A Qualitative Evaluation on Usability of Educational Simulations

Nesrin Özdener Dönmez
Assoc. Prof. at Marmara University Ataturk
(Turkey)
nozdener@marmara.edu.tr
Zeynep Gökkaya
Marmara University Distance Education Center
(Turkey)
zeynep.gokkaya@marmara.edu.tr

The purpose of this study is to examine the usability of simulations in an educational portal that is supported by Ministry of National Education and is extensively used by many teachers and students in Turkey. This study also aims to determine sufficiency in evaluating simulations' usability. Candidates of educational technologist as CEIT (Computer Education and Instructional Design) students having taken CBI (Computer Based Instruction) courses in their bachelor are expected to evaluate training materials professionally. Methodology of this research is designed as a case study in three phases. In the first phase, 14 criteria have been generated by literature review to determine simulation evaluating criteria and then interactive practices of the portal have been analyzed to remark simulations. In the second phase, 28 simulations have been assigned to 53 participants and each of these simulations has evaluated at least two participants. In the last phase, all of the simulations have been used by 27 participants. The participants have taken screenshot when they have faced a problem in simulation, and prepared reports for researchers after discussing among them. Content analysis has been applied to these reports to detect the problems encountered by participants in using simulations. The findings in this study show that simulations should be improved in terms of usability. On the other hand, curriculum of programs to educate education technologists should be updated from the point of software evaluation.
Keywords: sufficiency of simulation evaluation, usability, education technologist candidate.

1. Introduction

The expediency of instructional design is important considering the variety of teaching materials. When viewed from this aspect, making correct instructional design is a necessity to deliver the desired outcomes of the simulations [2]. Instructional design of the training materials and evaluating expediency has been made by educational technologists. One of the important points is analysing the sufficiency of the education process.

Educational abilities, design and usability are the fundamental criteria that are admitted for correct instructional design. User-friendly interface is of the necessity of usability and it effects evaluation of results [9, 7]. According to usability, the influential training materials should include several features such as: teachability, effectiveness, reminder, error messages and satisfactory design [11]. In addition, scenario of the simulations should be offered chance to manipulate and animate the circumstances with interactivity [5]. Moreover, they should provide convenient access to the results, which are obtained by experiments, and offer the opportunity to compare and discuss on students' theoretical and practical obtained result [8]. Besides, Pavoordt [15] indicates that the new generation educational software should include social media connection. Another research results show that embedded simulations in training software are more usable [17].

Simulations also have some cost-related and logistical advantages for learning outcomes that are superior to those achieved using traditional methods [1]. Especially, simulation based-learning is the best method thanks to the fact that it encourages students and guides them with iterative structure [3,14,16]. Moreover, offering the possibility to manipulate variables in real time helps the individuals for realizing the cases on time. Simulations also include role playing system and support collaborative learning. Briefly, simulations provide experimental active learning [6].

The purpose of this study is to examine the usability of simulations in an educational portal that is supported by Ministry of National Education and is extensively used by many teachers and students in Turkey [19]. This study also aims to determine sufficiency in evaluating simulations' usability.

Candidates of educational technologist as CEIT (Computer Education and Instructional Design) students having taken CBI (Computer Based Instruction) courses in their bachelor are expected to evaluate training materials professionally. In this study, the following questions have been answered:

- Are the instructions of simulations sufficient to usability?
- What are the views of participants about the opportunities to control and manipulate the simulations?
- Is the simulation assessment of the educational technologist candidates having a consistency each other?
- What are the determining impediments when using simulations?

2. Method

Methodology of this research is designed as a case study in three phases: evaluating simulations according to usability criteria, determining impediments when using simulations and determining sufficiency of educational technologists in the field of evaluating simulations. In the first phase, 14 criteria have been generated by literature review to determine simulation evaluating criteria and then interactive practices of the portal have been analysed to remark simulations. In the second phase, 28 simulations have been assigned to 53 participants and each of these simulations has evaluated at least two participants. Determining evaluation consistency of education technologist candidates is tested using assessment results. In the last phase, all of the simulations have been used by 27 participants. The participants have taken screenshot when they have faced a problem in simulation, and prepared reports for researchers after discussing among them. The discussion has supported with Edmodo.

2.1 Data collection instruments

In collecting data process, the simulation evaluating criteria have been chosen and grouped by researchers to determine usability. 14 criteria have been generated by literature review in the several subtopics: instructions, feedback, screen using, print out, communication and user control. The criteria have evaluated over a total of 28 points: yes (2), partially (1), no (0). Content analysis has been applied to these reports to detect the problems encountered by participants in using simulations. In order to determine internal consistency of assessments of participants, Fleiss Kappa parameter has been used by using above mentioned.

2.2 Findings

All of the interactive practices have been analysed with using criteria given at Table 1. After the evaluation, 28/34 practices have been accepted as simulation. 6 of them have not contained the criteria and accepted like animation.

Table 1. Simulation evaluation criteria

No	Evaluating criteria	Yes		Partially		No	
		%	*f*	%	*f*	%	*f*
1	Works performed in simulation may be taken back or forward [18] control is left to the user.	5.9	2	35.3	12	58.8	20
2	It offers taking note opportunity.	0	0	17.6	6	82.4	28
3	There is a communication platform.	0	0	100	34	0	0
4	There is an accessible help function.	91.2	31	0	0	8.8	3
5	Simulation gives the ability to cancel during the study.	100	34	0	0	0	0
6	It is possible to use the entire screen during simulation.	100	34	0	0	0	0
7	The simulation is embedded in the platform [17].	100	34	0	0	0	0
8	The animations are used to support understandability of instructions.	61.8	21	20.6	7	17.6	6
9	The experiment results obtained can be examined and users can continue from the rest part.	11.8	4	26.5	9	61.8	21
10	The obtained data can be print out.	14.7	5	0	0	85.3	29
11	The points that user wants to see are supported by focusing or swelling method at the end of obtained simulation results.	17.6	6	38.2	13	44.1	15
12	Error messages are intended to reduce problems [18]	67.6	23	14.7	5	17.6	6
13	Oral and written instructions are used.	76.5	26	23.5	8	0	0
14	The snap ability is used to place the objects easily and correctly [10].	23.5	8	11.8	4	64.7	22

In the phase of evaluating simulations according to usability criteria, the participants who have used simulations indicate that they had problems about both guiding and presentation of instructions and emphasizing them at the end of the simulation. Based on the research results, 76.5% of simulations

have the oral and written instructions but as seen at Figure 1 (a) (b) participants have remarked that descriptive instructions are not enough. According to participants, the instructions have not been cleared enough for 7 simulations (with rates ranging from 29.63% to 14.81%). In addition, as seen at Figure 1(b) (c), end of 5 simulations have not cleared what should be done (with rates ranging from 14% to 59%).

KG1: Instructions didn't disappear. Users have to click somewhere to start try"

KG6: …there is no problem for time and present. However, when the simulation is finished, there is no guidance.

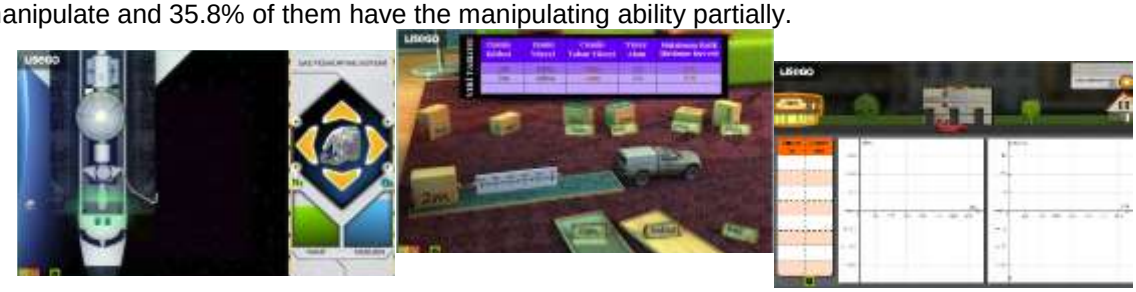
KG7: When I was using the on, is it finished?. When I clicked on the screen, it passed to practice audible or written instruction for part.

KG8: There is deficiency because the end is not clear…

(a) *(b)* *(c)*

Figure 1. Participants' reviews and screenshots for the ending simulations and instructions

It has been identified that there is deficiency in field of user control for 6 simulations. Participants have not changed the variables as they wish at particular experimental simulations. They have considered this as an error and they have reported the simulations as "failure simulation". The evaluating results that are made by researchers show that 58.8% of simulations have not offered an opportunity to manipulate and 35.8% of them have the manipulating ability partially.



KG1: Any of us could not enter the rocket. When we thought that we entered inside, it threw us to the outside. Students do not strive with this..

KG3: It didn't work, I tried 3 times. The astronaut have not gone to the correct side..

KG1: When I chose the surface, the substance changed. It is incoherent….

KG3: What I do, just the wooden surface changed.

KG5: I couldn't change the mass and surface…

KG2: you have 3 trial rights and error that is insufficient to new learners. If the learner can manipulate the values between distances, it would be more beneficial.

KG8: In my opinion, users should enter the values…

(a) *(b)* *(c)*

Figure 2. Participants review and screenshot for user control

Another finding is about educational technologist candidates who have taken lesson in field of CBI (Computer based instruction). The consistency of evaluation that each other has determined was lower (K=0, 21) than expected.

According to content analysis, participants have indicated several impediments to use simulations at the reports of participants: friendly-user interface, compatibility with internet browsers, Offer for taking note and manipulating opportunity to users.

3. Discussion

According to this research results, 6/34 of the interactive practices have not include interactivity and evaluated like animation. Despite of the fact that it is clear that computer-student interaction is necessary for them [13] the situation shows that educational technologists of software developing companies should be more careful when making the classification.

According to another research finding, the expression of instructions used in the software is not clear enough and what students will do at the end of the simulation is not clear enough too. Moreover, it is determined that the score of all of the simulations are above average with 16,36 points over 28.

The most highlighted problem of software by participants is user control. Participants want to change variables and if it was not possible they reported the situation as error. This result was consistent with other research result: the simulations developed for adults should be more controllable.

According to finding, low consistency has been determined between participants (K=0, 21). This situation shows that IT teacher candidates, who take CBI, have not sufficient instruction and their courses should include more application and practice.

The study results of indicate that [4] despite of the fact that increased abilities are not adequate. Self-sufficiency perception of 3 and 4 degree CEIT students are higher than 2 degree students. Likewise, the findings of this study are consistent with the findings of other study that determined inconsistency between teacher candidates in all field of software evaluation [12].

CEIT students aiming at becoming educational technologist should be capable of evaluating education software. Besides, their ability of the needs analysis to develop materials should also be improved.

References

[1] Bannetain, E., Boucheix, J.-M., Hamet, M., & Freysz, M. (2010). Benefits of computer screen-based simulation inlearning cardiac arrest procedures. Medical Education, 44, 716-722.

[2] Cook, D. A., Hamstra, S. J., Brydges, R., Zendejas, B., Szostek, J. H., Wang, A. T., & Erwin, P. J. (2013). Comparative effectiveness of instructional design features in simulation-based education: Systematic review and meta-analysis. Medical Teacher, 867-898.

[3] Dawley, L., & Dede, C. (2014). Situated learning in virtual worlds and immersive simulations. J. M.

[4] Demirer, V., Özdinç, F., & Şahin, İ. (2009). Self sufficiency perceptions of computer teacher candidate, 9th International Educational Technology Conference(pp.435-441). Ankara: Hacettepe University.

[5] Feinstein, A. H., & Cannon, H. M. (2001). Fidelity, verifiability, and validity of simulation: Constructs for Evaluation. Developments in Business Simulation and Experiential Learning, 28, 57-67.

[6] Feinstein, A. H., Mann, S., & Corsun, D. L. (2002). Charting the experiential territory. Journal of Management, 21, 732 - 744.

[7] Gökkaya, Z. (2014). A new approach in adult education: Gamification, Journal of Hasan Ali Yücel Education Faculty, 11(1), 71-84.

[8] Gündüz, M., Baykan, Ö. K., & Yıldız, F. (2007). Virtual lab application for electronic experiments. Selçuk University Teknik-Online Journal, 6(2), 61-74.

[9] Hurtado, N., Ruiz, M., Orta, E., & Torres, J. (2015). Using simulation to aid decision making in managing the usability evaluation process. Information and Software Technology, 209-526.

[10]Karagöz, Ö. (2006) Examining the impact on student achievement with using different instructional methods and evaluating the design and usability of different virtual laboratory programs in Physics courses, Unpublished master thesis, Marmara University.

[11] Karagöz, Ö., & Özdener, N. (2010). Evaluation of the usability of different virtual lab software used in physics courses. Bulgarial Journal of Science and Education Policy, 4(2), 216-235.

[12] Korkmaz,Ö. Usta,E. & Güzeller, C. (2009), Evaluation sufficiency of teacher candidates for chosing correct educational software, Journal of Ahi Evran University Educational Faculity, 10(3), 135-142

[13] Lepper, M.R. & Chabay, R.W. (1985) Intrinsic motivation and instruction: Conflicting views on the role of motivational process in computer-based education, Educational Psychologist, 217-230.

[14] Özdener, N. (2005). Using simulation in experimental teaching methods. The Turkish Online Journal of Education Technology, 93-98.

[15] Pavoordt, P. (2012). Gamification of education. Retrieved December 15, 2014, from http://www.cs.vu.nl/~eliens/sg/local/essay/12/17.pdf

[16] Salas, E., Wildman, J. L., & Piccolo, R. F. (2009). Using Simulation-Based training to enhance management education. Learning & Education, 8(4), 559-573.

[17] Sitzmann. (2011). A meta-analytic examination of the instructional effectiveness of computer-based simulation games. Personnel Psychology, 489-528.

[18] Squires, D. & Preece, J (1999). Predicting quality in educational software: Evaluating for learning, usability and the synergy between them, Interacting with Computers, 467-483.

[19] Türeli, S. (2013, May 23). Vitamin and vitamin teacher portal. Retrieved December 15, 2014, from http://usak.meb.gov.tr/:http://usak.meb.gov.tr/meb_iys_dosyalar/2013_06/04041538_vitaminvevitaminretmenportal.pdf