ORIGINAL ARTICLE

Microlearning and Gamification in Anxiety Management among girl adolescents in Iran: An interventional study

LADAN ZARSHENAS[1], ELHAM SARANJAM[2], MANOOSH MEHRABI[3], GITI SETOODEH[4]

[1]Associate Professor, Community based Psychiatric care research center, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran.

[2]Student Research Committee, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran.

[3]Assistant Professor, E-learning Department, Virtual School, Center of Excellence for E-Learning, Shiraz University of Medical Sciences, Shiraz, Iran.

[4] Department of Mental Health and Psychiatric Nursing, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran; Correspondence to Dr Manoosh Mehrabi, Email: mehrabi.manoosh@gmail.com, Tel: +98 -07132352942

ABSTRACT

Background: Considering the high prevalence of anxiety among adolescents and its horrible consequences, appropriate educational methods have to be used to prevent, control, and treat anxiety.

Aim: To compare the effects of anxiety management training via microlearning and gamification on anxiety control among girl adolescents.

Methods: In this randomized clinical trial with pre/posttest design, the research population included 13-15-year-old girl adolescents studying in the seventh, eighth, and ninth grades of high school in Shiraz in the academic year 2018-2019. The participants (n=378) were randomly selected from the schools and assigned to microlearning (n=125), gamification (n=129), and control (n=124) groups. After conducting the pretest using Spielberger's state/trait anxiety inventory, the educational intervention was carried out via microlearning and gamification for four weeks. The adolescents' anxiety levels were measured again immediately and two weeks after the intervention.

Results: The results revealed no significant difference among the three groups regarding the mean scores of state anxiety ($p=0.07$) and trait anxiety ($p=0.26$) before the intervention. However, a significant difference was observed among the three groups concerning anxiety scores immediately and two weeks after the intervention ($p<0.001$). This indicated the effectiveness of microlearning and gamification in reducing anxiety. Nonetheless, the two intervention methods were not significantly different in decreasing the level of anxiety ($p>0.05$).

Conclusion: The results demonstrated a decline in the microlearning and gamification groups' scores of state and trait anxiety after the intervention. Yet, anxiety reduced to a similar level in both intervention groups. Hence, the two methods were similarly effective in controlling the adolescents' anxiety. Therefore, both microlearning and gamification could be used to promote adolescents' mental health.

Keywords: Anxiety management, Adolescent, Virtual e-learning, Microlearning, Gamification

INTRODUCTION

Due to increased population, number of adolescents with mental disorders is increasing in the recent years. Anxiety disorders are amongst the most prevalent mental disorders in childhood and adolescence, recently affecting almost 4-20% of the adolescent population[1]. In Iran also, the prevalence of anxiety disorders is higher among children and adolescents compared to other age groups[2]. This measure was reported to range from 6.8% to 85% in the systematic review performed by Zarafshan et al[3]. Delayed treatment of anxiety disorders might lead to a broad spectrum of mental disorders in the long run[4]. Thus, individuals should be trained regarding anxiety management methods during childhood and adolescence so as to prevent these disorders in adulthood[5].

Evidence has indicated that the prevalence of anxiety disorders was two-three folds higher among girl adolescents in comparison to boys[6]. This might be attributed to the fact that girls are more prone to mood disorders, depression, and anxiety due to the physiological differences associated with puberty[7]. Anxiety disorders among females are created or intensified because of hormonal fluctuations during puberty, premenstrual, pregnancy, postpartum, and menopause periods[8].

Considering the everyday growth in science and technology, traditional methods are not responsive to the educational needs of today's communities. In this context, electronic learning methods have eliminated some barriers of traditional education and have provided easy and flexible access to learning[9]. Gamification is amongst the novel learning methods, which can be effective in promotion of healthy behaviors[10]. Gamification refers to utilization of game elements in non-game contexts, which increases the clients' experience and creates motivation for using the services and serious games [11]. Utilization of game elements points to using game components such a way to be measurable. These components include scoring, staging, standings, and badges of honor[12]. Health interventions based on gamification can help improve service provision. They can also eliminate communication constraints, such as shortage of therapists, long waiting times for therapeutic visits, huge costs, transportation difficulties, and social stigma resulting from diseases[13].

Microlearning is another electronic learning method, which is created through combination of small electronic contents about a particular issue through which key points of the intended content are presented in various electronic formats, such as audio files, films, and short tests[14]. The advantages of this method include repeatability of the intended educational content in the time, place, and format approved by the learner. Repeatability improves learning and causes the materials to stay in individuals' minds for a longer period of time[15].

The present study aims to compare the effects of microlearning and gamification on anxiety management among adolescents.

METHODS

Study design: This randomized interventional study with pre/posttest design was conducted on two intervention groups and a control group.

Sampling: This study was conducted on 378 girl students aged 13-15 years who studied in the seventh, eighth, and ninth grades of high schools in Shiraz, Fars province in the academic year 2018-2019. At first, the necessary permissions were obtained from the four educational districts of Shiraz. Then, three girl high schools were selected from each educational district using systematic random sampling. After that, a class was randomly chosen from each school via lottery and was assigned to the intervention or control groups. It should be noted that allocation of the students to the study groups was done at the school level. In so doing, the schools were randomly assigned to microlearning, gamification, and control groups. The inclusion criteria of the study were being a girl student, aging 13-15 years, studying in the seventh, eighth, or ninth grade of high school, obtaining a score between 20 and 80 in Spielberger's state/trait anxiety inventory (suffering from mild to severe anxiety), being willing to participate in the study, not having the history of mental disorders or consuming sedative medications, having the ability to work with the computer, and parents' satisfaction with the study procedures. In case the students were absent in pretest or posttest, did not cooperate regularly during the educational programs, and experienced crises during or 40 days prior to the intervention, they were excluded from the study.

Instruments: The study data were collected using a demographic information form and Spielberger's state/trait anxiety inventory. The demographic form contained information about the participants' age, educational grade, family history of mental disorders such as anxiety, history of taking part in anxiety management courses, and familiarity with the internet.

Spielberger's anxiety inventory consisted of two sections dealing with state and trait anxiety. State anxiety has been defined as a transient emotional status associated with stressful situations. On the other hand, trait anxiety refers to individual differences in responding to stressful situations. Each section contained 20 items responded via a four-point Likert scale. Accordingly, the minimum and maximum scores of each section were 20 and 80, respectively. The reliability of this inventory was explored by Mahram for the first time in Mashhad, Iran in 1993. Accordingly, the reliability of both sections was approved by Cronbach's alpha=0.90[16]. Indeed, its concurrent criterion validity has been confirmed in the previous studies[17]. Rabiei and Rouhi also reported the reliability of state and trait anxiety sections to be 0.89 and 0.90, respectively[18,19].

Study procedure: After gaining the approval of the Ethics Committee of Shiraz University of Medical Sciences, other necessary permissions were obtained from the authorities of the Department of Education and the selected schools. Then, the study objectives and procedures were explained to the adolescents and written informed consent forms for taking part in the study were obtained from them and their parents. Afterwards, the researcher started collecting proper educational contents from reliable library resources and articles. The educational materials included practicing concentration together with positive mental imagery, diaphragmatic breathing, replacing negative thoughts with positive ones, and training of assertiveness. The content of microlearning was also prepared from credible resources. After being confirmed by professors, the microlearning content was produced in accordance with the standard format determined by the Electronic Pole of Shiraz University of Medical Sciences [20]. It should be noted that all content development processes were evaluated by the Electronic Pole of Shiraz University of Medical Sciences.

Microlearning contents were presented via video clips to the adolescents in groups. In doing so, at least one video and one short animation were displayed for the adolescents every week and their questions were answered in person or via telephone contact. This was carried out for four weeks. Gamification contents were also presented to the adolescents through the website designed by the cooperation of the Electronic Pole of Shiraz University of Medical Sciences. This website was based on gamification and made use of game elements, including scoring, standings, and badges of honor. Overall, the educational intervention contained four anxiety management educational packages. At least one educational content including a short video and an animation was presented to the adolescents every week. After each package, a short test was considered for the students where they competed with their peers based on their obtained scores. At the end of each week, the adolescents' probable questions and problems were resolved in person or via telephone contact.

Statistical analysis: The students in the intervention and control groups were required to fill out Spielberger's state/trait anxiety inventory before and immediately and two weeks after the intervention. Descriptive statistics were used. Indeed, independent and paired t-tests were used to compare the means. All analyses were performed using the SPSS 16 software, and p=0.05 was considered to be statistically significant. It should be noted that this study was conducted on 378 participants divided into three groups as follows: microlearning (n=125), gamification (n=129), and control (n=124).

Ethical considerations: Sampling was done after gaining the approval of Shiraz University of Medical Sciences, Ethics Committee of the University, and Department of Education of Fars province (proposal No. 97-01-08-17542). At first, the adolescents were provided with information about the study objectives and procedures. Then, written informed consent forms were obtained from the adolescents and their parents. The adolescents were also explained about the methodology, advantages, and duration of the research. Indeed, they were reassured that they could withdraw from the study at any time. They were also ascertained about the confidentiality of their information and that the study results would be provided to the related organizations.

RESULTS

The results of ANOVA revealed no significant difference among the three study groups regarding the quantitative demographic variables (p>0.05). Besides, the results of chi-square and Fisher's tests showed no significant difference among the three groups concerning quantitative and qualitative demographic variables before the intervention (p>0.05). Hence, the three groups were similar in terms of demographic characteristics.

The results indicated no significant difference among the three groups with respect to the mean scores of state anxiety (p=0.07) and trait anxiety (p=0.26) prior to the intervention. Thus, the three groups were similar in this regard. However, the results of one-way ANOVA demonstrated a significant difference among the three groups in this respect (p<0.001). The results of Tukey's post-hoc test also revealed a significant difference among the three groups regarding the mean scores of state and trait anxiety, which revealed the effectiveness of the interventions in the intervention groups' state and trait anxiety mean scores (Tables 1 and 2). The results also demonstrated that both microlearning and gamification were effective in reduction of anxiety in the study groups. However, no significant difference was found in the effectiveness of the two intervention methods (p>0.05).

According to Figures 1 and 2 no significant difference was found among the three groups concerning the mean scores of state and trait anxiety before the intervention. However, a significant difference was observed among the three groups in this regard after the intervention. This represented different effects of the study groups on decreasing the anxiety scores.

Table 1. Comparison of the three groups regarding the mean scores of state and trait anxiety before and immediately and two weeks after the intervention

Mean score of anxiety / Group	State anxiety before the intervention	State anxiety immediately after the intervention	State anxiety two weeks after the intervention	Trait anxiety before the intervention	Trait anxiety immediately after the intervention	Trait anxiety two weeks after the intervention	P-value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Microlearning	42.56±13.14	33.36±10.74	34.41±10	42.59±12.39	34.48±9.45	35.23±9.09	<0.001
Gamification	40.71±12.73	30.63±6.84	32.61±7.93	40.58±12.43	32.34±7.05	34±8.46	<0.001
Control	44.40±12.22	40.75±11.39	41.87±11.54	42.83±11.43	40.39±11.22	41.75±10.82	<0.001
P-value	0.07	<0.001	<0.001	0.26	<0.001	<0.001	--------

able 2: Comparison of the mean difference of state and trait anxiety scores in the microlearning and gamification groups before and immediately and two weeks after the intervention

	Mean difference of state anxiety score before the intervention	Mean difference of state anxiety score immediately after the intervention	Mean difference of state anxiety score two weeks after the intervention	Mean difference of trait anxiety score before the intervention	Mean difference of trait anxiety score immediately after the intervention	Mean difference of trait anxiety score two weeks after the intervention
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Mean difference of gamification& microlearning	1.84+1.59	2.73+1.23	1.80+1.24	2.002+1.51	2.13+1.17	1.22+1.19
P-value	0.47	0.07	0.31	0.38	0.16	0.56

Fig. 1: Comparison of changes in the mean scores of state anxiety in the three groups before and immediately and two weeks after the intervention

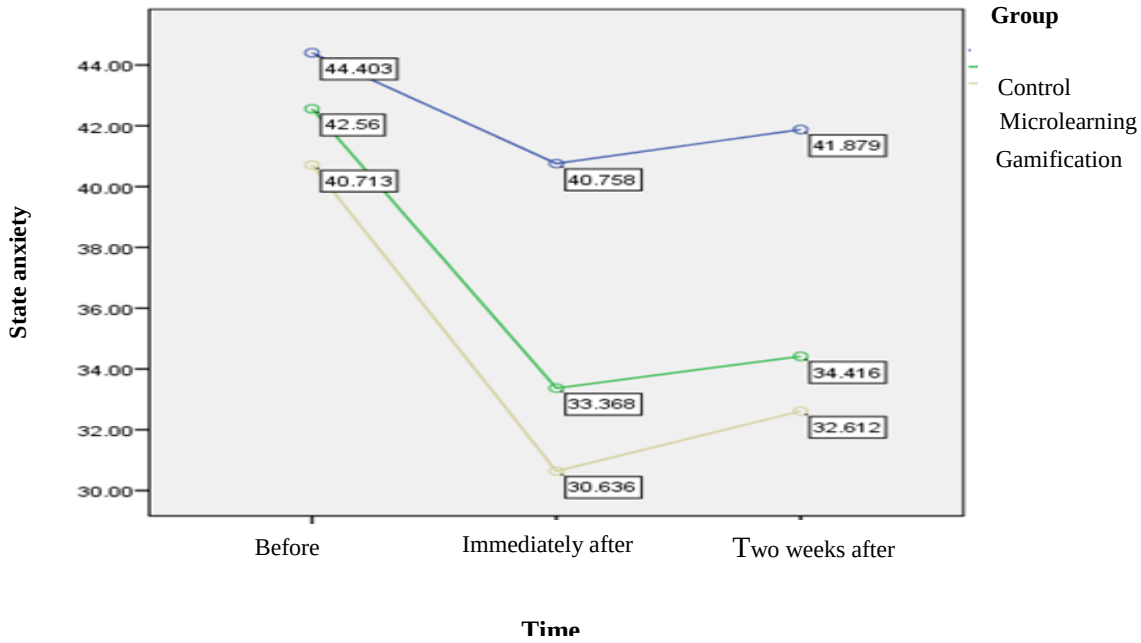
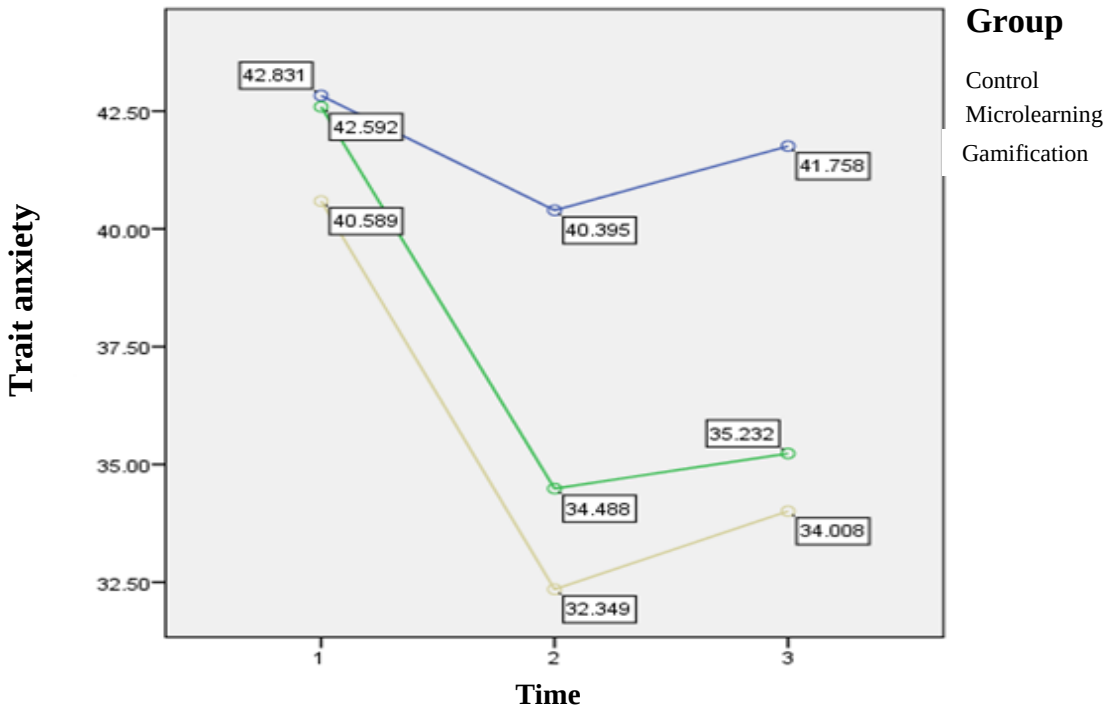


Fig. 2: Comparison of the changes in the mean scores of trait anxiety in the three groups before and immediately and two weeks after the intervention



DISCUSSION

The study results indicated that anxiety management training through microlearning and gamification was more effective in comparison to the control group. However, the two electronic methods were equally effective in reduction of anxiety.

Before the intervention, the three groups were assessed with respect to the frequency distribution of demographic variables, including educational grade, family history of mental disorders, familiarity with the internet, history of taking part in anxiety control courses, accepting the internet as an educational instrument, duration of using the internet, and anxiety score before the intervention. The results indicated no significant difference among the three groups concerning demographic variables. However, the interventions were more effective in the seventh-grade students and declined their anxiety levels to a greater extent. Yet, the impacts of the interventions reduced in all educational grades over time.

The study results demonstrated no significant difference among the three groups in terms of the mean scores of state and trait anxiety before the intervention. However, a significant difference was found among the three groups in this regard after the intervention. This represented the effects of the interventions on the study groups' scores of state and trait anxiety.

Considering the available recourses and information, this was the first study conducted in Iran in order to compare the effects of anxiety management training through microlearning and gamification. Some of the study findings were in agreement with those of somewhat similar studies, while some others were not.

In line with the present study, Simons et al. (2015) compared microlearning and routine educational method in individuals' health. The results indicated that microlearning through mobile applications was more influential in comparison to routine educational methods and, consequently, was more effective in promotion of individuals' health[21]. In the same vein, Pramana et al. (2018) compared the effects of gamification and utilization of a mobile application designed for health promotion on treatment of anxiety among 9-14-year-old individuals. The results demonstrated that education via gamification was more effective in reduction of children's anxiety compared to the designed application[22]. Lau et al. (2017) also reported that interventions through serious games could be more effective in treatment of mental disorders in comparison to routine educational methods. However, they did not specifically evaluate anxiety and did not investigate the articles using internet interventions[23]. Consistently, the results of the systematic review conducted by Johnson et al (2016) revealed that gamification could be more effective compared to traditional educational methods and have positive effects on individuals' health and well-being. However, they did not investigate anxiety specifically[24].

In agreement with the current study findings, Fredericksen et al. (1999) reported that 94% of the participants who had passed the course via the electronic method believed that they had learnt more compared to

traditional classrooms[25]. Aghvamy et al. (2011) also compared the impacts of group education and computer education on the quality of life of children aged 8-12 years who suffered from asthma. They came to the conclusion that computer education was more effective in enhancing the learners' awareness[26]. Similarly, Zarshenas et al. (2017) explored the effects of interactive multimedia training and educational booklet on adolescents' awareness and self-efficacy in prevention of osteoporosis. The findings showed that the participants receiving CDs obtained higher self-efficacy scores compared to those receiving booklets[9].

Furdu et al. (2017) investigated the advantages and disadvantages of gamification in classrooms. On the contrary to the present study, they reported lower attempt among the students who had used gamification for learning in comparison to the previous semester[27]. This might be attributed to non-existence of a manager or supervisor in the process of gamification, which might cause the students not to take the lessons and homework seriously.

Yeganehkhah et al. (2011) compared the effects of traditional, pamphlet, and electronic education on reduction of anxiety among the patients with acute myocardial infarction. The results revealed no significant difference among the three methods in this regard[28]. This might be due to the lack of opportunity for transferring the patients to a more appropriate place for education, because the hospital environment itself is stressful and patients cannot concentrate on the presented treatment methodologies. Moreover, that study did not include any control groups to compare the effects of the educational methods with.

Saki et al. (2014) compared the impacts of face-to-face and electronic education on anxiety among the patients with acute myocardial infarction and stated that both methods were significantly effective in decreasing the patients' anxiety. Yet, no significant difference was observed between the two methods[29], which might have resulted from the routine trainings provided by the personnel to all patients that was out of the researcher's control. Indeed, the study was conducted in the hospital environment, which could have affected the patients' anxiety levels. Another point that could have played a role in the results of the two above-mentioned studies[28,29] was not considering the participants' sex, age, and education level, which could have affected anxiety levels separately. Overall, the discrepancy observed among the results might be attributed to differences in educational contents and time and place of executing the interventions.

In the current study, changes in the two intervention groups' mean scores of anxiety were assessed compared to the control group. Considering the similar conditions and duration of interventions for the three groups, the study hypothesis was confirmed. Accordingly, a significant difference was observed between the two intervention groups and the control group regarding the mean score of anxiety immediately and two weeks after the intervention. Using these findings, therapists can present appropriate strategies for promotion of adolescents' health. They can also make use of the applied interventions and methodologies for training anxious adolescents.

CONCLUSIONS

This study was only conducted among girl adolescents. Therefore, future studies are recommended to be performed on boy adolescents to compare the results. Performing studies on individuals with various cultural and racial backgrounds can also complete the findings of the current research. Indeed, further studies are suggested to compare microlearning and gamification to other methodologies, such as face-to-face training and using educational booklets. The effects of microlearning and gamification on other age groups (e.g. youth) and mental disorders (e.g. depression) should be examined, as well.

Ethical approval and consent to participate: Written informed consents were obtained from all participants (students and parents for participants under 16 years old). The study was approved by the Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1397.896).

Consent to publish: Not applicable.

Availability of data and materials: The datasets during the current study are not publicly available due to confidentiality of the students' data, but they will be available upon reasonable request.

Competing interests: The authors declare that they have no competing interests.

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REFERENCES

1. Bhatia M, Goyal A. Anxiety disorders in children and adolescents: Need for early detection. Journal of postgraduate medicine. 2018;64(2):75.
2. Hajebi A, Motevalian SA, Rahimi-Movaghar A, Sharifi V, Amin-Esmaeili M, Radgoodarzi R, et al. Major anxiety disorders in Iran: prevalence, sociodemographic correlates and service utilization. BMC psychiatry. 2018;18(1):261.
3. Zarafshan H, Mohammadi M-R, Salmanian M. Prevalence of anxiety disorders among children and adolescents in Iran: a systematic review. Iranian journal of psychiatry. 2015;10(1):1.
4. Wehry AM, Beesdo-Baum K, Hennelly MM, Connolly SD, Strawn JR. Assessment and treatment of anxiety disorders in children and adolescents. Current psychiatry reports. 2015;17(7):52.
5. Rasing SP, Creemers DH, Janssens JM, Scholte RH. Effectiveness of depression and anxiety prevention in adolescents with high familial risk: study protocol for a randomized controlled trial. BMC psychiatry. 2013;13(1):316.
6. Essau CA, Lewinsohn PM, Lim JX, Moon-ho RH, Rohde P. Incidence, recurrence and comorbidity of anxiety disorders in four major developmental stages. Journal of affective disorders. 2018;228:248-53.
7. McHenry J, Carrier N, Hull E, Kabbaj M. Sex differences in anxiety and depression: role of testosterone. Frontiers in neuroendocrinology. 2014;35(1):42-57.
8. Hantsoo L, Epperson CN. Anxiety disorders among women: a female lifespan approach. Focus. 2017;15(2):162-72.

9. Zarshenas L, Keshavarz T, Momennasab M, Zarifsanaiey N. Interactive multimedia training in osteoporosis prevention of female high school students: An interventional study. Acta Medica Iranica. 2017:514-20.
10. Hoffmann A, Christmann CA, Bleser G. Gamification in stress management apps: a critical app review. JMIR serious games. 2017;5(2):e13.
11. Reiners T, Wood LC. Gami cation in Education and Business: Springer; 2015.
12. Campbell AA. Gamification in higher education: Not a trivial pursuit: St. Thomas University; 2016.
13. Brown M, O'Neill N, van Woerden H, Eslambolchilar P, Jones M, John A. Gamification and adherence to web-based mental health interventions: a systematic review. JMIR mental health. 2016;3(3):e39.
14. Giurgiu L. Microlearning an evolving elearning trend. Scientific Bulletin. 2017;22(1):18-23.
15. Mohammed GS, Wakil K, Nawroly SS .The effectiveness of microlearning to improve students' learning ability. International Journal of Educational Research Review. 2018;3(3):32-8.
16. Mahram B. Standardization of Spielberger inventory in Mashhad: MA thesis. Tehran. Allameh Tabatabaee University; 1994.
17. Behdani F, Sargolzaei M, Ghorbani E. Study of relationship between life style and depression and anxiety in Sabzevar students. 2001.
18. Rabiei M, Kazemi Malek-Mahmoudi S, Kazemi Malek-Mahmoudi S. The Effect of Music on Anxiety in Hospitalized Children. Journal of Gorgan University of Medical Sciences. 2007;9(3):59-64.
19. Rouhi G, Rahmani H, Abdollahi A, Mahmoudi G. The Effect of Music on Anxiety and Some Physiological Variables of Patients Before Abdominal Surgery. Journal of Gorgan University of Medical Sciences. 2005;7(1):75-8.
20. Mehrabi, M. (2019). "Setting up the Structure and Process for E-Content Development." Med Sci 10(4): 78-80.
21. Simons LP, Foerster F, Bruck PA, Motiwalla L, Jonker CM. Microlearning mApp raises health competence: hybrid service design. Health and technology. 2015;5(1):35-43.
22. Pramana G, Parmanto B, Lomas J, Lindhiem O, Kendall PC, Silk J. Using mobile health gamification to facilitate Cognitive Behavioral Therapy skills practice in child anxiety treatment: Open clinical trial. JMIR serious games. 2018;6(2):e9.
23. Lau HM, Smit JH, Fleming TM, Riper H. Serious games for mental health: are they accessible, feasible, and effective? A systematic review and meta-analysis. Frontiers in psychiatry. 2017;7:209.
24. Johnson D, Deterding S, Kuhn K-A, Staneva A, Stoyanov S, Hides L. Gamification for health and wellbeing: A systematic review of the literature. Internet interventions. 2016;6:89-106.
25. Fredericksen E, Swan K, Pelz W, Pickett A, Shea P. Student satisfaction and perceived learning with online courses-principles and examples from the SUNY learning network. 1999.
26. Aghvamy M ,Mohammadzadeh S, Gallalmanesh M, Zare R. Assessment the education compariment to two ways: groupe education and computer education on quality of life in the children 8-12 years suffering from Asthma in the valiasr hospital of Zanjan. ZUMS Journal. 2011;1-78:(74)9 .85
27. Furdu I, Tomozei C, Kose U. Pros and cons gamification and gaming in classroom. arXiv preprint arXiv:170809337. 2017.
28. Yeganehkhah M, Abedini A, Akbari H, Ziyaeinejad M. Comparison of different methods of education on reducing the anxiety of patients with myocardial infarction. Iran Journal of Nursing. 2012;24(74):36-44.
29. Saki A, Hooshmand Bahabadi A, Asadi Noghabi AA, Mehran A. Comparison of face-to-face and electronic education methods on anxiety in patients with acute myocardial infarction. Journal of hayat. 2014;20(1):6-14.