ORIGINAL ARTICLE

Evaluation of the Quality of Virtual Education Curriculum Components and Satisfaction rate of Dental Students during COVID-19 Pandemic

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Background: The coronavirus disease (COVID-19) has completely changed human lifestyle. Social distancing actions during COVID-19 pandemic switched the dental education to online learning, distance education, and remote learning. The aim of the present study was to determine the quality of virtual education curriculum components and satisfaction rate of dental students during COVID-19 pandemic.

Methods: The present descriptive cross-sectional study was carried out on 209 dental students of Ahvaz Jundishapur University of Medical Sciences who were studying in 2019/2020 academic year (second semester). Data collection tool included an online questionnaire consisting of three parts. Data were analyzed using descriptive statistics and SPSS version 18.0.

Results: The mean age of participant was 23.7 years old, and 55.5% of them were female. The mean score of quality of curriculum components including educational objective, content, instructor role, measurement and evaluation, and overall quality were 3.4±0.71, 3.19±0.65, 2.88±0.81, 3.27±0.66, and 3.18±0.58, respectively. Students' satisfaction in the context of online education including instructor, content, difficulty, attitude, perception, overall satisfaction was 2.55±0.78, 2.99±0.82, 3.77±0.68, 3.26±0.83, 2.96±0.63, respectively.

Conclusions: Based on the results, the quality of virtual education curriculum components and satisfaction rate of dental students were at a relatively desirable level. Online education can be a perfect complement for face to face education, especially during the COVID-19 pandemic.

Keywords: Students, Dental, Education, e-Learning, Satisfaction, COVID-19

تقييم جودة مكونات مناهج التعليم الافتراضي ومعدل رضا طلاب طب الأسنان خلال جائحة COVID-19

الخلفية: لقد غيّر مرض الفيروس كرونا (COVID-19) نمط الحياة تماماً. حولت إجراءات التباعد الاجتماعي أثناء جائحة COVID-19 تعليم طب الأسنان إلى التعلم عبر الإنترنت والتعليم و التعلم عن بعد. كان الهدف من هذه الدراسة هو تحديد جودة مكونات مناهج التعليم الافتراضي ومعدل رضا طلاب طب الأسنان خلال جائحة COVID-19.

الطرق: أجريت الدراسة المقطعية الوصفية الحالية على ٢٠٩ طلاب أسنان من جامعة أهواز جوندي شابور للعلوم الطبية الذين كانوا يدرسون في العام الدراسي ٢٠٢٠/٢٠١٩ (الفصل الثاني). تضمنت أداة جمع البيانات استبياناً عبر الإنترنت يتكون من ثلاثة أجزاء. تم تحليل البيانات باستخدام الإحصاء الوصفي و الإصدار ١٨ من SPSS.

النتائج: بلغ متوسط عمر المشاركين ٢٣,٧ سنة، و ٥٥,٥% من الإناث. بلغ متوسط درجة جودة مكونات المنهج بما في ذلك: الهدف التعليمي، المحتوى، دور المعلم، القياس، التقييم و الجودة الشاملة ٣,٤ ± ٠,٧١ و ٣,١٩ ± ٠,٦٥ و ٢,٨٨ ± ٠,٨١ و ٣,٢٧ ± ٠,٦٦ و ٣,١٨ ± ٠,٥٨ على التوالي. كان رضا الطلاب في سياق التعليم عبر الإنترنت بما في ذلك: المعلم ، المحتوى، الصعوبة، الموقف، الإدراك والرضا العام ٢,٥٥ ± ٠,٧٨ و ٢,٩٩ ± ٠,٨٢ و ٣,٧٧ ± ٠,٦٨ و ٣,٢٦ ± ٠,٨٣ و ٢,٩٦ ± ٠,٦٣ على التوالي.

الخلاصة: بناءً على النتائج؛ كانت جودة مكونات مناهج التعليم الافتراضي ومعدل رضا طلاب طب الأسنان في مستوى مرغوب فيه نسبيا. يمكن أن يكون التعليم عبر الإنترنت مكملاً مثالياً للتعليم وجهاً لوجه خاصة أثناء جائحة COVID-19.

الكلمات المفتاحية: الطلاب ، طب الأسنان ، التعليم ، التعلم الإلكتروني ، الرضا ، COVID-19

ارزیابی کیفیت مؤلفه های برنامه ی درسی آموزش مجازی و میزان رضایتمندی دانشجویان دندانپزشکی در طی همه گیری COVID-19

زمینه و هدف: بیماری ناشی از ویروس کرونا (کووید ۱۹)، کاملاً سبک زندگی را تغییر داده است. اقدامات انجام شده جهت ایجاد فاصله گذاری اجتماعی در دوران همه گیری کووید ۱۹، آموزش دندانپزشکی را به سمت یادگیری آنلاین، آموزش از راه دور و یادگیری از راه دور هدایت کرده است.

روش: این مطالعه توصیفی مقطعی بر روی ۲۰۹ دانشجوی دندانپزشکی دانشگاه علوم پزشکی جندی شاپور اهواز که در سال تحصیلی ۲۰۲۰-۲۰۱۹ (نیمسال دوم) مشغول به تحصیل بودند، انجام شد. ابزار جمع آوری داده ها یک پرسشنامه آنلاین شامل سه قسمت بود. داده ها با استفاده از آمار توصیفی و SPSS نسخه ۱۸ تجزیه و تحلیل شد.

یافته ها: میانگین سنی شرکت کنندگان ۲۳٫۷ سال و ۵۵/۵٪ از آن ها زن بودند. میانگین نمره مؤلفه های کیفیت برنامه ی درسی شامل هدف، محتوا، نقش مربی، سنجش و ارزشیابی و کیفیت کلی به ترتیب ۳/۴±۰/۷۱، ۳/۱۹±۰/۶۵، ۲/۸۸±۰/۸۱، ۳/۲۷±۰/۶۶ و ۳/۱۸±۰/۵۸ بود. رضایت دانشجویان در زمینه آموزش آنلاین شامل مربی، محتوا، دشواری، درک و همچنین رضایت کلی به ترتیب ۲/۵۵±۰/۷۸، ۲/۹۹±۰/۸۲، ۳/۷۷±۰/۶۸، ۳/۲۶±۰/۸۳ و ۲/۹۶±۰/۶۳ بود.

نتیجه گیری: بر اساس نتایج، کیفیت مؤلفه های برنامه درسی آموزش مجازی و میزان رضایت دانشجویان دندانپزشکی در سطح نسبتاً مطلوبی قرار داشت. آموزش آنلاین می تواند یک مکمل کامل برای آموزش چهره به چهره، به ویژه در طول همه گیری کووید ۱۹ باشد.

واژه های کلیدی: دانشجویان، دندانپزشکی، آموزش، یادگیری الکترونیکی، رضایتمندی، کووید ۱۹

کووِڈ ۱۹ وبائی امراض کے دوران ورچوئل ایجوکیشن نصاب کے اجزاء کے معیار اور ڈینٹل طلباء کے اطمینان کی شرح کا اندازہ

بیک گراؤنڈ: کورونا وائرس بیماری (COVID-19) نے طرز زندگی کو مکمل طور پر تبدیل کر دیا ہے۔ COVID-19 وبائی امراض کے دوران معاشرتی دوری کے اقدامات نے دانتوں کی تعلیم کو آن لائن سیکھنے ، فاصلاتی تعلیم اور دور دراز کی تعلیم میں تبدیل کردیا۔ موجودہ مطالعے کا مقصد کووِڈ ۱۹ وبائی امراض کے دوران ورچوئل تعلیمی نصاب کے اجزاء اور دانتوں کے طلباء کی اطمینان کی شرح کا تعین کرنا تھا۔

روش: موجودہ وضاحتی کراس سیکشنل مطالعہ ابواز جنڈیشاپور یونیورسٹی آف میڈیکل سائنسز کے ۲۰۹ ڈینٹل طلباء پر کیا گیا جو ۲۰۲۰/۲۰۱۹ تعلیمی سال (دوسرے سمسٹر) میں پڑھ رہے تھے۔ ڈیٹا اکھٹا کرنے کے آلے میں تین حصوں پر مشتمل ایک آن لائن سوالنامہ شامل ہے۔ وضاحتی اعدادوشمار اور SPSS ورژن ۱۸٫۰ کا استعمال کرتے ہوئے ڈیٹا کا تجزیہ کیا گیا۔

نتیجے: شریک کی اوسط عمر ۲۳٫۷ سال تھی، اور ۵۵٫۵ female خواتین تھیں۔ تعلیمی مقصد، مواد، انسٹرکٹر کردار، پیمائش اور تشخیص سمیت مجموعی نصاب کے معیار کا اوسط اسکور بالترتیب ۳٫۴ ± ۰٫۷۱، ۳٫۱۹ ± ۰٫۶۵، ۲٫۸۸ ± ۰٫۸۱، ۳٫۲۷ ± ۰٫۶۶، اور ۳٫۱۸ ± ۰٫۵۸ تھا۔ آن لائن تعلیم کے تناظر میں طلباء کا اطمینان بشمول انسٹرکٹر، مواد، مشکل، رویہ، تاثر، مجموعی طور پر اطمینان بالترتیب ۲٫۵۵ ± ۰٫۷۸ ، ۲٫۹۹ ± ۰٫۸۲ ، ۳٫۷۷ ± ۰٫۶۸ ، ۳٫۲۶ ± ۰٫۸۳ ، ۲٫۹۶ ± ۰٫۶۳ تھا۔

سفارش: نتائج کی بنیاد پر ، ورچوئل تعلیمی نصاب کے اجزاء کا معیار اور دانتوں کے طلباء کی اطمینان کی شرح نسبتا مطلوبہ سطح پر تھی۔ آن لائن تعلیم آمنے سامنے تعلیم کے لیے ایک بہترین تکمیل ہو سکتی ہے ، خاص طور پر COVID-19 وبائی مرض کے دوران۔

کلیدی الفاظ: طلباء ، ڈینٹل ، تعلیم ، ای لرننگ ، اطمینان ، COVID-19

INTRODUCTION

The novel coronavirus (2019-nCoV, or COVID-19) is a new respiratory disease originated from Wuhan (China) in December 2019 and rapidly spread to other countries worldwide (1,2). The COVID-19 pandemic has plunged the world into an economic and health crisis. Many countries have imposed various forms of quarantine and restrictions that affect work, trade and especially education (3). Social distancing and closing-off of face-to-face education associated with the COVID-19 pandemic has affected dental education program (4,5). Despite the importance of clinical training in dental practice, the Covid-19 pandemic forced dental schools to change their academic dental education programs and suspend their clinical practice and shift to distant learning (e-Learning) methods (6). The development of Internet-based information technologies (IT) guarantees the finest academic practice for dental students. Web-based distance education is a new modality of education which unleashes a new way of need-based learning and ensures the continuity of higher education (7).

The concept of e-learning has gained considerable recognition in dental education (8). E-learning refers to an active and intelligent training system in which student and instructor collaborate and exchange information via communications technologies including Internet, audio-visual tools, multimedia systems, CD-ROM, animation, and video conferencing & online meetings (9-11). The potential benefits of e-Learning compared to traditional or face-to-face learning are improved quality of learning, cost and time effective, constant learning opportunity, student-centered, and better preparation of students for reviewing educational program (12-14). Limitations are also evident in e-Learning including lack of control over the learning process, no self-discipline, no face-to-face interaction, lack of flexibility, and lack of input from trainers (15,16). Strategic planning is a key factor for successful e-Learning approach (17). Curriculum arrangement is crucial for instructional goals and learning. E-Learning curriculum should be relevant and specific to virtual learning environment (18,19).

The most common e-learning curriculum elements are goals (objectives), content, teaching methods, evaluation and assessment. The first step of the curriculum planning is goal setting. Flawless goals keep the focus on the learning objective and maximize student learning time and efficiency in e-Learning environments (17,20). E-learning content is a key element for developing a set of learning objectives. The interaction between content, student, and technology prompts higher level of e-learning. The shortcomings of distance education can be overcome by observing multimedia standards such as animation, diagrams, shapes, and practical examples/guidance. Virtual education instructors have a heavier task than traditional and face-to-face instructors. E-Instructors must be fully aware of the features and skills of teaching in a virtual learning environment.

Assessments should reveal how students are well educated. Assessments, learning objectives, and instructional strategies need to be closely aligned to e-learning environment. To ensure that, the mentioned three components are aligned and reinforced one another, as well as traditional face-to-face assessment can be integrated into the online learning environment. Continuous evaluation, the possibility of self-evaluation, and flexibility are among the requirements of virtual evaluation (17).

Some studies have indicated that online courses and academic programs introduced by university fail to meet national science education standards and learning objectives (21). Several methods have been used for measurement of e-learning systems, one of which is measuring student satisfaction with web based learning systems which is an important topic for the researchers and academia (22,23). The aim of the present study was to determine the quality of virtual education curriculum components and satisfaction rate of dental students during COVID-19 pandemic.

METHODS

Study Design
The present descriptive cross-sectional study was carried out on 209 dental students of Ahvaz Jundishapur University of Medical Sciences (AJUMS) who were studying in the 2019/2020 academic year (second semester).

Data Collection Methods & Tools for Research
Data collection tool included an online questionnaire consisting of three parts. The first part of questionnaire consisted of demographic information including age, sex, marital status, employment status, resources for internet connectivity and virtual training site, average hours of using cyberspace during the day, and average hours of using cyberspace for virtual education.

The second part of questionnaire contained 30 questions on a 5-point Likert scale (1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; 5 = Strongly agree) that measured the quality of the virtual curriculum components in four areas of objectives (7 items), content (11 items), teaching methods and instructor's role in e-learning (7 items) and assessment (5 items). The validity of this part of the questionnaire was confirmed by previous study (24). The validity and reliability of the questionnaire were shown to be satisfactory (coefficients of 0.93 and 0.92, respectively). The virtual curriculum was assessed based on the desirability level (not realized or undesirable (1-2.33), relatively realized or desirable (2.33-3.66), and realized or desirable (3.66-5)) (25).

The third part of the questionnaire consisted of 43 questions with a 5-point Likert scale that assessed students' satisfaction with virtual learning and included 4 areas of teaching (20 items, each item was scored on a 5-point Likert-type scale, ranging from 1 = Never, 2 = Rarely, 3 =Sometimes, 4 = Often, 5 = Always); educational content (12 items each item was scored on a 5-point Likert-type scale, ranging from 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5=Strongly Agree), Lesson difficulty (3 items each item was scored on a 5-point Likert-type scale, ranging from 1 = Very difficult, 2 = Difficult, 3 = Neutral, 4 = Easy, 5 = Very easy), and the student's attitude, perception, and final judgment towards online courses (8 items, each item was

scored on a 5-point Likert-type scale, ranging from 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5=Strongly Agree). The validity of this part of the questionnaire were confirmed by previous study (26). The validity and reliability of the questionnaire were confirmed equal to 0.95. An informed consent was obtained from the participants and the online questionnaire link was sent to the students.

Sample Size
The total number of students in the dental school was 420. This questionnaire was given to all students. Finally, 209 (49.7%) students completed and sent back the questionnaire.

Data Analysis
Data were analyzed using descriptive statistics and SPSS version 18.0.The mean scores of educational objective, content, teacher role, assessment, and overall quality, and the level of satisfaction from teaching, educational content, lesson difficulty, and attitude, perception, and final judgment towards online courses were calculated. The graphical representations of the numeric data were displayed using Histograms tools. Analysis of covariance (ANCOVA) was conducted to test whether the adjusted group means differ significantly from each other.

RESULTS

Demographic information
A total of 209 dental students were enrolled in the study (116 (55.5%) female, 93 (44.5%) male). The students were qualified for university admission in the following fall semester: 2019 (43, 20.6%), 2018 (50, 23.9%), 2016 (53,

25.4%), 2015 (34, 16.3%), 2014 (14, 6.7%), and 15 students were entrants of academic years 2010, 2011, 2012, 2013, 2017. The mean age of the participants was 23.7 years. Out of the total, 32 (15.3%) participants were married and 16 (7.7%) of them were employed. Students enrolled in online courses via computer (111, 53.1%), smartphone and tablet (95, 45.5%), or other social software tools (3, 1.4%). The survey found that on average, respondents spent 4.1 hours online in a day and the average times spending on online learning were 2.1 hours per day.

Quality of virtual education curriculum components
The main research question in this section was the quality of the components of the virtual education curriculum.

The mean of the objective component (3.4 ± 0.71) was relatively realized in terms of the desirability level (2.33-3.66). In this component, the highest mean was related to the objective coordination item with individual and cultural differences (3.59 ± 0.86) and the lowest mean was related to the goal coordination with virtual learning environment characteristics (3.27±1)

The mean of the content component (3.19 ± 0.65) was relatively realized in terms of the desirability level (2.33-3.66). In this component, the highest average was related to the item of ease of access to content (3.54 ± 0.92) and the lowest average was related to the item of hyperlink use and the possibility of searching for more content within the content (2.85 ± 1.04) (Table 1).

The mean component of the instructor role in the virtual classroom (2.88±0.81) was relatively realized in terms of desirability level (2.33-3.66). In this component, the highest mean was related to the teacher's ability and mastery in

Table 1. Means and Standard Deviations of e-Learning objective and content			
Frequency for objective		**Frequency for content**	
Question	**Mean (SD)**	**Question**	**Mean (SD)**
Harmony with individual and cultural characteristics and differences	3.59(0.862)	Challenging ,Nurturing critical and creative thinking skills	3.2(1.002)
Clear and accurate expression of learning objectives	3.29(0.944)	Up-to-day and tailored to the latest achievements and knowledge developments in the field of medical education	3.31(0.958)
Meet the needs and interests of learners	3.47(0.971)	Motivating and persuasive	2.89(1.069)
Flexibility of goals (diversity, fostering creativity)	3.33(1.07)	Ease of access	3.54(0.92)
Based on the development of competencies, Higher-order skills, such as problem solving, critical thinking, goal setting and decision	3.41(1.011)	Coordination and proportionality between content sections in terms of organization and arrangement	3.31(1.011)
Coordination between objectives and course content	3.44(0.959)	Standard and attractive in terms of layout (text, fonts, writing style, animation, diagram)	3.09(1.134)
Coordination of goals with the features of the virtual learning environment	3.27(1.007)	Using practical examples	3.18(1.001)
		Observing the aspect of "being self-learning"	3.24(0.986)
		Using hyperlinks and ability to search and access more content within the content	2.85(1.045)
		Being practical (clear and realistic)	3.15(0.962)
		Application of multimedia (text, sound, image individually and in combination) appropriately	3.34(1.04)

in presenting the subjects as well as managing the learning process (3.18±0.99) and the lowest average was related to the teacher's attention to the individual differences of learners (time and speed of learning process) (2.52±1.1).

The mean of the assessment and evaluation component (3.27 ± 0.66) was relatively realized in terms of desirability level (3.66 to 2.33). In this component, the highest mean was related to virtual learner participation in the assessment and evaluation process (3.44±0.91) and the lowest mean was related to the clarity and transparency of measurement and evaluation criteria for virtual learner (2.02±1.01) (Table 2). The total mean of quality of virtual education curriculum components (3.18±0.58) was relatively realized in terms of desirability level (2.33-3.66).

Student Satisfaction with Online Learning
The main research question in this section was the level of students' satisfaction with virtual education, which was assessed using the standard IDEA (Individual Development and Educational Assessment) questionnaire with a 5-point Likert scale. Students' satisfaction was evaluated in 4 areas of instructor role, educational content, difficulty of lesson, and the student's attitude, perception, and final judgment towards online courses.

The mean satisfaction of online teaching was (2.55 ± 0.78). In this area, the highest mean was related to the teaching and learning assignments match with other educational indicators and subject titles (1.1±3.2) and the lowest mean was related to the teacher's request for students to share their own experiences, hunches, and ideas about the concepts of subjects (1.18±2.1). The mean satisfaction of educational content was (2.99±0.82). In this area, the highest mean was related to learning how to access and use resources to answer questions (1.11±3.19) and the lowest average was related to creative capacity promotion (writing and invention) (1.15±2.76). The mean satisfaction of the course

difficulty domain was (3.77±0.68). In this area, the highest mean was related to set of tasks assigned by students (Web coursework) (3.91±0.89) and the lowest average was related to the items of difficulty of the subjects (3.52±0.85). The mean area of perception and final judgment of the student toward the course was (3.26±0.83). In this area, the highest mean score was related to the item: I worked very hard for this round of training compared to other courses (1.15±3.47) and the lowest mean score was related to the item: I was very interested in passing this virtual training course (3.15±1.23). The total mean of students' satisfaction with virtual education (2.96±0.63) was relatively realized in terms of desirability level (2.33-3.66).

The results showed that overall quality of virtual education, satisfaction with instructor, content, and overall satisfaction of virtual education follow the normal distribution at a significant level of 0.05. The results showed that there was a significant difference between single and married students in the areas of objective quality, content, and overall quality of virtual education and attitude, perception and final judgment of students toward online learning. The score of married students was significantly higher than single students at a significant level of 0.05.

Data analysis
The Shapiro–Wilk test was used to test the normality of data. Analysis of covariance (ANCOVA) was used to investigate the relationship between the overall quality of virtual education and its satisfaction with demographic variables. A p-value less than 0.05 (typically ≤ 0.05) was considered statistically significant. Data were analyzed using descriptive statistics and SPSS version 18.0 (SPSS Inc., Chicago II, USA).

DISCUSSION

The aim of the present study was to determine the quality of virtual education curriculum components and satisfaction

Table 2. Means and Standard Deviations of e-Learning instructor and assessment

Frequency for instructor		Frequency for assessment	
Question	**Mean(SD)**	**Question**	**Mean(SD)**
Appropriateness and effectiveness of quantity and quality of interaction between student and instructor	2.8(1.129)	Coordination and proportionality of assessment and evaluation with goals, content and learning resources	3.14(1.017)
Encouraging students to participate and learn actively	2.92(1.076)	Clarity and transparency of strategies and criteria for measurement and evaluation for virtual learner (in terms of scoring method, type of evaluation)	3.02(1.014)
Using a variety of methods in teaching content (lectures, group discussions, brainstorming)	2.83(1.099)	Using various assessment and evaluation methods (exam, quiz, self-assessment, article writing).	3.41(0.987)
Appropriateness and effectiveness of the quantity and quality of teacher feedback to students in the learning process	3.01(1.164)	Virtual learner's participation in self-assessment and evaluation process	3.44(0.913)
Play the role of facilitator, participatory and virtual tutor consultants in the learning process	2.91(1.119)	Continuous assessment and evaluation	3.38(0.959)
Paying attention to the individual differences of learners (time, style, and speed of learning)	2.52(1.101)		
The ability and mastery of the teacher in presenting the course materials, guiding and organizing the learning process	3.18(0.996)		

rate of dental students during COVID-19 pandemic. The results showed that the quality of the objective component in the virtual education curriculum was relatively realized and all items were higher than the hypothetical average (3), which was consistent with the results of Azizi et al.'s study (24). Goal-setting process is the roadmap or guideline of curriculum design and development. Similarly, curriculum is objectives driven, i.e., any change in curriculum involves change in objectives (20). The present study showed that diversity and individual differences were valued in the objective components which was inconsistent with the results of Azizi et al.'s study. However, the coordination of individual differences and objective components were emphasized.

The present study indicated that the quality of the content component in the virtual education curriculum was relatively realized, which was in line with the results of Azizi et al. and Kakaee et al.'s studies (24,27). Furthermore, in this study the quality of educational content concerning the items of ease of content access, use of multimedia (text, sound, image individually and in combination) in the content, being up-to-date and in line with the latest achievements and developments of educational content was higher than the hypothetical average (3) and was considered as the strengths of online learning. Moreover, the mean features of content in virtual education courses including hyperlinks, hypertext and search capabilities were lower than the hypothetical average (3). Moshtaghi et al., 2013 suggested that access to online *tutoring* services was the most important and effective items in the content of virtual education which can provide excellent opportunities to overcome remote learning challenges (28).

The results of the present study showed that the quality of the online instructor in the virtual education curriculum was relatively realized. Kakaee et al., 2016 showed that the quality of online teaching by faculty members was favorable which was consistent with the results of the present study (27). Moreover, the mean features of online instructor such as paying attention to the individual differences of learners, interaction between student and teacher, various methods of teaching materials, and teacher feedback to students in the learning process were lower than the hypothetical average (3). Azizi et al., 2018 showed a poor teacher-student interaction which was inconsistent with the results of the present study (24).

Since online education becomes ubiquitous as a result of the COVID-19, the teacher-student interaction has developed a new form during remote learning. Therefore, teachers must adapt face-to-face course to an online environment and apply the technological knowledge and skills required for distance learning (29). Since e-learning emphasizes individual differences, the teacher can provide pre-test to students and receive feedback from the way learners answer and offer assignments with two characteristics of diversity and different difficulty levels to learners (30).

The findings of this study showed that the quality of measurement and evaluation component in virtual education curriculum was relatively realized and all items were higher than the hypothetical average (3). Similarly, the results of

Kakaee et al., and Azizi et al. showed that the mean component of assessment in the virtual curriculum was favorable (24,27). Assessment is the integral part of the teaching and learning process and determines the strengths and weaknesses of the educational process as well as reinforces the efficacy of teaching and learning (31).

Since most of the assessment methods in Iran are face-to-face, the shortcomings of electronic assessment have caused the quality of the assessment system to be evaluated at the average level (30). Azizi et al., 2018 showed that the lowest mean assessment was related to the feature of learner's engagement in the process of self-assessment which was inconsistent with the results of the present study (24).

Transparency of assessment criteria, proportionality between the content and test, reliability of test scores, and content volume are among factors influencing assessment practices among university academic (32). A number of factors such as written exam can cause test anxiety, so other assessment methods such as research paper submission and quizzes can be used in many disciplines and contexts (27).

The results of this study showed that the overall quality of virtual education was at desirable level which was consistent with the results of the previous studies (24,27). Quality corresponds to student satisfaction i.e. the highest quality provides the highest satisfaction ratings (33). Similarly, the overall e-learning quality is positively associated with student satisfaction (34).

The present study showed that online instructors received favorable satisfaction in the item of clear expression of the subject and satisfaction with other items of online instructors was lower than the hypothetical average which was inconsistent with the results of Nourian et al.'s study (26).

It seems that items such as students' interaction with each other in the concepts of learning and sharing experiences, student-teacher interaction, clear expression of students' criticisms, providing solutions to answer questions, and frequent teacher-student feedback on exams and reports did not contribute to students' course satisfaction. Avatarkhani et al., 2012 showed that teacher immediacy in providing feedback was among the important determinants of student satisfaction (35).

In this study, satisfaction with educational content was relatively realized, but satisfaction of all items except teamwork skills, promotion of creative capacities, achieving a more correct understanding of intellectual activities, and improving learning by asking questions and receiving answers which spark discussion was higher than the hypothetical average (3). Avatarkhani et al., 2012 suggested that up-to-date and need-based content contribute most to student satisfaction (35). Ozkan et al., 2009 showed a strong and effective relationship between the quality of educational content and student satisfaction (36).

The findings of this study showed that satisfaction with course difficulty was at the realized level and all items were higher than the hypothetical average (3). Similarly, Nourian et al., 2012 showed that students were highly satisfied with course difficulty (26). Ababaf et al., showed the importance of tailoring the level of content difficulty with students' learning level (37).

The present study specified that the attitude, perception, and final judgment of students toward satisfaction with e-Learning course were relatively realized and all items were higher than the hypothetical average (3), which was inconsistent with the results of Nourian et al.'s study (26). The overall satisfaction of virtual education in the present study was at a relatively favorable level, which was confirmed by various studies (26,38).

So, the quality of virtual education curriculum components and satisfaction rate of dental students during COVID-19 pandemic was at desirable level. Online education can be a perfect complement for face to face education, especially during the COVID-19 pandemic. Management of virtual education objectives with the international standards, promoting educational content, using hyperlinks in educational content, promoting students in asking questions and receiving answers, promoting students' creative capacities, teacher's attention to individual differences of learners, more student-teacher interaction, frequent feedback through curriculum-based assessment, a synopsis of new teaching and learning principles from various sources and explicit assessment criteria can improve the quality of curriculum program.

The Covid-19 outbreak forced education systems to shift from face-to-face to online classes, so comparison of face-to-face and online teaching and learning was not possible. In this study, the participant response rate was 50%. Since online education is a new trend in education from COVID-19 and the emerging source of education in AJUMS, a low participation rate was predictable due to students' lack of familiarity with online learning, busy work schedule, time conflicts at the beginning of Covid-19 pandemic. Further studies with larger sample size and face-to-face and online teaching and learning components are recommended.

Ethical considerations

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