarısından itibaren özellikle eğitim ve endüstri alanlarında olmak üzere birçok alanda kullanılmaya başlanmıştır. Ancak sağlık alanına uygulanması 2014 yılı itibarıyla hız kazanmıştır. Günümüzde sağlıkla ilgili çok çeşitli alanda özelleşmiş bilgisayar oyunu örnekleri ile karşılaşmak mümkündür. Bu alanlar inme, diyabet, Alzheimer Hastalığı, kardiyovasküler hastalıklar, onkolojik hastalıklar (kanser), kronik hastalıklar, epidemik hastalıklar, rehabilitasyon, fiziksel aktivite, diyet-kilo verme, kişisel hijyen, el yıkama, ilaç kullanımı, tıbbi tedavi ve akıl sağlığı hastalıkları gibi konular üzerine yoğunlaşmaktadır. Ancak araştırmalarımıza göre özellikle sağlık okuryazarlığı odaklı ciddi oyun ve oyunlaştırılmış sistemlerin bulunmadığı tespit edilmiştir. Diğer taraftan özellikle pandemi döneminde öte evren (*metaverse*) platformu uygulamalarının hız kazanmasıyla oyunlaştırmadan eğitimde kullanımı daha çok akıllara gelmeye başlayıp, çevrimiçi eğitim için yeni bir bakış açısı sağlamıştır. Bu bağlamda, oyunlaştırma unsurlarının kullanılması, sağlık okuryazarlığı eğitimi ve farkındalığın artırılmasıyla bireysel olarak sağlık hizmetlerinden etkin bir şekilde yararlanılması ve yaşam kalitesinin yükselmesi, toplumsal olarak sağlık gelişmişlik düzeyinin artması ile gelişmiş ülkelerle farklılığın azalması, sağlık hizmetleri maliyetinin düşürülmesi ve sağlık hizmetlerinin kalitesinin yükseltilmesi sağlanabilecektir.

Anahtar Kelimeler: Sağlık okuryazarlığı, oyunlaştırma, sağlık eğitimi, ciddi oyunlar, öte evren

1. Health and Health Services Delivery

Healthcare services are one of the leading areas of sensitivity for societies, with their indispensable and non-delayed features. Health is the combination of knowledge, attitudes, behaviors, values, and rules. Health is not just about the diagnosis and treatment services offered by health professionals. Health is not a static but a dynamic process; health can be maintained as well as improved. It is necessary to create a culture to protect and improve health. In the development and protection of health, the participation of the owner of the health is necessary and it protects the health of the person best. The fulfillment of health services is a result of a high level of professional knowledge and skills; it requires a high level of technology and healthcare production is significantly expensive. As per the health care concept of the 21st century, it is the natural right of every individual to understand health information and to take a role and responsibility in the decision-making process of the healthcare service.

With the support of scientific development and new technological fields, a great increase in the average life expectancy and quality has been procured. With the change in social structure and the concept of patient rights gaining importance, there is a great increase in the health expectations of society. Despite the increase in health informatics opportunities and efficiency efforts, the cost increase in health services cannot be prevented given the increase in the occurrence of chronic diseases. The health care concept of the 21st century gives service users broad rights while also imposing responsibilities on the service recipients.

The fundamental principles in the implementation of health services are effectiveness with the understanding of evidence-based medicine, efficiency without causing waste within the framework of health economics possibilities, and the right to health/right to live within the framework of basic constitutional rights and equity. Healthcare should be timely, safe, effective, efficient, patient-oriented, and compatible with the patient's decision, and values. Also, beliefs in clinical decisions should be in line with the principle of not harming the patient and in line with the principle of respect for human beings. The amount, scope, and quality of the service should be fair without being differentiated into different layers (Kramer et al., 2014).

In the past, an institutionalized and structured service-based and homogeneous healthcare approach provided by high-hierarchy-intensive healthcare personnel has been replaced by user-oriented, flexible, and open-to-change healthcare services that require new technology-supported skills. In the past, while the dynamics determining the social health level were the formal relationship between the healthcare recipient and the healthcare provider; today, the paradigm shift has replaced social health level markers with the ability to participate in health services and use healthcare through health awareness and health education.

2. Non-formal Health Education and Health Literacy

Nowadays, the increasing sensitivity to protect health remains uncontrolled, and it becomes a tool for malicious purposes and a threat in terms of public health with commercial pressures supported by unconfirmed information and information pollution. There is a great need to increase the efforts to protect and improve health on a personal scale, by developing widespread health education in society and directing them to the right area with the right health awareness. Non-formal health education is a culture-building method for health protection and maintenance. Health education ensures that the individual is competent in one's own health and public health. It strengthens the communication between the health service recipient and the service providers, helps to use the resources correctly and to benefit from health services more effectively. It supports the creation of quality conditions in healthcare. It resolves health inequalities. It is a supportive tool for increasing personal development areas, self-confidence, and social skills. As a result, social and personal health education increases the number of healthy life years and their quality.

The capacity of individuals to read about health-related issues at the basic level of non-formal health education, to listen to what is said, and to adapt to their own health by interpreting this information is the concept of health literacy. Health literacy (hl) refers to the ability of individuals to understand basic health issues, discuss expectations about complex processes related to health, and make decisions. Health literacy is the ability of the person to read, understand and use health information to make effective and appropriate decisions about health. It is the criterion of having knowledge and competence and developing social skills in the process of making healthcare decisions and selections. Individuals should have a sufficient level of health literacy to know where, how, and to what extent the health system facilities can be used.

The concept of health literacy was introduced about 70 years ago, and its scope has increased gradually over different periods. The need for the integration of healthcare users into the system and services, which was previously attempted with concepts such as community participation in health services, health awareness, and health education, is expressed under the heading of health literacy.

Between 1950-1970, health literacy was carried out with a global perspective, focusing on pregnancy education and general hygiene issues affecting public health in third world countries. Between 1970-1980, research studies on the health level related to the socioeconomic level, and associations between the health level and education level were conducted. Between 1980-1990, studies on the relationship between health literacy and health outcomes were carried out with the health literacy measurement project. The point emphasized in the Al-

ma-Ata (WHO 1978) and Ottawa (WHO 1986) Declarations is that if the health literacy level of the society is not increased in health services, it will not be successful with only the efforts of health professionals and the structure of the state (Brach et al., 2012). Many studies and reports have been published after the 1990s that emphasize the importance of the relationship between the level of health literacy and health outcomes (HLS-EU CONSORTIUM 2012).

3. Health Literacy Requirement

The concept of health literacy emphasizes the functions of individuals to evaluate the credibility and validity of health-related information given to them, to analyze the risks and benefits of the reported issues, and to place health information in their minds. With health literacy, the increase of oral language use opportunities in the field of health of people increases their ability to express their own health status, and problems and ask appropriate questions about their health, to define their observations and symptoms (Willis et al., 2015). Having health literacy makes it easier to read and understand physicians' instructions, medical education brochures, consent forms, drug information, calculate dosages, and interpret test results.

Considering the basic knowledge and skills related to health, health literacy is grouped as functional, interactive, and critical health literacy levels. Functional health literacy shows the basic skills of individuals' reading and writing about health. With the health literacy training to be provided at the functional level, how to use the health system is taught, the ability to read basic health education materials is developed, and individuals are informed about health risks. Interactive health literacy includes advanced cognitive literacy and social skills. With the health literacy training to be provided at this level, individuals' ability to understand health messages, participate in health activities, and apply health information in changing conditions is developed. The level of critical health literacy represents improved cognitive and social abilities. At this level, health literacy represents the ability to critically analyze health information, improve personal and community health capacity, and see and understand the social and economic definition of health (Sorensen et al., 2013).

Depending on the level of health literacy, having insufficient health information, a low level of physical health status notification in the field of personal health brings with it the risks of delaying the diagnosis and losing health in case of illness. A low level of health literacy leads to an unnecessary emergency application or a high hospitalization rate. A low level of health literacy causes factors such as difficulty in compliance with treatment, misuse of medication or discontinuation of drug treatment, and failure in treatment (Berkman, Sheridan, Donahue, Halpern, Crotty, 2011). Failure to understand the explanations and sugges-

tions given in health literacy results in a lack of responsibility, lack of responsibility sharing, physician-patient communication, unscientific-irrational expectations, and the application of violence in health with out-of-science expectations. Ultimately, the high risk of illness and high healthcare costs are a reflection of the lack of health literacy or inadequacy. According to the Literacy and Health Outcomes (Agency for Health Care Research and Quality Report, 2004) report, two important consequences of low health literacy are higher hospitalization rates and eventually using more expensive emergency services.

The geometrical rapid increase of scientific and technological field information and terms related to health, the fact that health information is not shared adequately with society by health professionals, and the dimensions of the increase in health expenditures are the basic requirements of health literacy. The environmental factors that affect health literacy are the development of medical science and continuity of information flow, the development of medical technology, new methods of diagnosis and treatment, constantly renewed research findings, and the complexity of the diagnosis process. As access to information becomes easier, uncontrolled information pollution and the difficulty of managing information make it necessary to access correct information with health literacy. In addition, the insufficient time allocated for the physician-patient relationship increases the need for health literacy. Personal factors affecting health literacy are age, general education, sociocultural and economic level, and knowledge and experience related to healthcare provision in terms of physical and cognitive changes. In order to obtain and apply health-related information and be able to calculate and execute numerical ideas, it is necessary to be a general literate and to be a visual and computer literate in order to understand visual information such as graphics and tables. On the other hand, rural and urban life can be shown among the factors affecting health literacy. According to the systematic literature review by Aljassim and Ostini (2020), studies conducted in 19 different countries have shown that people living in rural areas are at a lower level of health literacy than those living in urban areas. In addition to the fact that educational opportunities can be effective in this study, especially technological opportunities, it has been emphasized that internet access, smartphone, and computer usage opportunities may also be effective.

In addition, the Brookings Global and Economic Development Institution co-director and senior Universal Education Center member Rebeca Winthrop (2020) stated that the Covid-19 crisis has revealed a lack of health literacy education in schools for both K-12 students and their families within the scope of Covid-19 and other health needs. She called for the creation of new teaching resources, ways, and ideal models within the framework of health literacy principles.

A more comprehensive definition of health literacy by the World Health Organization (WHO) was provided as “cognitive and social skills that determine the motivation and ability of individuals to access, understand and use information through means that contribute to maintaining well-being”. In the WHO study in 2013, in order to increase the health literacy levels of societies, organizations, social associations, and most importantly individuals, the things to be done especially in education are listed as follows (Kickbusch, Pelikan, Apfel & Tsouros, 2013):

- What to do in early childhood: Important/critical information about health should begin to be provided in early childhood. This valuable information can be provided by parents and other family members while playing games, during early childhood education with specialists, and during the interaction of children with other children.
- What to do during the school education period: Schools should establish regulations that positively change personal behavior and organizational attitudes in health matters. A goal should be set to gain important knowledge and life skills in health literacy. This goal can be achieved with three components; the comprehensive curriculum of health education can be achieved by establishing the school’s stance on this issue and cooperating with supporting partners/services.
- What to do in adult education: Attract the motivation and interest of adult individuals in health literacy education, ensure their self-confidence, and reduce the effects of their bad experiences. Unlike the normal education system, extra effort should be made to identify possible problems and reduce the effects of these problems since they are not within a certain system. The opportunity for adult education on this subject will also enable the education of other family members.
- Versatile and special approaches: In health literacy education, multimedia resources that can appeal to many people should be used instead of a single source of information. It should include content that covers the general population rather than a single group. If necessary, society should be divided into certain groups and appropriate training should be provided for each group. This training should be available through print sources, social networks, television, and other media.
- Participatory approaches: Individuals should be able to interact with other individuals and share their knowledge and experiences in health literacy learning processes in terms of the health of themselves and their children.
- New approaches to health education: Other literacy training for health literacy should be supported, integrative education environments in which users can actively parti-

cipate should be used, and developments and new concepts and methods should be utilized.

Considering these requirements, benefiting from the innovative and efficient learning tools mentioned in the last (sixth) article above and covering other articles can provide important benefits for health literacy education and awareness. Gamified systems are examples of innovative approaches that can be used for these purposes.

4. Gamification

Gamification is making rewarding systems and competitive elements used in games interactive and effective by using digital game design techniques to make the learning process more efficient. Although various definitions have been made for gamification, the brief definition of Sebastian Deterding and his research colleagues is accepted in many studies in the literature. According to this definition, gamification is considered as the inclusion of game elements in non-game contexts (Deterding, Khaled, Nacke & Dixon, 2011).

Gaining rich and personalized experiences using today's information technologies can be achieved with real-time gamification. One of the ways to provide more effective, productive, and attractive experiences in the learning processes is to increase the motivation of the learners, to ensure the dedication of the learners to these processes, and make designs for the sustainability of the processes. Accordingly, gamification is emerging as an innovative approach that provides suggestions for applying game design principles to non-game contexts. Quality computer games with gamification features increase user concentration (Connolly, Boyle, MacArthur, Hailey & Boyle, 2012), provide deep learning (Dondlinger, 2007), change behavior positively (Read & Shortell, 2011), and make it easy to remember important information (Andrews, 2011). Another useful feature is that the system with gamification elements enables interaction and information sharing between users, if possible (Palmer, Lunceford & Patton, 2012). Also, gamification has some important advantages compared to other educational approaches. They have a positive effect on users' emotional experiences such as curiosity, optimism, pride, and encouragement (McGonigal, 2011). On the other hand, negative emotional experiences are replaced by positive emotional experiences over time and can be demonstrated from possible benefits (Hammer & Lee, 2011). Moreover, gamification communication skills are also effective in the development of high-level social skills such as judgment, collaboration, and leadership (Read & Shortell, 2011).

Gamified systems use some basic game mechanics such as feedback, reward, progress-development, and socialization (Sardi, Idri & Fernández-Alemán, 2017). Palmer, Lunceford and Patton (2012) explain these important features as follows:

- **Progress:** In the understanding of the game, achievements and missions are usually absorbed in the game. The clarity of the rules is taken as a basis. Once the stages in the game are completed, progress is clearly visible to the player. The level and complexity of gains increase over time. This increases the motivation and focus of both novice and expert players.
- **Feedback and reward:** In terms of player motivation, rewards and feedback must be given on time as an indicator of success and failure.
- **Socialization:** Interaction with other users is beneficial not only for users' communication but also for game competition and support. Players usually have a more satisfied and passionate experience thanks to this opportunity.
- **Interface and user experience:** Players often expect the game to be aesthetic, useful, and fun. With the help of technological possibilities, quality games can be developed through mobile devices, augmented reality and virtual reality environments, the internet, and sensors.

However, the content of these mechanics may sometimes not be equally motivating, entertaining and educational-instructive for all users. For this reason, especially the target audience analysis should be done well, and the gamification elements should be adaptable features considering the user diversity.

In gamification, users are exposed to game mechanics and game thinking processes. These features are the most important parts of serious games, advergaming and games-for-change mentioned in the literature (Zichermann & Cunningham, 2011).

Examining gamification elements, especially serious games used to meet real-life needs such as health literacy, will also be useful in seeking different methods for health literacy education. The concepts of gamification and serious games in the field of health are intertwined in scientific studies and used for almost similar purposes. Although various definitions have been made in the literature, serious games, as common acceptance, can be defined as digital games that have primarily learning-teaching purposes rather than entertainment purposes (Susi, Johannesson, & Backlund, 2007). It is seen that these games are generally designed with the aim of learning in areas such as military, management, emergencies, engineering, city planning, education, and health. In these designs, attention is paid to having real-world events, problems, and possible solutions in the game. Their most important advantage is that they can provide their users with a realistic experience in a safe, cheaper, and more time-ef-

ficient manner (Corti, 2006). Moreover, in a virtual environment, it is possible for people to encounter events that are possible but difficult or impossible to experience in the real world. We can include natural disasters such as earthquakes, floods, volcano eruptions, traffic accident scenarios, and health problems, etc. as examples. While providing this opportunity, learning theories, real event simulations, and making maximum use of game elements bring maximum benefit from the serious game developed.

Gamification started to be used in many areas in the second half of 2010, especially in education and industry. However, its implementation in the field of health has accelerated as of 2014. Many scientific studies in this field have been carried out, especially in America, Portugal, Canada, Netherlands, England, and Finland. Studies in other countries are very few (Sardi, Idri & Fernández-Alemán, 2017).

5. Health and Gamification

Today, it is possible to encounter examples of computer games specialized in a wide range of health-related areas. These areas may be on topics such as stroke, diabetes, Alzheimer's Disease, cardiovascular diseases, oncological diseases (cancer), chronic diseases, epidemic diseases, mental diseases, substance abuse, rehabilitation, physical activity, diet-weight loss, personal hygiene, hand washing, drug use, and medical treatment protocols. Brief information about sample applications with some focus on basic areas is given below.

5.1. Personal hygiene and hand hygiene:

The Hand Washing Challenge: It is an online hand hygiene game developed in a flash environment, especially for children. Videos containing advice and information on hand washing are used.

BBC's bobinogs: It is a game developed by the BBC for the education of children and aimed at understanding the hand washing steps.

Ella's Hand Washing Adventure: It is a tablet application developed by Tork company to encourage hand washing.

Wi-Five?: It is a game prepared by considering the five steps for hand hygiene in accordance with the WHO program on the National Patient Safety Agency website.

5. 2. Diet and weight control:

SpaPlay: It is a computer game especially designed to help women adopt healthy eating and exercise behaviors. Progress in the game depends on real life activities. Examples include eating healthy snacks and climbing the stairs.

Diet Dash: It is a game where players are expected to increase their points by not buying as much health-hazardous foods as possible but by buying the beneficial ones in a market while competing against time.

Slimkicker: In the game with mobile and desktop applications, the player sets diet and exercise goals. He gains points according to the exercises and calories he burns and takes, and increases his level in the game.

5.3. Physical activity:

Nike Run Club: It is an application that follows its users in real-life activities, especially during running and walking, makes the necessary guidance, and provides feedback by scoring based on calories, distances, and rhythms they run.

Zamzee: It is a website application designed especially for children and adolescents to act adequately in their daily lives and earn points and badges in return for their daily activities.

5.4. Oncological diseases (Cancer):

Pain Squad: It is a game designed to determine exactly where the pains of children who have been treated for cancer at a young age are and how much they suffer. In addition, the children who play the game can help the police in very important cases in these matters and reach the levels of a chief.

That Dragon, Cancer: Although it does not fully meet the game elements, it is an application that aims to increase awareness about cancer by making players feel what a small child passes through in a fairytale environment.

5.5. Alzheimer's Disease:

Sea Hero Quest: It is a game application that aims to bring back the lost memory of an old sailor. Failures in the game can be evaluated as possible Alzheimer's Disease and dementia symptoms.

On the other hand, it is possible to come across studies especially in new health fields recently. In their study, Haruna et al. (2021) developed a gamified system on sexual health and compared its results with the traditional teaching environment. In the study, they concluded that gamified sex education is significantly more beneficial than the traditional teaching environment ($p < .01$). As a result of the study, it was argued that gamification, as an innovative teaching technique, would improve learning outcomes, transform traditional education and support the learning skills required in the 21st century.

6. Health Sector Employee Trainings and Gamification

Today, the health sector has to be very interested in using new health-related technologies (Haux, 2010; Arnab, Dunwell, Debattista, 2013). Considering the dramatic increases in human life expectancy and the increasing chronic diseases worldwide, it causes an increase in the need for healthcare professionals in almost all health fields (Lopez, Mathers, Ezzati, Jaminson & Murray, 2006). Responding to this need may be difficult, as resources are restricted and limited to meet this need, especially in low- and middle-income countries (Kuehn, 2007). In addition, the limited number of training programs and lecturers in these sectors may result in unmet needs (Chen, 2010; Dorman et al., 2009). To cope with these challenges, providing and developing innovative educational environments should be firmly grounded (WHO, 2011). It can be considered as a new strategy to improve health in combating these diseases and to benefit from serious games for the training of the sector employees. (Arnab et al, 2013).

On the other hand, patients may suffer during the implementation of most health procedures. For this reason, it may be possible for students who are trained in the field of health to practice these procedures on real patients but this can also bring some drawbacks. Developing new teaching methods will bring significant benefits to student education in this field without risking patient health (Lin, Chen & Cheng, 2016). Training of health professionals is of utmost importance for patient safety. Education and training in relevant areas should be carried out during actual practice. However, it may sometimes not be achieved because it will bring a high cost, as this kind of education practice can be obtained by practicing on a human or animal cadaver and sometimes on a live person (Ricciardi & De Paolis, 2014). New technologies bring new possibilities to medical education. They can also provide valuable learning opportunities to healthcare professionals who have completed their education in their health specialties and experience. Simulations and serious games are good examples of these new learning environments. These environments can be used not only at the beginning of the career of inexperienced healthcare students and employees, but also during the learning of new health procedures for experienced healthcare workers (Lin, Chen & Cheng, 2016). Many studies show that simulation games achieve successful results in health education. It is seen that they achieve this by providing a higher understanding and content opportunity compared to the traditional classroom environment. (Wenzler, 2009).

Learning can be defined as the use of information during the experience and its transformation within the individual (Kolb, 1984). This process consists of four stages;

- (1) concrete experience,

- (2) reflective observation,
- (3) abstract conceptualization
- (4) active experience.

In this sense, games have the potential to facilitate and improve these processes. Thanks to games, what is conceptualized by observing with concrete experiences can be actively experienced (Thatcher, 1990). Thus, educational games encourage learning the facts and correct cognitive processes (Duke & Greenblat, 1981). In their study, Akl and his colleagues (2010) give the main application points especially for educators in the health sector as follows:

- Games should be used in cases where conventional education interventions and activities are proven to be limited.
- The potential benefits, cost, effort and time required to develop the game developed for education should be implemented.
- To ensure active learning with entertainment and excitement, which are game elements, integration adaptation of the permanence and usability of the required information needs to be done correctly.
- The results and effects of games designed for education and other learning environments should be compared, quality should be improved accordingly, and existing alternatives should be evaluated.
- Researchers should do the assessment of the games and report their results.

7. Health Literacy and Gamification

Gamification should be considered as an approach that can be used to ensure the motivation and learning concentrations of learners and the learning experiences in e-learning processes, which will enable learners to have more meaningful learning experiences by using motivation-enhancing strategies in providing health literacy. In one study (Alahäivälä & Oinas-Kukkonen, 2016), it was observed that gamification in health behavior change support systems (hBCSSs) had positive effects on users in need of different health categories. However, according to our research, it has been determined that there are no serious games and gamified systems focused on health literacy.

Many systematic screening studies in the literature can effectively alter a certain health behavior change due to the fact that serious games and gamification elements offer motivation, entertainment, and focus (Charlier et al., 2015; Lau, Smit, Fleming & Ripper, 2017). According

to Johnson and his colleagues (2016), the seven potential benefits of gamification in health are summarized as follows: (1) supporting internal motivation, (2) adapting to mobile technologies and providing data flow to the game through sensors, (3) the potential of games to become widespread, (4) adaptability to many areas of health, (5) the possibility of being able to develop gamified systems, (6) daily fitness for life (use with existing activities instead of additional requests) and (7) the potential to offer users positive experiences.

In this context, as a result of the literature review conducted by Davaris et al. (2021), they reached similar conclusions. According to the study, digital health resources and gamification can improve health literacy. In addition, it can help patients to prepare before surgery, as well as enable positive changes in their attitudes towards general health problems. Finally, it has been claimed that gamified health care, which is a new paradigm, can become a critical complement to patient-centered care.

8. Metaverse Health Literacy and Gamification

Metaverse combines the words *meta*, meaning virtual and *verse*, meaning the world. The term was first used by Neal Stephenson in his science fiction novel *Snow Crash* in 1992. Stephenson describes the Metaverse as a large virtual environment (Joshua, 2017). Today, however, Metaverse can be briefly called the online virtual world that can connect users, and establish social and business bonds with the natural world of feeling (Jaynes et al., 2003). Especially, it is seen as a world that can include both online and offline purposes, especially after the pandemic (Van der Merwe, 2021). Metaverse has gained more popularity especially in the pandemic when people shifted their activities (working, studying, shopping, etc.) online.

Metaverse is based on interactions between virtual and physical worlds. Special technologies are essential for this interaction and Metaverse. Virtual reality (VR) and augmented reality (AR) may be the most important ones. Firstly, VR is a virtual form of an object, asset or objects. According to Schultheis and Rizzo (2001), VR is a better version of human-computer interaction. Users can interact more effectively with virtual 3D environments or objects with the help of various devices; head-mounted displays, earphones comprising digital environments or objects on only a screen. Secondly, AR is a superimposed form of the real world and a virtual view of the World, environment, or objects. AR usually has more realistic effects for users compared to VR with the help of more control opportunities over virtual objects interacting with real objects (Mubin et al., 2019). VR and AR have brought tremendous benefits to science, education, training, music, and health (Mubin et al., 2019).

According to Andrews et al. (2019) both VR and AR provide students with a virtual learning experience by giving controlled safe environments. Non-interactive online learning is not significantly different from traditional learning. It has a negative effect on students' learning

motivation and learning attitude (Mukhtar et al., 2020). 2D platforms have some limitations for students: a) Low self-perceptions: they are represented as disembodied beings through a photograph, icon, or live video, b) No presence: web conferencing sessions are seen as video calls rather than joining in. Long meetings tend to result in distracted participants, c) Inactivity: 2D platforms serve limited interaction opportunities among users, d) Crude emotional expressions: users have limited options for showing their thoughts and feelings with emojis and icons (Mystakidis, 2022). These limitations can be overcome with the help of 3D learning environments (Mystakidis, 2022).

With the help of AR and VR, the Metaverse promises to provide more interactive, experimental, and immersive online environments (Wiederhold, 2022). From an educational perspective, Metaverse has the potential to address the fundamental limitations of web-based 2D e-learning tools (Mystakidis, 2022). Henderson and Feiner (2007) claimed that using AR, which combines real and virtual objects in three dimensions, helps in reducing the cognitive load (Henderson & Feiner, 2007).

In the context of education and learning, both VR and AR environments provide virtual learning experiences by performing learning activities in controlled environments (Demirer & Erbaş, 2015). Moreover, Schoenfeld (2016) stated that augmented reality applications as an educational tool can improve students' performance and analytical skills. New models of Metaverse-powered distance education can enable hybrid formal and informal education opportunities with the help of 3D virtual campuses (Mystakidis, 2022). In addition, students may be included when determining the curriculum and learning activities for them (Mystakidis, 2022). Looking at the literature about Metaverse, they have seen that some virtual education sites were designed on a Metaverse platform and gamification was applied to predict and learn about future social problems such as climate change, low fertility, and aging (Park & Kim, 2022). Also, later, these environments and games allowed public officials to design a virtual smart city to solve these problems (Park & Kim, 2022). Butt and his colleagues assert that virtual reality introduces an innovative approach to encourage learning and retention. It contributes positively to these processes with special haptic technology combined with game-based learning (Butt & Ellertson, 2018). In addition, it is an undeniable fact that after Covid 19, we need more realistic distance education environments. Metaverse platforms powered by VR and AR seem to be appropriate to meet this need.

On the other hand, besides the possible benefits that Metaverse will provide, it is also possible to bring some problems with it. According to Christopoulos and his colleagues (2021), risk related to AR can be considered under four main headings: a) data privacy; data collection

and sharing with other platforms or parties may pose a risk for users' privacies, b) psychology; use of AR and VR may lead to addiction, social isolations or abstinence from real, physical life (Slater et al., 2020), c) physical well-being, health and safety; VR headsets' weight may cause head and neck fatigue due to longer use sessions, and d) morality and ethics; an open social world may conclude with antisocial behaviors like cyber-bullying, harassment and grieving (Chesney et., 2009).

Although the Metaverse phenomenon creates a potential for some problems, it is possible to say that it will increase its prevalence in the coming days. Its influence has already begun, especially in the business world, fashion, shopping, and marketing. It is very likely to see an impact in areas such as education and health in the coming days. Metaverse has a potential for education by providing a safe environment in laboratory applications (e.g., safety chemistry and physics training), procedural skills development (e.g., surgery), and STEM education (Logishetty et al., 2019; Mystakidis et al., 2021). In particular, making use of gamification elements on the Metaverse platform can offer significant benefits in education and training services. Gamification elements provide an immersive and engaging environment in the Metaverse. It also positively influences the user mindset for social interaction (Easley & Ghosh, 2016; Krath et al., 2021). Metaverse is more flexible than traditional games with respect to offering frames. It can also provide global systems that do not limit the number of users (Stokel-Walker, 2021). According to Milanese and his colleagues (2022), gamification in Metaverse can provide more extensible and lasting environments for inviting more users with help of the primary aim of social connection.

It is possible to say that Metaverse has the potential to offer exciting opportunities in many subjects in the context of education and gamification. The same prediction can be made for health literacy, which is the main subject of this study. With the opportunity to have a more realistic and tangible experience provided by the Metaverse platform, it may be possible to provide users with possible health literacy gains. Thus, the idea of preparing people for possible situations in real life does not seem far away. What needs to be done for this is to bring people to a better life thanks to the conveniences and opportunities it brings, taking into account the possible hadiths of the Metaverse environments.

9. Game Situation Examples

Generally, enriched content is used to enable learners to reach more complex and high-level learning outcomes more easily. In this related study, it is ensured that the game developed within the scope of the project is understood with small status videos. Below are three explanations and links to status videos showing that explanation:

Introduction: After a short introduction to the health literacy game, the game starts with the player choosing the age range they are in. The reason for choosing an age here is to ensure that the game encounters health literacy situations in a different life stream according to the age of the player. There are 14-25 age categories for high school and university students, 25-65 for individuals who are active in working life, and over 65 for individuals who are generally retired and have problems with old age. The game is generally designed with people's common life flow situations in mind. Waking up to the day with an alarm, the player gets out of bed and encounters a question about health literacy that needs to be decided. (<https://shorturl.at/czC29>)



Education at school for 14-25-year-olds: Assuming that most of the players in this age range will go to school in their daily life, they come to the school/university environment and after that, do their homework. They go to class for health literacy training by a specialist. Welcoming them there, the trainer completes the necessary directions and question/answer phases. (<https://shorturl.at/prAK8>)



Exercise section: The introductory part of the section where all users will take the decisions and advice they will make about exercise and sports within the scope of health literacy in order to be healthy and protect their health. (<https://shorturl.at/hnLU0>)



Healthy nutrition and Dietitian: The introductory part of the section where all users will make decisions and recommendations regarding nutrition and eating habits within the scope of health literacy in order to be healthy and protect their health. (<https://shorturl.at/mrtEF>)



10. Afterword

In this context, through the use of gamification elements, health literacy education, and awareness raising, it will be possible to provide effective use of health services individually and increase the quality of life, increase the level of social health development, decrease the difference with developed countries, decrease the cost of health services, and increase the quality of health services. On the other hand, especially after the pandemic, with the acceleration of Metaverse platform applications, the use of gamification in education has started to come to mind more and provided a new perspective for online education. Gamification and health literacy will also support the adaptation of wearable tech-

nology-supported personalized medicine and telemedicine applications, which are elements of the paradigm shift in current healthcare (Bozbuğa, 2022).

References / Kaynakça

- Aljassim, N., & Ostini, R. (2020). Health literacy in rural and urban populations: A systematic review. *Patient education and counseling*, 103(10), 2142-2154.
- Akl, E. A., Pretorius, R. W., Sackett, K., Erdley, W. S., Bhoopathi, P. S., Alfarah, Z., & Schünemann, H. J. (2010). The effect of educational games on medical students' learning outcomes: a systematic review: BEME Guide No 14. *Medical teacher*, 32(1), 16-27.
- Andrews A. Serious games for psychological health education. In: Shumaker R, editor. *Virtual and Mixed Reality – Systems and Applications*. Berlin, Heidelberg: Springer (2011). p. 3–10.
- Andrews, C., Southworth, M. K., Silva, J. N., & Silva, J. R. (2019). Extended reality in medical practice. *Current treatment options in cardiovascular medicine*, 21(4), 1-12.
- Alahäivälä, T., & Oinas-Kukkonen, H. (2016). Understanding persuasion contexts in health gamification: A systematic analysis of gamified health behavior change support systems literature. *International journal of medical informatics*, 96, 62-70.
- Arnab, S., Dunwell, I., & Debattista, K. (2013). *Serious games for healthcare: Applications and implications*. Medical Information Science Reference.
- Berkman, N.D., Sheridan, S.L., Donahue, K.E., Halpern, D.J., & Crotty, K. (2011). Low Health Literacy and Health Outcome: An Updated Systematic Review. *Annals of Internal Medicine*, 155(2): 97-107.
- Bozbuğa N. (2022). Tıp alanında inovasyon ve telesağlık. Dijital Psikiyatri. *Türkiye Klinikleri*, 1-6. Online ISBN 978-625-401-648-6
- Brach, C., Keller, D., Hernandez, L.M., Baur, C., Parker, R., Dreyer, B., Schyve, P., Lemerise, A.J., & Schillinger, D. (2012). *Ten Attributes of Health Literate Health Care Organizations*. Discussion Paper, Institute of Medicine (IOM), Washington, DC.
- Butt, A. L., Kardong-Edgren, S., & Ellertson, A. (2018). Using game-based virtual reality with haptics for skill acquisition. *Clinical Simulation in Nursing*, 16, 25-32.
- Charlier, N., Zupancic, N., Fieuws, S., Denhaerynck, K., Zaman, B., & Moons, P. (2015). Serious games for improving knowledge and self-management in young people with chronic conditions: a systematic review and meta analysis. *Journal of the American Medical Informatics Association*, 23(1), 230-239.
- Chen, L. C. (2010). Striking the right balance: health workforce retention in remote and rural areas.
- Chesney, T., Coyne, I., Logan, B., & Madden, N. (2009). Griefing in virtual worlds: causes, casualties and coping strategies. *Information Systems Journal*, 19(6), 525-548.
- Christopoulos, A., Mystakidis, S., Pellas, N., & Laakso, M. J. (2021). ARLEAN: An Augmented Reality Learning Analytics Ethical Framework. *Computers*, 10(8), 92.
- Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, 59(2), 661-686.
- Corti, K. (2006). Games-based Learning; a serious business application. *Informe de PixelLearning*, 34(6), 1-20.
- Davaris, M. T., Bunzli, S., Dowsey, M. M., & Choong, P. F. (2021). Gamifying health literacy: how can digital technology optimize patient outcomes in surgery? *ANZ Journal of Surgery*.
- De Ottawa, C. (1986). Primeiraconferênciainternacionalsobrepromoção da saúde. *Ottawa, novembro de*.
- Demirer, V., & Erbaş, Ç. (2015). Mobil artırılmış gerçeklik uygulamalarının incelenmesi ve eğitimsel açıdan değerlendirilmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 11(3).

- Deterding, S., Khaled, R., Nacke, L. E., & Dixon, D. (2011, May). Gamification: Toward a definition. In *CHI 2011 gamification workshop proceedings* (Vol. 12). Vancouver BC, Canada.
- Dondlinger, M. J. (2007). Educational video game design: A review of the literature. *Journal of applied educational technology*, 4(1), 21-31.
- Dorman, K., Satterthwaite, L., Howard, A., Woodrow, S., Derbew, M., Reznick, R., & Dubrowski, A. (2009). Addressing the severe shortage of health care providers in Ethiopia: bench model teaching of technical skills. *Medical education*, 43(7), 621-627.
- Duke, R., & Greenblat, C. (1981). Principles and practices of gaming simulation. *Beverly Hills: Sage*.
- Easley, D., & Ghosh, A. (2016). Incentives, gamification, and game theory: an economic approach to badge design. *ACM Transactions on Economics and Computation (TEAC)*, 4(3), 1-26.
- Hammer, J. & Lee, J. (2011). Gamification in Education: What, How, Why Bother. *Academic Exchange Quarterly*, 15(2).
- Haruna, H., Zainuddin, Z., Okoye, K., Mellecker, R. R., Hu, X., Chu, S. K. W., & Hosseini, S. (2021). Improving instruction and sexual health literacy with serious games and gamification interventions: an outlook to students' learning outcomes and gender differences. *Interactive Learning Environments*, 1-19.
- Haux, R. (2010). Medical informatics: past, present, future. *International journal of medical informatics*, 79(9), 599-610.
- Henderson, S. J., & Feiner, S. K. (2007). *Augmented reality for maintenance and repair (armar)*. Columbia Univ New York Dept of Computer Science.
- HLS-EU CONSORTIUM. (2012). Comparative Report of Health Literacy in Eight EU Member States. *The European Health Literacy Survey HLS-EU*.
- Jaynes, C., Seales, W. B., Calvert, K., Fei, Z., & Griffioen, J. (2003, May). The Metaverse: a networked collection of inexpensive, self-configuring, immersive environments. In *Proceedings of the workshop on Virtual environments 2003* (pp. 115-124).
- Johnson, D., Deterding, S., Kuhn, K. A., Staneva, A., Stoyanov, S., & Hides, L. (2016). Gamification for health and wellbeing: A systematic review of the literature. *Internet interventions*, 6, 89-106.
- Jordan, J.E., Buchbinder, R., Briggs, A.M., Elsworth, G.R., Busija, L., Batterham, R. & Osborne, R.H. (2013). The Health Literacy Management Scale (HeLMS): A Measure of an Individual's Capacity to Seek, Understand and Use Health Information within the Healthcare Setting. *Patient Education and Counseling*, 91(2): 228-235.
- Joshua, J. (2017). Information Bodies: Computational Anxiety in Neal Stephenson's Snow Crash. *Interdisciplinary Literary Studies*, 19(1), 17-47.
- Kickbusch, I., Pelikan, J. M., Apfel, F., & Tsouros, A. (2013). *Health literacy*. WHO Regional Office for Europe.
- Kramer, M.H., Bauer, W., Dicker, D., Durusu-Tanriover, M., Ferreira, F., Rigby, S.P., Roux, X., Schumm-Draeger, P.M., Weidanz, F., & van Hulsteijn, J.H.; on behalf of the Working Group on Professional Issues, European Federation of Internal Medicine (EFIM) (2014). The Changing Face of Internal Medicine: Patient Centred Care. *European Journal of Internal Medicine*, 25(2):125-127.
- Krath, J., Schürmann, L., & Von Korfflesch, H. F. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior*, 125, 106963.
- Kuehn, B. M. (2007). Global shortage of health workers, brain drain stress developing countries. *JAMA*, 298(16), 1853-1855.
- Lau, H. M., Smit, J. H., Fleming, T. M., & Riper, H. (2017). Serious games for mental health: are they accessible, feasible, and effective? A systematic review and meta analysis. *Frontiers in psychiatry*, 7, 209.
- Logishetty, K., Rudran, B., & Cobb, J. P. (2019). Virtual reality training improves trainee performance in total hip arthroplasty: a randomized controlled trial. *The bone & joint journal*, 101(12), 1585-1592.

- Lin, A. J., Chen, M., & Cheng, F. F. (2016). Game for Health Professional Education. *International Journal of Information and Education Technology*, 6(12).
- Lopez, A. D., Mathers, C. D., Ezzati, M., Jamison, D. T., & Murray, C. J. (Eds.). (2006). *Global burden of disease and risk factors*. The World Bank.
- McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world*. Penguin.
- Milanesi, M., Guercini, S., & Runfola, A. (2022). Let's play! Gamification as a marketing tool to deliver a digital luxury experience. *Electronic Commerce Research*, 1-18.
- Mubin, O., Alnajjar, F., Jishtu, N., Alsinglawi, B., & Al Mahmud, A. (2019). Exoskeletons with virtual reality, augmented reality, and gamification for stroke patients' rehabilitation: Systematic review. *JMIR rehabilitation and assistive technologies*, 6(2), e12010.
- Mukhtar, K., Javed, K., Arooj, M., & Sethi, A. (2020). Advantages, Limitations and Recommendations for on-line learning during COVID-19 pandemic era. *Pakistan journal of medical sciences*, 36(COVID19-S4), S27.
- Mystakidis, S. (2022). Metaverse. *Encyclopedia*, 2(1), 486-497.
- Mystakidis, S., Christopoulos, A., & Pellas, N. (2021). A systematic mapping review of augmented reality applications to support STEM learning in higher education. *Education and Information Technologies*, 1-45.
- Palmer, D., Lunceford, S., & Patton, A. J. (2012). The engagement economy: how gamification is reshaping businesses. *Deloitte Review*, 11, 52-69.
- Park, S., & Kim, S. (2022). Identifying World Types to Deliver Gameful Experiences for Sustainable Learning in the Metaverse. *Sustainability*, 14(3), 1361.
- Read, J. L., & Shortell, S. M. (2011). Interactive games to promote behavior change in prevention and treatment. *Jama*, 305(16), 1704-1705.
- Ricciardi, F., & De Paolis, L. T. (2014). A comprehensive review of serious games in health professions. *International Journal of Computer Games Technology*, 2014.
- Sardi, L., Idri, A., & Fernández-Alemán, J. L. (2017). A systematic review of gamification in e-Health. *Journal of biomedical informatics*, 71, 31-48.
- Schoenfeld, A. H. (2016). Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics (Reprint). *Journal of education*, 196(2), 1-38.
- Schultheis, M. T., & Rizzo, A. A. (2001). New directions for rehabilitation: virtual reality technology. *Rehabilitation Psychology*, 23(3), 296-311.
- Sorensen, K., Broucke, S.V., Pelikan, J.M., Fullam, J., Doyle, G., Slonska, Z., Kondilis, B., Stoffels, V., Osborne, R.H., & Brand, H. (2013). Measuring Health Literacy in Populations: Illuminating the Design and Development Process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). *BMC Public Health*, 13:948.
- Slater, M., Gonzalez-Liencre, C., Haggard, P., Vinkers, C., Gregory-Clarke, R., Jelley, S., ... & Silver, J. (2020). The ethics of realism in virtual and augmented reality. *Frontiers in Virtual Reality*, 1, 1.
- Stokel-Walker, C. (2021). Facebook is now Meta—but why, and what even is the metaverse? *New Scientist*, 252(3359), 12.
- Susi, T., Johannesson, M., & Backlund, P. (2007). Serious games: An overview.
- Thatcher, D. C. (1990). Promoting learning through games and simulations. *Simulation & Gaming*, 21(3), 262-273.
- Van der Merwe, D. (2021, October). The metaverse as virtual heterotopia. In *3rd world conference on research in social sciences*.
- Wenzler, I. (2009). The ten commandments for translating simulation results into real-life performance. *Simulation Gaming*, 40(1), 98-109.

- Wiederhold, B. K. (2022). Metaverse Games: Game Changer for Healthcare? *Cyberpsychology, Behavior, and Social Networking*, 25(5), 267-269.
- Winthrop, R. (2020). COVID-19 is a Health Crisis. *So Why is Health Education Missing from Schoolwork*.
- Willis, C.D., Saul J.E., Bitz J, Pompu, K., Best, A., & Jackson, B. (2014). Organizational Capacity to Address Health Literacy in Public Health: A Rapid Realist Review. *Public Health*.
- World Health Organization (1978). *Declaration of Alma-Ata International Conference on Primary Health Care, Alma-Ata, USSR*.
- World Health Organization (1986). *The Ottawa Charter for Health Promotion, First International Conference on Health Promotion, Ottawa*.
- World Health Organization. (2011). *Transformative scale up of health professional education: an effort to increase the numbers of health professionals and to strengthen their impact on population health*.
- Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. "O'Reilly Media, Inc."

