


Determination and Comparison of the Factors Related to Effective Blended Learning in Medical Sciences from the Viewpoints of Instructors and Learners

This article was published in the following Dove Press journal:
Advances in Medical Education and Practice

Zohrehsadat Mirmoghtadaie¹ 
Nooshin Kohan²
Davood Rasouli³

¹Department of Virtualization in Medical Education, Virtual School, Tehran University of Medical Sciences, Tehran, Iran; ²Department of Medical Education, Virtual University of Medical Sciences, Tehran, Iran; ³Center for Educational Research in Medical Sciences (CERMS), Department of Medical Education, School of Medicine, Iran University of Medical Sciences, Tehran, Iran

Introduction: According to rapid growth of innovation in use of technologies in education and learning, blended learning has become an effective method in the student's education. The purpose of this study was to extract the factors related to effective blended learning and compare the viewpoints of students and instructors in this regard.

Methods: Mixed method model was used in this study. A content analysis approach was employed in the qualitative phase of the study. Seven faculty members and eight master's students of medical sciences selected through purposive sampling participated in the qualitative phase. Individual semi-structured interviews were conducted for data collection. In the quantitative phase, appropriate and relevant items were designed based on the main concepts of theoretical and practical definitions that were extracted in the qualitative phase.

Results: The results of the qualitative phase were 5 categories and 40 subcategories, including student's capabilities, teacher merits, technological aspects, pedagogic topics and supportive environment.

Discussion: The results of the questionnaire analysis showed no significant difference in student capabilities and supportive environment between the viewpoints of students and faculty members while there were significant differences in other categories. Although new technologies have offered promising opportunities, they do not result in effective education. The results of the present study suggest that a major revision in student and instructor admission and provision of required technical facilities can promote the status of this type of education. On the other hand, instructor empowerment programs in this field can enhance the effectiveness of virtual education.

Keywords: blended learning, online education, e-learning, distance education

Background

The most important mission of education in medical sciences is to train competent and capable individuals who possess the required knowledge, attitude, and skills to preserve and enhance public health. In this regard, along with the goals of sustainable development, medical education plays a key role in improving the students' knowledge for decision making in the future and developing a global perspective through effective education that is proportional to the evolution.^{1,2} This area, as part of the higher education that is responsible for providing students with a massive volume of knowledge, attitude, and skills for acquiring professional competencies,³ is obliged to

Correspondence: Davood Rasouli
Center for Educational Research in
Medical Sciences (CERMS), Department
of Medical Education, School of Medicine,
Iran University of Medical Sciences,
Tehran, Iran
Email: rasouli.d@iums.ac.ir

employ modern methods because public health improvement depends on high-quality education. Moreover, the ultimate goal of human resources planning in the health sector is to train efficient and high-quality manpower.⁴

Blended learning is a relatively new term while its concept has been prevailing in areas such as virtual education for decades.⁵ In general, the term “blended learning” refers to the third generation of distance education defined as a method to maximize the benefits of face-to-face education and multiple learning technologies.⁶ In this approach, in addition to regular classes, some electronic classes are also held during a semester, and the students are not forced to be present at a definite place at a definite time and can interact with their instructors and other learners via the Internet.⁷ Providing pure online education to a heterogeneous group of learners with different intellectual and experience backgrounds may not be effective enough. The aim of blended learning is to create opportunities for students to use both the real and virtual environments to enhance their learning.⁸ This method is used to optimize the results of learning and cost-effectiveness.⁹ Since blended learning has the benefits of traditional and virtual education, it is an appropriate method for achieving the training-learning objectives in medical education. The blended learning have been used to develop competencies in medical sciences.¹⁰ The results of the studies conducted by research institutes and universities like Stanford and Tennessee suggest that blended learning has priority over traditional approaches regarding the mechanisms; Moreover, blended learning not only is capable to transferring the learning material more effectively but also is a more effective educational method.¹¹ The design and implementation of blended learning in medical fields in Iran showed that this type of education can be cost-effective and recommended to implement. Results of the studies also showed that the learners were more significantly satisfied with learning through blended method than the traditional education (face-to-face). Therefore, by considering the valuable position of blended education in increasing the satisfaction and success of learners in medical courses, employing this approach included among the development programs for medical education from 2017.

The term “effectiveness” was first used in the field of management and different viewpoints and frameworks were presented for it. Effectiveness is usually defined as the degree to which the desired objectives are achieved.¹² In general, effective education is achievement of multiple objectives and priorities in the form of a value system, so achievement of goals in terms of cost and time is optimal

and satisfy learners and teachers.¹³ In the process of education, teaching and learning are interrelated. Although teaching is a teacher’s activity, but the result of learning depends on the student. Effective education is based on participation and cooperation.¹⁴ Therefore, effectiveness should be assessed based on the viewpoints of the students and instructors to produce comprehensive results. Although some researchers have investigated blended learning and its problems and barriers, we found no studies that compared the viewpoints of the stakeholders in this regard. Therefore, we decided to extract the factors related to effective blended learning and compare the viewpoints of students and instructors in this regard.

The research questions were as follows:

1. What are the most important factors related to effective blended learning from the viewpoints of students?
2. What are the most important factors related to effective blended learning from the viewpoints of instructors?
3. Is there a significant difference between the viewpoints of students and instructors regarding factors related to effective blended learning?

Method

The mixed method model, which combines both qualitative and quantitative approaches, was used in this study. By using the mixed method, research strong aspects of quantitative and qualitative methods can be utilized and its limitations can be minimized.^{15–18} Particularly, complexity of social facts is eliminated by bringing different methods together than observing and discussing them, which hereby contributes to the better understanding of the fact.¹⁵ In this study sequential exploratory mixed method was employed, further described in (Figure 1).

Qualitative Phase

In an exploratory design, qualitative data is first collected and analyzed, and themes are used to drive the development of a quantitative instrument to further explore the research problem.^{16,18,19} As a result of this design, three stages of analyses are conducted: after the primary qualitative phase, the secondary quantitative phase use and then, at the integration phase two strands of data and extends connects to create initial qualitative exploratory findings.¹⁶ This article reports on the final integration phase of the research. A content analysis approach was employed in the

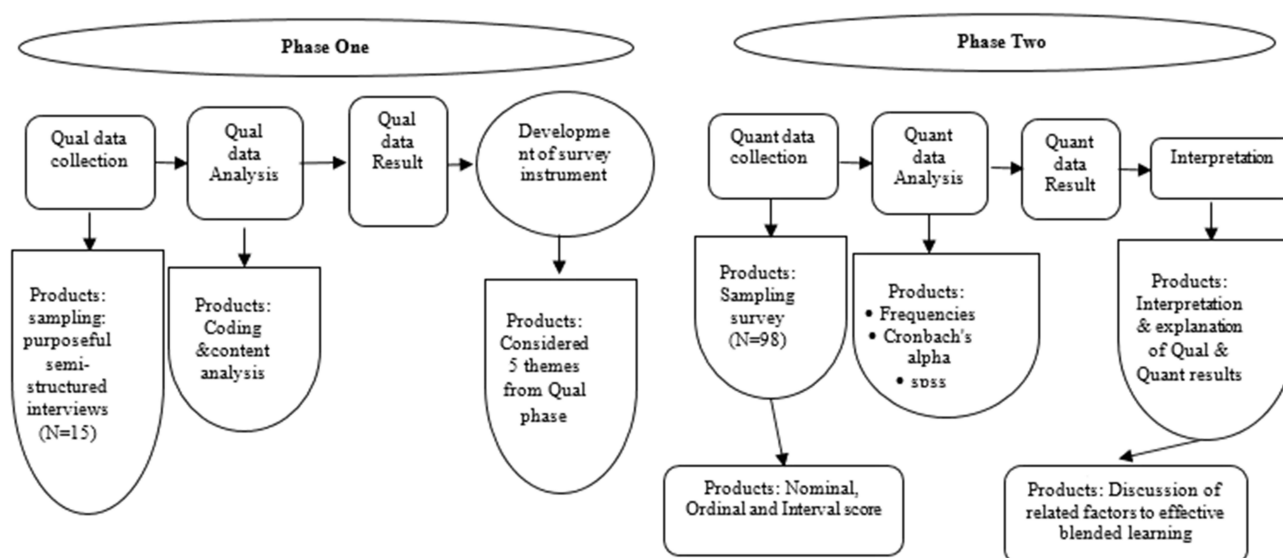


Figure 1 Sequential exploratory mixed-method design.

qualitative phase of the study. Qualitative content analysis is an approach for Subjective interpretation of the textual data through the processes of systematic categorization, coding, and themes or known patterns design.²⁰ In the content analysis approach, categories are directly extracted from the textual data to help the researcher achieves a deeper perception of the phenomenon.²¹ The reason that this approach was applied in this study was to explore the meaning, priorities, attitudes and perception of the students and instructors of effective blended learning through analyzing their verbal messages.

Participants

The sampling was purposeful. Seven faculty members of Medical Sciences universities of IRAN with at least two consecutive years of experience in the blended learning system and eight master's students of medical sciences selected through purposive sampling participated in the qualitative phase. The inclusion criteria were experience of teaching or learning in the virtual education system, availability, and willingness to participate in the study.

Data Collection and Analysis

Individual semi-structured interviews were conducted for data collection. After obtaining of informed consent from the participant, the interviews begun with unstructured questions, some probe questions were also in the interview protocol to ensure interviewees' perceptions regarding concept of factors related to effective blended learning in medical sciences. Each interview lasted for 30–45 min. All

interviews were recorded then transcribed for analysis. The introductory questions were "What do you think about blended learning and how it should be held?" "What do you think about the challenges of blended learning?" and "What are executable solutions to improve this educational method considering the prevailing context?" According to the participants' answers, probing questions were also asked during the interview. The seven-step Colaizzi's method was applied for data analysis, including familiarization with the data by reading important findings and developing empathy with the participants to extract significant statements, formulating meanings for the extracted sentences, categorizing identified meanings and clusters, referring to the original statements and comparing the data, describing the phenomenon under investigation, and finally returning the description to the participants for verification of results. These steps were followed by coding and extraction of themes and sub-themes.²² Interviewing continued, until the data from the interviews was being consistently duplicated. There appeared to be saturation of data as no new information was gained from the last interviews. The MAXQDA version 12 was used for data analysis.

Trustworthiness of Qualitative Data

Numerous frameworks have been developed to evaluate the rigor or assess the trustworthiness of qualitative data^{23,24} and strategies for establishing credibility, transferability, dependability, and Confirm ability. In this study, the credibility of the qualitative findings was ensured by using member check and

immersion techniques as well as ongoing engagement of the researchers with the data and also participation in similar congresses.

Then, in order to complete the data and examine the transferability of the findings, the people who had the experience of conducting qualitative research were asked (peer check) to review the initial interviews, coding and categories. To increase the reliability of the data, the long-term work with the research subject, the observers' review and controlling the findings with the participants in terms of the extent of reflecting their experiences were used. The principles of confidentiality of information and informed consent for interviewing and recording the conversations were observed as well. The right to withdraw from research at any time was one of the ethical considerations that were observed, too.

Quantitative Phase

In the quantitative phase, appropriate and relevant items were designed based on the main concepts of theoretical and practical definitions that were extracted in the qualitative phase and preliminary questionnaire was developed in 40 items in five general categories. The validity and reliability of questionnaire was assessed. The face validity, content validity index (CVI) and ratio (CVR) of the questionnaire was examined by 10 students and 10 faculty members and their comments were applied to the questionnaire after they were reviewed by the research team. In the next step, to Compilation of the final version, the questionnaire was assessed by a number of e-learning experts in a face-to-face session, and their comments were reviewed by research team. Finally, the final version of the questionnaire was prepared that contained 40 items in 5 general categories related to effective-blended learning. The final questionnaire included students' capabilities (four questions), teacher merits (11 questions), technological aspects (9 questions), pedagogic topics (11 questions), and supportive environment (5 questions). The questions of each category were scored on a 5-point Likert scale from very low (1 point) to very high (5 points). The minimum score of questionnaire was 40 and maximum was 200. The Cronbach's alpha was calculated to assess the reliability of the questionnaire, which was 0.91 for faculty members and 0.86 for students. The questionnaire was forwarded to 105 faculty members and students through email to prioritize effective blended learning indexes that 24 faculty members and 63 students (total=98) completed the questionnaire (Response rate: 93.3%). For data analysis, the total score of each

category was divided by the number of questions, and a mean score was calculated. SPSS version 21 was applied for analysis, using descriptive (mean, and standard deviation) and analytical (independent *t* test) statistics.

For ethical considerations, the objectives and protocol of the study were explained to the participants and informed consent was obtained from all of them. The participants were assured that participation was voluntary, they could withdraw from the study at any time, and the audio files confidential and anonymous.

Results

The mean age of students and professors participated in the study was 29.31 ± 5.2 and 41.6 ± 4.8 years, respectively. Fifty-two percent of students and 44% of professors were female. The results of the qualitative and quantitative phase are presented in the following.

Qualitative Phase Results

The aim of the qualitative phase was to determine the factors affecting effective-blended learning and to compare the viewpoints of faculty members and students in this regard. The results of this phase in five categories and 40 subcategories are presented in (Table 1).

Student Capabilities

According to the interviewees, student capabilities were an important indicator of effective-blended learning, which includes metacognitive skills like creativity, critical thinking, self-direction, etc., in addition to cognitive skills. According to participant number 10, "Blended learning requires personal maturity, critical thinking, creativity, and self-education." Moreover, one of the faculty members (participant number 7) said,

Both the student and the teachers should have the minimum information and computer literacy. In addition, their personality is also a key determinant of developing a constructive interaction and effective learning.

Teacher Merits

Teacher merits were another category. Participant number 12 said "Our faculty members neither have the literacy in such areas nor are they familiar with ethics of this environment. So how can they deliver effective education?"

Table 1 The Categories and Subcategories of Factors Affecting Effective Blended Learning According to Faculty Members and Students of Medical Sciences

Category	Sub Category
Student Capabilities	Metacognitive Skills Information literacy Personality Dimensions Netiquette
Teacher Merits	Content Expertise Professional Commitment Information literacy Netiquette Verbal & Non-Verbal Communication Skills Emotional Intelligence Virtual Class Management Cyber Skills Cybergogy Accessibility Role Modelling
Technological Aspects	High-Quality Content Up-To-Date Content Reviewability & Reversibility Content User-Friendly Sketching System Cyber Rules Interactive Virtual Environment Free Access to Content Virtual Computing Infrastructure Content Size
Pedagogic Topics	Team Working Collaborative E- Learning Effective Evaluation Designing E-Learning Activities Active E- Learning Student Progress Monitoring Content Flexibility Content Qualities Content Attractiveness Virtual Feedback System Organized Content
Supportive Environment	E- Mentoring Active Management Deeper Connection Safe Environment Strong Guidance

Technological Aspects

Another category that emerged in the qualitative phase was technological aspects, including the cyberspace and electronic content. Participant number 52 said,

If the educational content isn't easy to access, high quality, and up-to-date, education will not be effective. Blended learning should develop with technological advances and the learning system should be a lovely environment.

Pedagogic Topics

Another category was pedagogic topics, which included the subcategories of team working, effective evaluation, organize content, etc. According to participant number 41, "Pedagogic topics are important in every teaching-learning process, and they are much greater importance in blended learning."

Supportive Environment

According to the participants, a supportive environment could enhance effective-blended learning. This means that, deeper connection and e-monitoring produce a Compatible environment that is interesting for the learners and instructors to embark on teaching and learning. Participant number 36 said "The students are entitled to educate in a tension-free environment with the maximum relationship with the instructor without discrimination and commotion."

Quantitative Phase Results

Normality of data was assessed by the Kolmogorov–Smirnov test and regarding the normal distribution of data, parametric tests were used. The total mean score of questionnaire for teachers was 148.4 ± 7.74 and for students was 164.1 ± 9.68 that was significant. The results revealed that no significant difference in student capabilities and supportive environment between the viewpoints of students and faculty members while there were significant differences in other categories (Table 2).

In the student's capabilities category, metacognitive skills were the most important factor related to blended learning according to faculty members (90%) and students (85.9%). In the category of teacher merits, the faculty members pointed to information literacy (90%) and the students cited content expertise (100%) as the most important subcategories. In the category of technological aspects, the interactive virtual environment was the most important determinant of effective-blended learning according to faculty members (90%) and students (92.3%). Faculty members (100%) and students (96.2%) believed that student progress monitoring was the most important

Table 2 Comparison of Factors Related to Effective Blended Learning According to Students and Faculty Members viewpoints

Related Factors	Group			t	P value	Confidence Interval (%95)	
		Mean	SD			Lower	Upper
Student Capabilities	Teachers	15	2.24	0.068	0.946	-0.724	0.778
	Students	14.9	1.26				
Teacher's Merit	Teachers	38.8	2.28	-10.521	<0.0001	-8.573	-5.852
	Students	46	2.83				
Technological Aspects	Teachers	32.4	1.95	-7.654	<0.0001	-7.068	-4.481
	Students	38	3.11				
Pedagogic Topics	Teachers	42.3	2.93	-4.013	<0.0001	-4.188	-1.313
	Students	45.1	2.74				
Supportive Environment	Teachers	19.9	1.61	-0.374	0.712	-0.979	0.677
	Students	20	1.61				
Total score	Teachers	148.4	7.74	-6.736	<0.0001	-19.912	-11.594
	Students	164.1	9.68				

subcategory of pedagogic topics. Finally, in the category of supportive environment, all faculty members (100%) and (96.2%) of the students pointed to e-monitoring as the most important determinant of blended learning (Table 3).

Discussion

Blended learning encompasses different components. The results of a study entitled “the Arab union’s E-learning Effectiveness evaluation framework” showed that a group of participants only emphasized technological aspects, another group underlined pedagogic factors, and some participants focused on both.²⁵ In this study, five categories were identified for effective-blended learning, including students’ capabilities, teacher merits, technological aspects, pedagogic aspects and supportive environment. The process of teaching-learning is a knowledge transfer from the teacher to the learner which both play an undeniable role. Information literacy and metacognitive skills were the most important subcategories of student capabilities. Other experimental studies have also shown that in this type of learning, the learner is self-directed and its effectiveness is increased due to control over the time and location of learning.^{26,27}

The results of some studies indicate that in blended learning, the students have more control over the speed and flow of learning and can achieve their objectives sooner through selecting proper resources and applying metacognitive processes like time management.²⁸ Moreover, it is important to consider satisfaction and values for measuring the effectiveness of any type of education.²⁹ In other words, the student satisfaction is

associated with increased motivation and commitment to the E-learning program, resulting in educational success and decreased dropout rate.³⁰ We found that student knowledge is a determinant of effectiveness while there was no evidence of the role of attitude on effectiveness. On the other hand, it has been shown that counselling and teaching study and time management skills to students can enhance the effectiveness of this education system, which is almost consistent with the results indicating the role of metacognitive skills.³¹

Instructors and teachers are the second part in the teaching-learning process that play a crucial role in effective learning.³² Several studies confirm the results of present study.^{33,34} Studies claim that the role of instructors in E-learning is more prominent than the new technologies. New technologies do not play an important role in student satisfaction.³⁵ It should be noted that a teacher should have special capabilities to leave a positive effect on the teaching-learning process. Content experience and virtual class management were two important subcategories of teacher merits. Adams believes that these merits improve learning significantly. In a study conducted in South Korea, the experience and expertise of the teachers and their knowledge of the cyberspace were identified as important aspects of the quality of online education.³⁶ Studies have shown that the teacher’s attitude is also a determinant of failure or success because the teacher’s beliefs are in close association with teaching behavior and learning objectives;³⁵ however, this finding was not observed in our study.

Table 3 Perspectives of Research Units Regarding Determinants of Effective Blended Learning in Different Categories

		Instructors			Students		
		Very Low & Low	Rarely	High & Very High	Very Low & Low	Rarely	High & Very High
Students' Capabilities	Meta Cognitive Skills	–	10%	90%	6.4%	7.7%	85.9%
	Information Literacies	10%	10%	80%	24.4%	10.3%	65.4%
	Personality Dimensions	30%	20%	50%	42.3%	17.9%	39.7%
	Netiquette	50%	20%	30%	17.9%	26.9%	55.1%
Teacher Merits	Content Expertise	10%	10%	80%	–	–	100%
	Professional Commitment	10%	30%	60%	–	3.8%	96.2%
	Information Literacies	–	10%	90%	14.1%	25.6%	60.3%
	Netiquette	20%	10%	70%	7.7%	3.8%	88.5%
	Verbal & Non-Verbal	10%	30%	60%	1.3%	35.9%	62.8%
	Communication Skills	–	–	–	–	–	–
	Emotional Intelligence	40%	30%	30%	12.8%	14.1%	73.1%
	Virtual Class Management	10%	40%	50%	1.3%	1.3%	97.4%
	Cyber Skills	40%	20%	40%	7.7%	20.5%	71.8%
	Cybergogy	60%	–	40%	7.7%	24.4%	67.9%
	Accessibility	60%	10%	30%	–	3.8%	96.2%
	Role Modelling	10%	30%	60%	6.4%	35.9%	57.7%
Technological Aspects	High-Quality Content	10%	30%	60%	10.3%	7.7%	82.1%
	Up-To-Date Content	30%	30%	40%	10.3%	7.7%	82.1%
	Reviewability & Reversibility	–	40%	60%	3.8%	28.2%	67.9%
	Content	–	–	–	–	–	–
	User-Friendly Sketching System	20%	30%	50%	–	23.1%	76.9%
	Cyber Rules	20%	40%	40%	5.1%	9%	85.9%
	Interactive Virtual Environment	–	10%	90%	–	7.7%	92.3%
	Free Access to Content	40%	10%	50%	3.8%	16.7%	79.5%
	Virtual Computing Infrastructure	30%	10%	60%	–	32.1%	67.9%
	Content Size	30%	20%	50%	1.3%	21.8%	67.9%
Pedagogic Topics	Team Working	–	–	100%	–	37.2%	62.8%
	Collaborative E- Learning	40%	20%	40%	1.3%	21.8%	76.9%
	Effective Evaluation	10%	30%	60%	11.5%	15.4%	73.1%
	Designing E-Learning Activities	10%	30%	60%	3.8%	16.7%	79.5%
	Active E- Learning	20%	10%	70%	11.5%	15.4%	73.1%
	Student Progress Monitoring	–	–	100%	–	3.8%	96.2%
	Content Flexibility	40%	20%	40%	7.7%	14.1%	78.2%
	Content Qualities	10%	30%	60%	14.1%	29.5%	70.5%
	Content Attractiveness	20%	10%	70%	–	29.5%	70.5%
	Virtual Feedback System	–	40%	60%	1.3%	3.8%	94.9%
	Organize Content	10%	30%	60%	1.3%	35.9%	62.8%
Supportive Environment	E- Mentoring	–	–	100%	–	3.8%	96.2%
	Active Management	–	20%	80%	23.1%	30.8%	46.2%
	Deeper Connection	10%	30%	60%	–	23.1%	76.9%
	Safe Environment	30%	20%	50%	1.3%	38.5%	60.3%
	Strong Guidance	20%	20%	60%	10.3%	9%	80.8%

Regarding technological aspects, several studies have shown a broad spectrum of factors related to blended learning. Evidence reported that in any electronic education,

a flexible educational design and standard educational content have a direct effect on the effectiveness and efficiency.³⁷ However, quality problems regarding provision of education

material and modifying and updating the courses are limitations of electronic education.³⁸ In this category, the subcategories of interactive virtual environment and virtual computing infrastructure had the highest frequency according to teachers and students. Electronic education required an interesting mutual interactive environment.³⁹

It is obvious that having the basic infrastructures and equipping it regularly along with technological advances are important determinants of quality.⁴⁰ Another category that emerged in this study was pedagogic topics, which forms the basis of any type of training. A review of the literature about pedagogy suggests that attention should be paid to the principles of Instructional Design, production of appropriate educational content, effective evaluation, and learning strategies,⁴¹ which is consistent with the results of the present study. According to education experts, pedagogic topics and process evaluation complement each other.⁴² However, in the present study, the research units believed that evaluation was less important than other factors, which could be due to the type of learners since they were all adults and practiced self-directed learning, so they did not consider evaluation as an important factor.

The present study showed the significance of virtual feedback system and student progress monitoring. Many researchers have also reported that feedback is an important component of blended learning skills.⁴³ Osguthorpe and Graham stated that the principle of blended learning was to improve areas such as pedagogy and interactions.⁴⁴ Providing prompt constructive feedback enhances the teacher-student cooperation and interaction.⁴⁵

The last category of effective education was supportive environment. Among its subcategories, strong guidance and e-monitoring have a greater importance. Bouras believes that in a virtual educational environment, educational objectives are not met if proper guidance is lacking.⁴⁶ The information era has created dynamic changes in relationships and the presence of education in this area required electronic mentoring. This finding is consistent with the results of other studies in this field.^{47,48}

Conclusion

The importance of “learning-teaching process” and the increasing demand for access to education on the one hand and emphasis on the effectiveness of education on the other hand are the challenges experienced by all educational organizations. Education used to be at information transfer level and expressing a series of facts as the necessary knowledge in the field of medical sciences. But in the

world of exploding information how fast and to what extend can we really transfer facts with education? Although new technologies have offered promising opportunities, they do not result in effective education. The results of the present study suggest that a major revision in Student and instructor admission and provision of required technical facilities can promote the status of this type of education. On the other hand, instructor empowerment programs in this field can enhance the effectiveness of virtual education. Having a full knowledge of the factors influencing blended learning in medical sciences from the viewpoint of medical students, educational authorities can improve the environmental and organizational conditions to help medical students prevent Learning defects in order to take steps to improve the health of the community.

Data Sharing Statement

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.

Ethics and Consent Statement

Ethics approval was obtained from the Tehran University of Medical Sciences. Written informed consents were obtained from all participants.

Acknowledgment

We sincerely thank all the students and faculty members from medical Universities of Iran who participated in this study.

Author Contributions

All authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no conflicts of interest in this work.

References

1. Barth M, Rieckmann M. Academic staff development as a catalyst for curriculum change towards education for sustainable development: an output perspective. *J Clean Prod.* 2012;26:28–36. doi:10.1016/j.jclepro.2011.12.011
2. Fadeeva Z, Mochizuki Y. Higher education for today and tomorrow: university appraisal for diversity, innovation and change towards sustainable development. *Sustain Sci.* 2010;5(2):249–256. doi:10.1007/s11625-010-0106-0
3. Wood DF. ABC of learning and teaching in medicine: problem based learning. *BMJ.* 2003;326(7384):328. doi:10.1136/bmj.326.7384.328

4. Twomey A. Web-based teaching in nursing: lessons from the literature. *Nurse Educ Today*. 2004;24(6):452–458. doi:10.1016/j.nedt.2004.04.010
5. Kintu MJ, Zhu C, Kagambe E. Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. *Int J Educ Technol Higher Educ*. 2017;14(1):7. doi:10.1186/s41239-017-0043-4
6. Pinto-Llorente AM, Sánchez-Gómez MC, García-Peñalvo FJ, Casillas-Martin S. Students' perceptions and attitudes towards asynchronous technological tools in blended-learning training to improve grammatical competence in English as a second language. *Comput Human Behav*. 2017;72:632–643. doi:10.1016/j.chb.2016.05.071
7. Rodriguez Triana MJ, Prieto Santos LP, Vozniuk A, et al. Monitoring, awareness and reflection in blended technology enhanced learning: a systematic review. *Int J Technol Enhanc Learn*. 2017;9(EPFL–ARTICLE–216019):126–150. doi:10.1504/IJTEL.2017.084489
8. Henrie CR, Bodily R, Manwaring KC, Graham CR. Exploring intensive longitudinal measures of student engagement in blended learning. *Int Rev Res Open Distrib Learn*. 2015;16:3. doi:10.19173/irrodl.v16i3.2015
9. Donnelly R. Blended problem-based learning in higher education: the intersection of social learning and technology. *Psychosociological Issues Hum Resour Manage*. 2017;5:2.
10. Rowe M, Frantz J, Bozalek V. The role of blended learning in the clinical education of healthcare students: a systematic review. *Med Teach*. 2012;34(4):e216–e21. doi:10.3109/0142159X.2012.642831
11. Park SY. An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educ Techno Soc*. 2009;12(3):150–162.
12. Scheerens J. *Educational Effectiveness and Ineffectiveness. A Critical Review of the Knowledge Base*. Springer; 2016:389.
13. Flórez MT, Sammons P. *Assessment for Learning: Effects and Impact*. ERIC; 2013.
14. Kington A, Sammons P, Day C, Regan E. Stories and statistics: describing a mixed methods study of effective classroom practice. *J Mix Methods Res*. 2011;5(2):103–125. doi:10.1177/1558689810396092
15. Creswell JW, Creswell JD. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage publications; 2017.
16. Creswell JW, Clark VLP. *Designing and Conducting Mixed Methods Research*. Sage publications; 2017.
17. Johnson B, Christensen L. *Educational Research: Quantitative, Qualitative, and Mixed Approaches*. Sage; 2008.
18. Johnson B, Turner LA, Tashakkori A, Teddlie C. *Handbook of Mixed Methods in Social and Behavioral Research. Data Collection Strategies in Mixed Methods Research*. Thousand Oaks, CA: Sage; 2003:297–319.
19. Onwuegbuzie AJ, Bustamante RM, Nelson JA. Mixed research as a tool for developing quantitative instruments. *J Mix Methods Res*. 2010;4(1):56–78. doi:10.1177/1558689809355805
20. Denzin NK, Lincoln YS. *The SAGE Handbook of Qualitative Research*. Sage; 2011.
21. Spannagel C, Gläser-Zikuda M, Schroeder U, editors. *Application of Qualitative Content Analysis in User-Program Interaction Research. Forum Qualitative Sozialforschung/Forum*. Qualitative Social Research; 2005.
22. Colaizzi PF. *Psychological Research as the Phenomenologist Views It*. Oxford University Press; 1978.
23. Guba EG, Lincoln YS. *Effective Evaluation: Improving the Usefulness of Evaluation Results Through Responsive and Naturalistic Approaches*. Jossey-Bass; 1981.
24. Lincoln YS, Guba EG. *Naturalistic Inquiry*. Sage; 1985.
25. AbuSneineh W, Zairi M. An evaluation framework for e-learning effectiveness in the Arab world. 2010.
26. Bersin J. *The Blended Learning Book: Best Practices, Proven Methodologies, and Lessons Learned*. John Wiley & Sons; 2004.
27. Ostaszewski NM, Reid D, Moisey S. Applying constructionist principles to online teacher professional development. *Int Rev Res Open Distrib Learn*. 2011;12(6):143–156. doi:10.19173/irrodl.v12i6.976
28. Teräs H, Kartoğlu Ü. A grounded theory of professional learning in an authentic online professional development program. *Int Rev Res Open Distrib Learn*. 2017;18:7. doi:10.19173/irrodl.v18i7.2923
29. Wu J-H, Tennyson RD, Hsia T-L. A study of student satisfaction in a blended e-learning system environment. *Comput Educ*. 2010;55(1):155–164. doi:10.1016/j.compedu.2009.12.012
30. González-Gómez F, Guardiola J, Rodríguez OM, Alonso MAM. Gender differences in e-learning satisfaction. *Comput Educ*. 2012;58(1):283–290. doi:10.1016/j.compedu.2011.08.017
31. Abrami PC, Bernard RM, Bures EM, Borokhovski E, Tamim RM. *Interaction in Distance Education and Online Learning: Using Evidence and Theory to Improve Practice. The Next Generation of Distance Education*. Springer; 2012:49–69.
32. Wilcock P, Lewis A. Putting improvement at the heart of health care: medical students need to learn continuous quality improvement skills as core skills. *BMJ*. 2002;325(7366):670. doi:10.1136/bmj.325.7366.670
33. Alayyar GM, Fisser P, Voogt J. Developing technological pedagogical content knowledge in pre-service science teachers: support from blended learning. *Australas J Educ Technol*. 2012;28:8. doi:10.14742/ajet.773
34. Wang Q, Quek CL, Hu X. Designing and improving a blended synchronous learning environment: an educational design research. *Int Rev Res Open Distrib Learn*. 2017;18:3. doi:10.19173/irrodl.v18i3.3034
35. Van Driel JH, Bulte AM, Verloop N. The relationships between teachers' general beliefs about teaching and learning and their domain specific curricular beliefs. *Learn Instr*. 2007;17(2):156–171. doi:10.1016/j.learninstruc.2007.01.010
36. Adams A, Ross D, Swain C, Dana N, Leite W, Sandbach R. Preparing teacher leaders in a job-embedded graduate program: changes within and beyond the classroom walls. *Teach Educ Pract*. 2013;26(3):581–598.
37. Meher SK, Kurwal NS, Suri A. E-learning through telemedicine in neurosurgical teaching and patient care. *Int J Telemedicine Clin Pract*. 2017;2(1):2–11. doi:10.1504/IJTMCP.2017.082099
38. Ryan S, Scott B, Freeman H, Patel D. *The Virtual University: The Internet and Resource-Based Learning*. Routledge; 2013.
39. Murugaiah P, Thang SM. Development of interactive and reflective learning among Malaysian online distant learners: an ESL instructor's experience. *Int Rev Res Open Distrib Learn*. 2010;11(3):21–41. doi:10.19173/irrodl.v11i3.842
40. Gordillo A, Barra E, Gallego D, Quemada J, editors. An online e-Learning authoring tool to create interactive multi-device learning objects using e-Infrastructure resources. In 2013 IEEE Frontiers in Education Conference (FIE); Oklahoma City, OK, USA; IEEE; 2013.
41. Raisler J, O'Grady M, Lori J. Clinical teaching and learning in midwifery and women's health. *J Midwifery Womens Health*. 2003;48(6):398–406. doi:10.1016/S1526-9523(03)00304-0
42. Nicklin PJ, Kenworthy N. *Teaching and Assessing in Nursing Practice: An Experiential Approach*. Elsevier Health Sciences; 2000.
43. Klein HJ, Noe RA, Wang C. Motivation to learn and course outcomes: the impact of delivery mode, learning goal orientation, and perceived barriers and enablers. *Pers Psychol*. 2006;59(3):665–702. doi:10.1111/peps.2006.59.issue-3
44. Osguthorpe RT, Graham CR. Blended learning environments: definitions and directions. *Q Rev Distance Educ*. 2003;4(3):227–233.
45. Knapper C, Cropley AJ. *Lifelong Learning in Higher Education*. Psychology Press; 2000.
46. Bouras C, Tsiatsos T. Educational virtual environments: design rationale and architecture. *Multimed Tools Appl*. 2006;29(2):153–173. doi:10.1007/s11042-006-0005-7
47. Perren L. The role of e-mentoring in entrepreneurial education and support: a meta-review of academic literature. *Educ Trng*. 2003;45(8/9):517–525. doi:10.1108/00400910310508900
48. Bierema LL, Merriam SB. E-mentoring: using computer mediated communication to enhance the mentoring process. *Innovat Higher Educ*. 2002;26(3):211–227. doi:10.1023/A:1017921023103

Advances in Medical Education and Practice**Dovepress****Publish your work in this journal**

Advances in Medical Education and Practice is an international, peer-reviewed, open access journal that aims to present and publish research on Medical Education covering medical, dental, nursing and allied health care professional education. The journal covers undergraduate education, postgraduate training and continuing medical education

including emerging trends and innovative models linking education, research, and health care services. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <http://www.dovepress.com/advances-in-medical-education-and-practice-journal>