Original Article
http://mjiri.iums.ac.ir

Medical Journal of the Islamic Republic of Iran (MJIRI)
Iran University of Medical Sciences

Designing and assessing fixed dental prostheses 2 multimedia-based education in dentistry students

Yousef Jahandideh[1], Leila Roohi Balasi[2], Bardia Vadiati Saberi[3], Ideh Dadgaran*[4]

Received: 27 November 2015 Accepted: 26 June 2016 Published: 20 December 2016

Abstract

Background: Above all methods effective learning results from decent training, acquired in the proper environment and encouraging creative methods. Computer-assisted training by educational software is considered a fundamental measure to improve medical and dentistry education systems. This study aims to design and assess fixed dental prostheses via 2 multimedia instructional contents at the Guilan dentistry school.

Methods: This is a descriptive and cross-sectional study. First off, the instructional content was analyzed. The software used to produce multimedia was the iSpring suite Ver.7.0. After designing the instructional multimedia, this software was loaded by LMS. Sixty-nine dentistry students in the 5th semester at Guilan Dentistry School were selected via convenience sampling. At the end of the course, a structured questionnaire containing 26 items were handed to the students to evaluate the instructional multimedia quality.

Results: Mean ±SD age was 24.68±3.24 years, 43 were women (62.4%) and 26 were men (37.6%) –the majority of 76.8% used the internet at home. A portion of 33.3% were inclined to use multimedia and the internet with in-person training. About 60% declared that multimedia quality as being good.

Conclusion: the instructional multimedia designs which are compatible with lesson objectives and audio-visual facilities can have a great effect on the student's satisfaction. Preparing instructional multimedia makes the instructional content easily accessible for students to be able to review it several times at the proper opportunity and if presented through LMS they would be able to study the lesson subject wherever and whenever accessing the internet.

Keywords: Dental Prostheses, Dentistry, Education, Multimedia.

Cite this article as: Jahandideh Y, Roohi Balasi L, Vadiati Saberi B, Dadgaran I. Designing and assessing fixed dental prostheses 2 multimedia-based education in dentistry students. *Med J Islam Repub Iran* 2016 (20 December). Vol. 30:455.

Introduction

In the past, teaching medical courses was commonly performed via scientific and theoretical classes via teaching aids including textbooks and journals (1). However, today changing health care and medical curriculum has made computer-assisted learning more valuable than before (2). In fact, currently the increasing availability of accessing suitable hardware and software for Electronic-learning has provided a new horizon for educational institutes (3). Thus integrating it into the current educational curriculum of universities seems inevitable. On the one hand, the necessity behind this approach is the scientific view about various dimensions of E-learning and the changing process of design based on the existing conditions and logical goals on the country's medical training (4). Effective learning above all methods results from decent training, acquired in the proper environment and encouraging creative methods (5). Computer-assisted training by educational software such as CD or DVD is considered a fundamental measure to improve

[1]. Assistant Professor, Medical Education Research Center (MERC), Education Development Center, Guilan University of Medical Sciences, Rasht, Iran, & Department of Fixed Prostheses, Dentistry School, Guilan University of Medical Sciences, Rasht, Iran. drjahandideh5@gmail.com
[2]. Instructor, Medical Education Research Center (MERC), Education Development Center, Guilan University of Medical Sciences, Rasht, Iran. roohi_balasi@yahoo.com
[3]. Assistant Professor, Department of Periodontology, Dentistry School, Guilan University of Medical Sciences, Rasht, Iran. dr.bardia_vad@yahoo.com
[4]. (**Corresponding author**) Assistant Professor, Medical Education Research Center (MERC), Education Development Center, Guilan University of Medical Sciences, Rasht, Iran. i_dadgaran@yahoo.com

medical and dentistry education systems. According to the results derived from some other studies that have used a computer-assisted method training concurrently has been a reliable and useful method in learning clinical skills and its results have been compared with regular methods (6). A very critical role of the computer is organizing and presenting data making the user's data accessible, control easy and facilitating knowledge acquisition (2). Actually, using multimedia boosts the learning process and also applies the learners' senses; stimulating their motivation to actively participate besides the training process, making the learners self-organized and self-directed (7). Furthermore, it provides the student with an opportunity to fully control the educational content, time and place (2). Generally speaking, multimedia facilitates the growth of data-based knowledge spreading (5).It seems that the application of multimedia in educational settings has diverse advantages, some of which include using five senses for learning, further practice to become competent, facilitating participation to create inter-conceptual links, facilitating lesson repetition for re-use & cost-effectiveness and the program flexibility versus the learners' need. Computer-assisted training has its own limitations such as the inability to substitute for teacher, emotional and human interactions, and face-to-face communication occurring in classrooms (3). Moreover some critics assume that personal and computerized educational approaches create monotonous and dull educational conditions where there is no spontaneous interaction and communication between the teacher and students or even among the learners (4).

Various studies have presented different results regarding the use of multimedia for students' learning. The study by Amanloo aimed to assess and discover Web-based instruction strengths and weaknesses in mycology training, showing that in the final test of the course, no meaningful difference to be found between the E-learning and control groups' students in terms of learning and achievement (4).While in the research by Aly et al. (2003) which targeted to compare two multimedia methods and a traditional lecture in training orthodontics (orthodontia) among dentistry students, it was declared that although the individuals in multimedia group got a better score, this difference wasn't statistically significant (2). In addition, the results by Naseri et al. (2013) aiming to study the effectiveness of using endodontics training on medical students' knowledge and skill indicated that this educational program application has been useful in terms of scientific endodontics skills learning and or the learners' knowledge promotion in this field as much as regular demonstration method (6). Since no study has been performed with the mentioned goal among the Dentistry Students of Guilan Medical University so far, in this study, instructional design and assessment of using fixed dental prostheses 2 multimedia in Guilan Medical University dentistry students of the year 2010 semester has been studied.

Methods

This is a descriptive and cross-sectional research. First off, instructional content based on a 5-step guide of the Virtual Labs Project at Stanford University (VLPSD) has been analyzed (8).

***First step*:** (Understand): to identify the target group, instructional needs and learning objectives.

***Second step*:** (Design): to design instructional content, identify common mistakes of the student, define educational resources, surf the Internet, select proper software for producing content, choose motivations to make students participate in learning, and estimate the effectiveness of this method to a traditional one

Third step: (Building): to build an interactive instructional multimedia

***Fourth step*:** (User testing): to achieve learning objectives, being applicable and have content resolution.

Fifth step: (Improve): to assess multimedia effectiveness through polling the stu-

dents' opinion and getting their feedback.

The software used to produce multimedia was iSpring Suite ver.7.O with audio and visual facilities. To produce multimedia, at first, the fixed dental prostheses 2 educational clip and images were imported to the software, thereafter via using the audio and visual facilities, the teacher explained the lesson subjects and simultaneously, the slide demonstration together with the teacher's sound and image were presented (Figs. 1-3). Content output in Sharable Content Object Reference Model (SCORM) format was saved to make Learning Management System (LMS) loading possible. SCORM is a standard for edu-

Fig. 1. Sample of instructional content uploaded on LMS

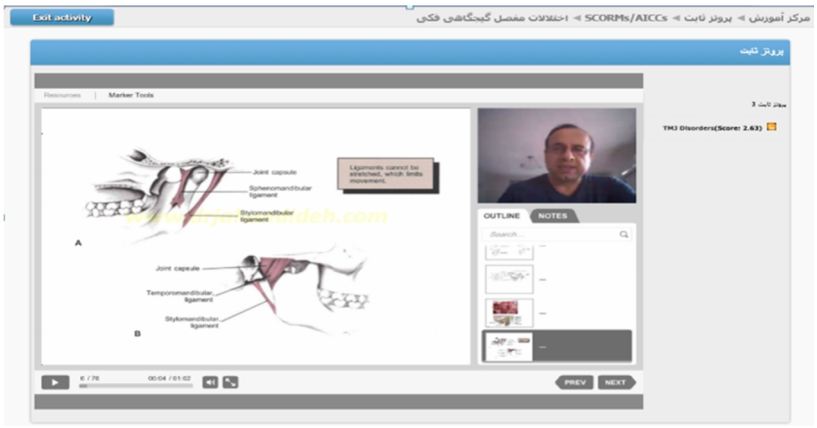

Fig. 2. Fixed dental Prosthesis lesson multimedia example produced by iSpring software

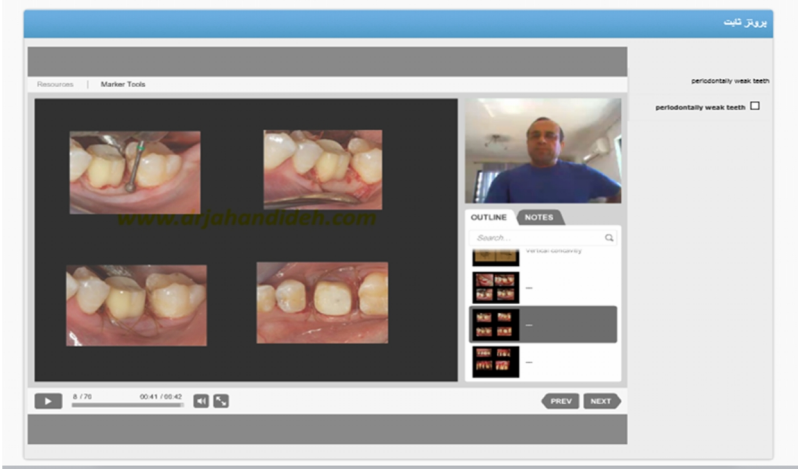

Fig. 3. Fixed dental prosthesis multimedia example produced by iSpring software

cational content that builds upon existing standards for e-learning. It specifies a framework with which e-learning content is made durable, portable, reusable, interoperable, and accessible (9). The primary objective of the LMS is to manage learners, keeping track of their progress and performance across all types of training activities. The LMS manages and allocates learning resources such as registration, classroom and instructor availability, instructional material fulfillment, and online learning delivery (10).

After designing the instructional multimedia and obtaining the necessary permits, this software was loaded by LMS and 69 students in their 5th semester of Guilan Dentistry School, who were selected via convenience sampling. The instructional content could be accessed by LMS system. Study course lasted 20h. Two sessions (4h out of 20h) of fixed dental prostheses 2 lesson were assigned for virtual training and applying multimedia. At the end of the course, a researcher-built questionnaire whose validity was determined by 10 authorities' comments and whose reliability was defined by alpha-Cronbach (α=0.82), containing 26 items in two parts: 1) demographic information (9 items) and multimedia quality assessment items (17 items) were handed to the students to evaluate the instructional multimedia quality. Statistical comparisons were performed using the T-test for independent samples and the ANOVA test.

Results

Mean±SD age was 24.68±3.24 years, 43 were women (62.4%) and 26 men (37.6%) –the majority of 76.8% (n=53) used the internet at home. A portion of 33.3% (n=23) were inclined to use multimedia and the internet with an in-person training. About 60% (n=35) announced multimedia quality as good. Based on the ANOVA and independent t-test, there was no significant relationship between age groups, gender and satisfaction of multimedia quality. The students' opinions about the instructional multimedia quality have been given in Table 1.

Discussion

This study has been conducted with the aim to design and assess fixed dental prostheses 2 multimedia instructional content. Computer-assisted training by software as CD or DVD has been viewed as a funda-

Table 1. Frequency distribution of the students' opinions (n=69) about the fixed dental prostheses 2 multimedia quality

Items on instructional multimedia quality	Strongly agree	Agree	No idea	Disagree	Strongly disagree
1. Are they consistent with instructional objectives?	22(31.9)*	27(39.1)	8(11.6)	9(13)	3(4.3)
2. Lesson process (defining content reading route, attending cooperative spaces, tests & practices...) has been clearly explained for the students.	19(27.5)	27(39.1)	12(17.4)	7(10.1)	4(5.8)
3. It has been prepared based on the topic.	21(30.4)	31(44.9)	10(14.5)	4 (5.8)	3(4.3)
4. It is highly accurate and exact.	24(34.7)	25(36.2)	12(17.4)	5(7.2)	3(4.3)
5. It has been prepared in the form of question & answer with suitable educational objectives and feedback (interactive).	14(20.3)	17(24.6)	22(31.9)	12(17.4)	4(5.8)
6. It has been vividly clear and has logical sequence subjects.	18(26.1)	30(43.5)	12(17.4)	7(10.1)	2(2.9)
7. The text accompanies sufficient explanation.	18(26.1)	29(42)	11(15.9)	9(13)	2(2.9)
8. Color, graphics, sound, image, film...have been used regarding the objectives.	17(24.6)	36(52.2)	9(13)	5(7.2)	2(2.9)
9. A large part of content contains audio-visual facilities.	19(27.5)	33(47.8)	10(14.5)	5(7.2)	2(2.9)
10. Images, text and sound have high quality and resolution.	15(21.7)	33(47.8)	11(15.9)	8(11.6)	2(2.9)
11. It can be printed.	11(15.9)	16(23.2)	28(40.6)	10(14.5)	4(5.8)
12. It can be easily installed and run.	18(26.1)	31(44.9)	9(13)	7(10.1)	4(5.8)
13. There is no need to install special software before and during using lesson.	21(30.4)	27(39.1)	12(17.4)	5(7.2)	4(5.8)
14. Menu can be easily accessed.	21(30.4)	26(37.7)	12(17.4)	7(10.1)	3(4.3)
15. Common Persian fonts have been applied.	16(23.2)	32(46.4)	14(20.3)	3(4.3)	4(5.8)
16. It is appropriate in terms of writing and editing.	18(26.1)	35(50.7)	10(14. 5)	3(4.3)	3(4.3)
17. The references have been listed at the end.	15(21.7)	27(39.1)	18(26.1)	4(5.8)	5(7.2)

*n(%)

mental measure to improve medical and dentistry systems. This method is a powerful tool and the integration of audio and visual data in a multimedia tool format is considered as one of its remarkable advantages (6).Considering the necessity behind designing multimedia for training dentistry students, Fakhry et al. (2007) stated: due to the limitation of surgery space, oral cavity being small and the nature of the dental procedure, the majority of the students in the clinical situation don't have the correct view of the procedure details and this impedes learning opportunities. Applying the multimedia procures training through magnified images improving students' learning (11). Learning happens better by the spoken text and images than the written form (12,13).In addition, another research, that concluded that it isn't possible to train the practical procedures by the traditional method well and due to this, and in order to make students familiar with practical work and utilizing its results and interpretation, and motivate the students, multimedia based method (preparing practical lesson plan, practical program plan, practical educational software, using PowerPoint and computer) has been employed (14). Besides boosting the instructional content quality, designing an instructional multimedia can also promote the students' independent learning.

As stated in the methods, in this study, instructional content has been designed for reuse in LMS in SCORM format. Bradley & Boyle (2004) have also designed instructional multimedia for computer courses. In their research, they emphasized on two key goals, namely, designing pedagogic-based instructional multimedia and the potential of reusing multimedia in other universities (15), both of which have been observed in this study. In order to follow the schools' pedagogical principles and taking into consideration the learning objectives, the iSpring software was employed to produce the multimedia via; blending the textual, audio and visual facilities using authentic scientific references of dentistry; so that students achieve maximum learning objectives. In order to reuse the multimedia, a SCORM output has been applied so that it is possible to use and apply in LMS. In other studies, employing SCORM in addition to reusing, the instructional content has been shared in various disciplines; in a way that students could access the instructional content at any a time and place (16,17). Besides the students accessing the multimedia content at any time and place, adjusting the learning speed is of the cases studied in the use of multimedia. In multimedia based training, two general states about speed control are taken into account: 1) system-paced education where the instructional content presentation time is carried out by the system and the learners don't interfere in controlling and adjusting the training speed; 2) self-paced learner education where the training time is determined by the learners. The studies have suggested that when the self-paced learners control their training presentation speed, their learning is improved (18,19). Moreno et al. (2001) asserted that the learners could control the speed animated presentation (the principle as self-paced), compared with the learners receiving the same animation at normal speed and with no control, they had better performance in learning tasks (20). In the current research, the latter method, i.e., self-paced learner has been used and learning speed control was done by the learner, which itself is one of the merits behind using instructional multimedia and through that influences learner's learning promotion. Despite this, some studies have reported conflicting results, for instance, Chung (2006) drew this conclusion after his research that the material presentation speed control by the learner had no effect on learning improvement (21). It seems that in addition to speed control, some other cases such as the learner's prior knowledge, ability to recognize words and understand the material, the instructional content complexity and difficulty also affect learning (22).

The results of this study showed no sig-

nificant relationship between age, gender and student's satisfaction of multimedia quality. While other studies revealed that men's perception of usefulness was the more significantly direct and more salient than women's in determining behavioral intention to use e-learning. This finding suggests that men tend to concentrate on the usefulness of a new technology, and that they appear to be fairly ''pragmatic'', considering productivity- related factors when using this new technology. Useful content is an important pragmatic factor attracting male users to use e-learning. Pedagogical principles, including principles of developing and packaging content, could be employed in the development and evaluation of e-learning content (23,24). Also other studies revealed no significant relationship between various ages and e-learning (25), while other studies showed significant relationship between different ages and e-learning (26,27).

This study extracted revealed that the majority of students have been satisfied with the instructional multimedia. Brett stressed that when using multimedia technology, the students play the leading role since they independently use the multimedia and for this reason, polling the students' opinions is essential in order to decide about continuing using this method and or including it in the instructional curriculum (28). Ozuah (2002) assumes that the recent advances in ICT, genome, supplementary medicine and other cases in medical science and transformation in the instructional curriculum seems inevitable (29). In other studies, the requirement to change the instructional curriculum due to moving from traditional teacher-oriented method to applying novel student-oriented method has been stressed (30,31). Before anything else, when implementing every program, it is critical to evaluate the students' opinions about educational design and content and quality to be assured that the students have the necessary motivation and interest to implement the program (31). Brett (1996) discovered in his study that being satisfied with using the multimedia can be studied from diverse dimensions in different students such as the students' learning styles, being interested in using technology and computer and it can be assumed that the students learning independently and being highly interested in technology view instructional multimedia as an appropriate method for training (28). This study derived results implying that the majority of students are in agreement with instructional program running through multimedia accompanied with in person training. The study results by Banados (2013) have also revealed that the students prefer face-to-face instruction and believe that applying online training can lead to the students feeling isolated (32). In another research, despite being satisfied with the instructional multimedia, the majority of the students asserted that it is better not to consider using multimedia as a compulsive method in the instructional curriculum rather than applying it along with the conventional method (28). Here the issue known as blended learning is set forth. Blended learning refers to integrating face-to-face learning in technology based facilities; combining these two types of learning results in traditional learning promotion (33). In other studies, the importance of blended learning and its impact on learning has been emphasized (38-44). It's worth mentioning that face-to-face learning and e-learning each has its own merits and disadvantages and if they are used with each other, they can be highly effective in the students' learning. In this respect, Hoic et al. (2009) emphasized in their research, that despite having lots of advantages including individual learning, interaction, immediate feedback and online evaluation that computer-assisted learning has, one of the main disadvantages is its inability to keep the student; in other words, the students' drop-out percentage (34).

This matter is of the main reasons behind the bilateral communication importance of e-learning and face-to-face training in order to raise interaction, communication and participation in learning (34). In another

study, the students' satisfaction with E-learning was lower and they preferred the traditional method. The students are still inclined to the traditional method and believe that the material presentation and tracking, learning the principles and concepts and clarifying the complicated lesson subjects in the traditional method are more than the blended and internet based method. This group of students preferred to reapply the traditional method in the following training course. The reason for their dissatisfaction was their unfamiliarity with technology and lacking motivation at using novel methods (39). However, in another study, no meaningful relationship has been discovered between the students' dissatisfaction and familiarity with computer science (40).

Moreover, in the current study, the instructional multimedia quality was assessed by the students. The results demonstrated that the majority of the students have announced the produced multimedia quality as good. In other studies, similar results were also stated, too (41,42). On the other hand, in another research, students had announced the quality of the produced multimedia as average (43). Of the cases investigated in this study is the ability of the instructional multimedia at being interactive. The study results denoted that the majority of the students were satisfied with the produced multimedia being interactive: Student-student and student-content (44); the latter mentioned case is among those not analyzed upon. The students' opinion poll about the electronic instructional content being interactive is critical. Most of the studies have shown that the inter-activeness of the content plays a significant role in the students being satisfied with E-learning, their engagement in learning, achieving high learning levels and positive attitude towards distance learning (45,46).

Another feature assessed in the instructional multimedia is the audio-visual facility and the quality of the images and films in terms of color, graphics, resolution and sound. The study results revealed that the students were satisfied with all stated cases and these specifications have been exactly observed in the produced software. Other studies results' about instructional content has suggested that the images presented by the teacher can't alone promote the students' learning. In this study, the conclusion has been drawn that lack of images by the teacher has had no effect on the students' learning (20); while the teacher's mouth, lips, eyebrows, nose movements and expressions like laughing and frowning: each has its own meaning, providing additional information for transferring the teacher's tendencies, emotions and knowledge (47, 48).

Among the specifications of the designed multimedia assessed are the material's logical order, the material matching the learning objectives and the instructional content accuracy. The noted cases are of the instructional content design principles which the multimedia format instructional content wasn't separated from and these cases have to be considered and observed in multimedia design. The current study results imply the students' satisfaction with observing the above cases in the designed multimedia. Other studies' results also verify this issue (49).

Conclusion

The results derived from this study demonstrated that the instructional multimedia design was compatible with lesson objectives and also that audio-visual facilities can have a great effect on meeting the student's satisfaction. Preparing instructional multimedia makes it easy for the students to access the instructional content and study the classroom instructional content. Allowing them to review it several times at the proper opportunity. Furthermore, if it is presented through LMS, they will be able to study the lesson subject wherever and whenever by just accessing the internet. Using instructional multimedia such as training the procedures via magnified images leads to the students' learning improvement. This is especially significant for

dentistry students because the limited oral cavity doesn't allow them to see all the procedure' details and via magnified images and films, the necessary training can be presented to them. Besides this, other multimedia facilities such as providing the appropriate questions while presenting the content and giving immediate feedback to the student can promote student-content interaction and increase their learning.

References

1. Silva CC, Toledo SL, Silveira PS, Carvalho CR. Evaluation of a multimedia online tool for teaching bronchial hygiene to physical therapy students. Brazilian Journal of Physical Therapy 2012;16(1):68-73.
2. Aly M, Willems G, Carels C, Elen J. Instructional multimedia programs for self-directed learning in undergraduate and postgraduate training in orthodontics. European Journal of Dental Education 2003;7(1):20-6.
3. Saeedinejat S, Vafaeenajar A. The Effect of E-Learning on Students' Educational Success.Iranian Journal of Medical Education 2001;11(1):1-9. [Persian]
4. Amanloo S, Didehdar R. Web-Based Education in Teaching Medical Mycology to The Students of Pharmacy in Zabol University of Medical Sciences in 2009. Iranian Journal of Medical Education 2001;11(3):230-7. [Persian]
5. Alijanpour E, Amri-maleh P, Khafri S, Razzaghi F. Assessment of different cardio-pulmonary resuscitation teaching approach on quality of education in medical student, Babol 2011. Medical Journal of Mashhad University of Medical Sciences 2014;56(6):376-82. [Persian]
6. Naseri M, Ahangari Z, Shantiaee Y, Rasekhi J, Kangarlou A. The efficacy of an Endodontic Instructional Multimedia Program for Enhancing the Knowledge and Skills of Dental Students. JIDA 2013;25(2):141-7. [Persian]
7. MousaRamezani S. The impact of multimedia teaching and lecture on achievement motivation and self-regulation of distance students. Educational Technology 2011;6(1):45-57. [Persian]
8. Huang C. Designing high-quality interactive multimedia learning modules. Computerized Medical Imaging and Graphics 2005;29(2):223-33.
9. Njuguna N, Flanders AE, Kahn JrCE. Informatics in radiology: envisioning the future of e-learning in radiology: an introduction to SCORM. Radiographics 2011;31(4):1173-9.
10. Rapuano S, Zoino F. A learning management system including laboratory experiments on measurement instrumentation. Instrumentation and Measurement, IEEE Transactions on 2006; 55(5):1757-66.
11. Fakhry A, Dehkordi-Vakil FH. Video-Assisted Clinical Instruction in Dentistry (VACID) enhances real-time visualisation of clinical procedures. European Journal of Dental Education 2007;11(4):238-44. [Persian]
12. Sanchez E, Garcia-Rodicio H. The use of modality in the design of verbal aids in computer-based learning environments. Interacting with Computers 2008;20(6):545-61.
13. Segers E, Verhoeven L, Hulstijn-Hendrikse N. Cognitive processes in children's multimedia text learning. Applied Cognitive Psychology 2008; 22(3):375-87.
14. Qujeq D, Abbassi N, RasolpourRoshan K. Use of Multimedia in the Training of Biochemistry Laboratory Course to the Students in Babol University of Medical Sciences. Biannual Medical Education, Babol Univ Med Sci 2014;2(Autumn, Winter):53-8.
15. Bradley C, Boyle T. The design, development, and use of multimedia learning objects. Journal of Educational Multimedia and Hypermedia 2004; 13(4):371-89.
16. Jones ER, editor Implications of SCORM™ and emerging e-learning standards on engineering education. Proceedings of the 2002 ASEE Gulf-Southwest Annual Conference; 2002.
17. Bohl O, Scheuhase J, Sengler R, Winand U, editors. The sharable content object reference model (SCORM)-a critical review. Computers in education, 2002 proceedings international conference on; 2002: IEEE.
18. Kühl T, Eitel A, Damnik G, Körndle H. The impact of disfluency, pacing, and students' need for cognition on learning with multimedia. Computers in Human Behavior 2014;35:189-98.
19. Stiller KD, Freitag A, Zinnbauer P, Freitag C. How pacing of multimedia instructions can influence modality effects: A case of superiority of visual texts. Australasian Journal of Educational Technology 2009;25(2).
20. Moreno R, Mayer RE, Spires HA, Lester JC. The case for social agency in computer-based teaching: Do students learn more deeply when they interact with animated pedagogical agents? Cognition and instruction 2001;19(2):177-213.
21. Chung W. The effects of presentation pace and modality on learning a multimedia science lesson: The University of Texas at Austin; 2006.
22. Schmidt-Weigand F, Kohnert A, Glowalla U. A closer look at split visual attention in system-and self-paced instruction in multimedia learning. Learning and Instruction 2010;20(2):100-10.
23. Ong CS, Lai JY. Gender differences in perceptions and relationships among dominants of e-learning acceptance. Computers in Human Behavior 2006;22(5):816-29.
24. Govindasamy T. Successful implementation of e-learning: Pedagogical considerations. The Internet and Higher Education 2001;4(3):287-99.

25. Chu RJC. How family support and Internet self-efficacy influence the effects of e-learning among higher aged adults–Analyses of gender and age differences. Computers & Education 2010; 55(1):255-64.
26. Venkatesh V, Morris MG, Ackerman PL. A longitudinal field investigation of gender differences in individual technology adoption decision-making processes. Organizational behavior and human decision processes 2000;83(1):33-60.
27. Wang YS, Wu MC, Wang HY. Investigating the determinants and age and gender differences in the acceptance of mobile learning. British Journal of Educational Technology 2009;40(1):92-118.
28. Brett P. Using multimedia: an investigation of learners' attitudes. Computer Assisted Language Learning 1996;9(2-3):191-212.
29. Ozuah PO. Undergraduate medical education: thoughts on future challenges. BMC Medical Education 2002;2(1):8.
30. Bannan-Ritland B, Dabbagh N, Murphy K. Learning object systems as constructivist learning environments: Related assumptions, theories, and applications. from http://reusability. org/read/ chapters/bannan-ritland. doc; 2000.
31. Ruiz JG, Mintzer MJ, Issenberg SB. Learning objects in medical education. Medical teacher 2006;28(7):599-605.
32. Bañados E. A blended-learning pedagogical model for teaching and learning EFL successfully through an online interactive multimedia environment. Calico Journal 2013;23(3):533-50.
33. Kerres M, Witt CD. A didactical framework for the design of blended learning arrangements. Journal of Educational Media 2003;28(2-3):101-13.
34. Hoic-Bozic N, Mornar V, Boticki I. A blended learning approach to course design and implementation. Education, IEEE Transactions on 2009; 52(1):19-30.
35. Alonso F, López G, Manrique D, Viñes JM. An instructional model for web-based e-learning education with a blended learning process approach. British Journal of educational technology 2005; 36(2):217-35.
36. Garrison DR, Kanuka H. Blended learning: Uncovering its transformative potential in higher education. The internet and higher education 2004; 7(2):95-105.
37. Prišćan S, Horvat D, Hoic-Bozic N, Pervan P, Vlahović-štetiC V, editors. Results of the CARNet programme" educational projects". Information Technology Interfaces, 2003 ITI 2003 Proceedings of the 25th International Conference on; 2003: IEEE.
38. Bubaš G, Kermek D, editors. The prospects for blended learning in Croatian academic institutions. 6th CARNet Users Conference, Zagreb; 2004.
39. Rivera JC, Rice ML. A comparison of student outcomes & satisfaction between traditional & web based course offerings. Online Journal of Distance Learning Administration 2002;5(3).
40. Kitchen D, McDougall D. Collaborative learning on the Internet. Journal of Educational Technology Systems 1999;27(3):245-58.
41. Amir F, Iqbal SM, Yasin M, editors. Effectiveness of cyber-learning. Frontiers in Education Conference, 1999 FIE'99 29th Annual; 1999: IEEE.
42. Piotrow PT, Khan O, Lozare BV, Khan S. Health communication programs: a distance-education class within the Johns Hopkins University School of Public Health Distance Education Program 2000.
43. AkbariBurng M, Jafari Sani H, Ahanchian M, Kareshky H. Assess the quality of e-learning in Iranian universities based on the orientation of the curriculum and experienced instructors Journal of Research and Planning in Higher Education 2012; 66:75-97.
44. Moore MG. Editorial: Three types of interaction 1989.
45. Zhang D. Interactive multimedia-based e-learning: A study of effectiveness. The American Journal of Distance Education 2005;19(3):149-62.
46. Fulford CP, Zhang S. Perceptions of interaction: The critical predictor in distance education. American Journal of Distance Education 1993; 7(3):8-21.
47. Elliott C. Research problems in the use of as allow Artificial Intelligence model of personality and emotion 1994.
48. Hapeshi K, Jones D. Interactive multimedia for instruction: A cognitive analysis of the role of audition and vision. International Journal of Human-Computer Interaction 1992;4(1):79-99.
49. Van Merriënboer JJ, Kester L. The four-component instructional design model: Multimedia principles in environments for complex learning. The Cambridge handbook of multimedia learning 2005:71-93.