RESEARCH ARTICLE

Dental Students' Perception of Competencies related to Biomedical Sciences in the Dental Curriculum

¹Yegane Guven, ²Sule Batu, ³Sevgi Turan, ⁴Emine Karsli

ABSTRACT

Aim: A dentist should be empowered to have knowledge of basic biological, medical, technical, and clinical sciences to distinguish the difference between normal and pathological conditions. The aim of this study was to describe the perception of dental students about competencies related to biomedical sciences in dental curriculum.

Materials and methods: A 26-question questionnaire was administered to fifth-year students who were the first group to complete the new integrated dental curriculum, to measure the extent to which the students had competences with biomedical science information, which were classified as "have knowledge," "have competence," and "have familiarity" according to the Profile and competences for the graduating European Dentist—update, 2009. A Likert-type 5-point scale was used (1 = not much, 5 = a great deal) to evaluate the answers. The opinion of the students about qualification of education was also assessed with six questions.

Results: Fourteen questions related to "have knowledge" (Q1–17) of biomedical science subjects were rated somewhat, two rated them much, and one scored somewhat and much as equal on the Likert scale. Four questions related to "have competence" (Q18–24) were rated much, and three were rated somewhat. Students rated "have familiarity" with "pharmacology in general medicine" and "awareness of environmental issues relevant to dental biomaterials' use" (Q 25, 26) as somewhat. Most of the students approved of integrated education (60.7%).

Conclusion: While planning and developing the curriculum aims to meet the practical needs of your future dentist, the importance of training based on competence should be taken into consideration.

Keywords: Biomedical sciences, Competency, Dentistry, Descriptive research, Students' evaluation.

¹Professor, ²Assistant, ³Associate Professor, ⁴Postgraduate Student

¹Department of Basic Science, Faculty of Dentistry, Istanbul University, Istanbul, Turkey

²,⁴Department of Dentistry, Istanbul University, Istanbul, Turkey

³Department of Medicine, Hacettepe University, Ankara, Turkey

Corresponding Author: Yegane Guven, Professor, Department of Basic Science, Faculty of Dentistry, Istanbul University Istanbul, Turkey, Phone: +00902124142020, e-mail: guven@istanbul.edu.tr

INTRODUCTION

The principal aim of dental education is that the graduated dentist possesses extensive professional knowledge and skills and these competencies can be reflected in his/her clinical practice.[1,2] This can be achieved by integrated learning of subjects in the curriculum. This type of learning improves understanding of biologic principles, mechanisms, and basic concepts, and reinforces deep learning, which prepares students for lifelong learning.[3,4]

Integration of topics is important to prevent a crowded curriculum with redundant or marginally useful material, and to give students much more time to unite notions or develop critical thinking skills.

The Association for Dental Education in Europe (ADEE) DentEd III Profile and Competencies for European Dentists outlined major and supporting competencies, and was updated in 2009.[5] Major competence of domain III (knowledge base, information, and information literacy) is related to "application of basic biological, medical, technical and clinical sciences." On graduation, a dentist must be competent to apply knowledge and understanding of the basic biologic, medical, technical, and clinical sciences to recognize the difference between normal and pathologic conditions/disorders relevant to clinical dental practice and understand their bases.

The graduated dentist should have acquired these competencies to perform his/her occupation in the best manner. The most important question is: Which competencies should be emphasized in which discipline in the dental curriculum? Achievement can be obtained through multidisciplinary integrated courses, which include basic and clinical sciences, and clinical medicine.

In assessing the quality of an academic program, student evaluations constitute an important parameter in the structuring of education. Effective evaluation provides valuable information that contributes to both student and course success.[6]

Therefore, in this study, we evaluated the outcomes of students' perception regarding the competencies related to biomedical sciences in the dental curriculum.

MATERIALS AND METHODS

The present study was approved by the Ethics Committee of Istanbul University, Faculty of Dentistry (Approval number: 128/2016). We undertook this survey to measure the extent to which the students had competences with biomedical science information, which were classified as "have knowledge," "have competence," and "have familiarity" in line with the expectations set out in the profile and competences for the graduating European Dentist—update, 2009. A questionnaire of 26 questions using a Likert-type 5-point scale was administered to fifth-year students (n = 56) from Istanbul University Faculty of Dentistry who were the first group to complete the new integrated dental curriculum. Medians and ranges of the Likert scale values for the 26 items were calculated. For this purpose, a Turkish language version of the DentEd III-ADEE document related to competencies was used.[7] Cronbach's alpha was applied to quantify the reliability and internal consistency of the scale on the questionnaire.

The participation level of students to propositions related to education was also assessed with a six-question questionnaire. There were two different propositions opposite to each other. Positive and negative statements from the questions were selected in equal numbers.

The first three of these were regarding support "integrated education," and the remainder were about "conference-based education." A principal component analysis (PCA) with varimax rotation was performed to examine construct validity. Adequacy of the data for factor analysis was investigated using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity for the evaluation of questionnaire of qualification of education. The KMO value was 0.63 and the Bartlett's test for sphericity was significant (p < 0.001), which suggested that this survey was suitable for PCA.

Statistical analysis was performed using IBM Statistical Package for the Social Sciences Statistics version 19 for Windows (SPSS Inc., Chicago, Illinois, USA).

RESULTS

Descriptive statistics and frequency distribution can be seen in Tables 1 and 2.

The internal consistency of the questionnaire was found to have a high reliability coefficient (Cronbach alpha: 0.92 for questions about knowledge, 0.84 for competence, 0.58 for familiarity, 0.80 for proposition integrated education, and 0.63 for conference-based education).

The mean scores of the 26 items on the 56 students' questionnaires showed the following results:

Of the 17 questions (Q1–Q17) related to "have knowledge" about biomedical science subjects in the curriculum regarding the scientific principles of sterilization, disinfection and antisepsis; cross-infection control; and disease processes, such as infection, inflammation, disorders of the immune system, degeneration, neoplasia, metabolic disturbances, and genetic disorders, 14 questions were rated somewhat on the Likert scale and two were rated much. The remaining question about oral manifestations of systemic disease was rated σομεωηατ and much equally on the Likert scale.

Of the 7 questions (Q18–24) related to "have competence," questions 18, 19, 20, and 23 were rated much, and 21, 22, and 24 were rated somewhat. Students rated "have familiarity" with "pharmacology in general medicine" and "awareness of environmental issues relevant to dental biomaterials' use" (Q25, 26) as somewhat.

Using PCA with a criterion of eigenvalue > 1, two factors were extracted that accounted for 65.84% of the total variance. The first factor accounted 37.7% of the total variance (items 1, 2, and 3, eigenvalue: 2.26) and was related to "integrated education." The second factor made up 28.14% of the total variance (items 4, 5, and 6, eigenvalue: 1.69) and explained "conference-based education." In the evaluation of qualification of education in terms of frequency distribution, most students approved of integrated education (60.7%). The number of students who neither agreed nor disagreed that "dental education must be based on the master–apprentice relationship" was quite high (33.9%) (Table 3).

DISCUSSION

Most of the answers related to "have knowledge" were rated somewhat, which may be accounted for by crowded classrooms and lecture-based courses. In this teaching method, information cannot be kept in the memory; on the contrary, it is superficial and is soon forgotten. Conway et al[8] reported that when students were actively involved in learning and completing practical experiments, they tend to have a stronger memory. In our study, although the integrated modular curriculum is in force and comprehensive, these answers of the students indicate a lack of knowledge retention. Unused information disappears after a while. Biomedical science education must be emphasized in the clinical years of the dental school curriculum where the main aim is to achieve certain skills. This can be obtained in part through case-based and problem-based discussion.[9]

In our study, students had settled the memory of subjects of sterilization–disinfection and disease processes because these are highlighted many times in various clinical courses.[10]

Henzi et al[3] performed a SWOT analysis (strengths, weaknesses, opportunities, and threats) of the dental curriculum, and "education based on memorization" was found as a weakness.

Table 1: Descriptive statistics for the 26 questionnaire items (n = 56)

	Minimum	Maximum	Mean	Standard deviation
Have knowledge of				
Q1. The structure and metabolism of human body	2.00	5.00	3.4107	0.80401
Q2. The scientific principles of sterilization, disinfection and antisepsis, and cross-infection control	2.00	5.00	3.7857	0.77961
Q3. Leading the team on radiation protection measures	1.00	5.00	3.2143	0.96699
Q4. The hazards of ionizing radiations and their effects on biological tissues	1.00	5.00	3.3393	0.92002
Q5. The scientific basis of dentistry, including the relevant biomedical sciences, the mechanisms of knowledge acquisition, scientific method, and evaluation of evidence	2.00	5.00	3.2321	0.93402
Q6. Basis of biomedical sciences	1.00	5.00	2.8929	0.90812
Q7. The biological processes in the body to a sufficient depth to be able to exploit new emerging biological technologies in clinical practice, especially in regenerative medicine	1.00	5.00	2.7857	0.70619
Q8. The cellular and molecular basis of life including both eukaryotic and prokaryotic cells	1.00	5.00	3.3036	1.00760
Q9. The biomedical sciences in the normal healthy individual at a depth relevant to dentistry	1.00	5.00	3.1429	0.77292
Q10. Disease processes, such as infection and inflammation	2.00	5.00	3.6964	0.65836
Q11. Disorders of immune system	2.00	5.00	3.2679	0.72591
Q12. Degenerative disturbances and neoplasia	1.00	5.00	2.9464	0.79589
Q13. Metabolic disturbances and genetic disorders	1.00	5.00	2.8929	0.86715
Q14. Pathological features and dental relevance of common disorders of the major organ systems	2.00	5.00	3.3393	0.79262
Q15. Oral manifestations of systemic disease	2.00	5.00	3.4107	0.65441
Q16. The etiology and pathological processes of oral diseases to facilitate their prevention, diagnosis, and management	2.00	5.00	3.2679	0.72591
Q17. The science of dental biomaterials and their limitations	1.00	5.00	3.0000	0.71351
Be competent at				
Q18. I can use the basic science information to learn functioning of the human body	2.00	5.00	3.3036	0.87219
Q19. I can use the basic science information for clinical skills	2.00	5.00	3.4464	0.78438
Q20. I can implement sterilization, disinfection and antisepsis, and cross-infection control in the practice	2.00	5.00	3.9286	0.80582
Q21. I can implement the ionizing radiation regulations on radiation protection measures	1.00	5.00	3.2500	0.93905
Q22. I can lead the dental team on radiation protection measures	1.00	5.00	3.0179	1.10357
Q23. The ability to apply this knowledge and understanding of basic biological, medical, and clinical sciences to everyday real life and clinical situations	1.00	5.00	3.3214	0.91666
Q24. I can apply the information of pharmacology and therapeutics relevant to clinical dental practice	1.00	5.00	3.0536	0.84034
Be familiar with				
Q25. Pharmacology in general medicine	1.00	5.00	2.7321	0.84188
Q26. Environmental issues relevant to their use	1.00	5.00	3.0893	0.81524

Problem-oriented courses with small groups cannot be realized because of the high number of students. Previously we observed that the success rate of students who attended a problem-oriented course was higher than when the same students attended a lecture-based course only.[10] In this type of learning method, the information given to solve the problem cases is more memorable, and the courses are designed to provide students with clinical competency development to manage the health of patients in terms of dentistry-related illness. Self-directed learning and communication skills contribute to several of the supporting competences adopted by the ADEE.[5] Appropriate teaching and learning methods are required to gain the defined competencies.

On the contrary, as the number of patients admitted to our school is high (approximately the number of patients seen is 50,000, and number of procedures applied is 150,000 per year) and has much diversity, students were more confident with stating "have competence" than "have knowledge" (three questions were rated somewhat, four questions were rated much).

In a report by the American Dental Education Association (ADEA),[9] it was emphasized that case-based/problem-based teaching and learning techniques should be designed to support oral-systemic diagnostic approaches. If basic science education is taught with a case-based problem-solving approach in the clinical years of the dental curriculum, then it has been determined that certain skills can be acquired.

Table 2: Frequency distribution of Likert-scale values for the 26 questionnaire items

	1		2		3		4		5	
	n	%	n	%	n	%	n	%	n	%
Have knowledge of										
Q1			6	10.7	26	46.4	19	33.9	5	8.9
Q2			2	3.6	18	32.1	26	46.4	10	17.9
Q3	2	3.6	9	16.1	26	46.4	13	23.2	6	10.7
Q4	1	1.8	9	16.1	21	37.5	20	35.7	5	8.9
Q5			14	25.0	20	35.7	17	30.4	5	8.9
Q6	3	5.4	16	28.6	22	39.3	14	25.0	1	1.8
Q7	2	3.6	14	25.0	35	62.5	4	7.1	1	1.8
Q8	1	1.8	11	19.6	22	39.3	14	25.0	8	14.3
Q9	1	1.8	8	14.3	31	55.4	14	25.0	2	3.6
Q10	1	1.8	20	35.7	30	53.6	–	–	5	8.9
Q11			1	1.8	20	35.7	30	53.6	5	8.9
Q12	1	1.8	14	25.0	30	53.6	9	16.1	2	3.6
Q13	4	7.1	11	19.6	29	51.8	11	19.6	1	1.8
Q14			8	14.3	24	42.9	21	37.5	3	5.4
Q15			4	7.1	26	46.4	25	44.6	1	1.8
Q16			8	14.3	26	46.4	21	37.5	1	1.8
Q17	1	1.8	10	17.9	34	60.7	10	17.9	1	1.8
Be competent at										
Q18			12	21.4	18	32.1	23	41.1	3	5.4
Q19			6	10.7	23	41.1	23	41.1	4	7.1
Q20			2	3.6	14	25.0	26	46.4	14	25.0
Q21	1	1.8	10	17.9	25	44.6	14	25.0	6	10.7
Q22	4	7.1	14	25.0	22	39.3	9	16.1	7	12.5
Q23	1	1.8	10	17.9	19	33.9	22	39.3	4	7.1
Q24	2	3.6	10	17.9	29	51.8	13	23.2	2	3.6
Be familiar with										
Q25	2	3.6	21	37.5	25	44.6	6	10.7	2	3.6
Q26	1	1.8	11	19.6	28	50.0	14	25.0	2	3.6

1 to 5: Answering options for the Likert scale; 1: Not much; 2: Little; 3: Somewhat; 4: Much; 5: A great deal

Table 3: Descriptive statistics and frequency distribution for the six questionnaire items related to qualification of education (n = 56)

	Descriptive statistics				Distribution									
					1		2		3		4		5	
	Minimum	Maximum	Mean	Standard deviation	n	%	n	%	n	%	n	%	n	%
The clinical dimension of basic science courses should be integrated in clinical courses in later years of education	1.00	5.00	4.1786	1.19251	2	3.6	5	8.9	8	14.3	7	12.5	34	60.7
Basic science practices should be made through clinical cases (e.g., prescribing, evaluation of laboratory tests)	2.00	5.00	4.2500	0.99544			5	8.9	7	12.5	13	23.2	31	55.4
Dental education should be based on the competencies that a graduate dentist must possess	2.00	5.00	4.3214	0.85508			1	1.8	11	19.6	13	23.2	31	55.4
Basic science courses must be completed in the first two years of education and independent of clinical courses	1.00	5.00	2.0893	1.19509	24	42.9	13	23.2	12	21.4	4	7.1	3	5.4
Basic science applications should be based on laboratory practices of basic science theoretical knowledge only	1.00	5.00	2.2143	1.18650	21	37.5	13	23.2	13	23.2	7	12.5	2	3.6
Dental education should be based on master–apprentice relationship and traditional methods	1.00	5.00	2.7500	1.28275	14	25.0	7	12.5	19	33.9	11	19.6	5	8.9

1–5: Answering options for the Likert scale; 1: Strongly disagree; 2: Disagree; 3: Neither agree nor disagree; 4: Agree; 5: Strongly agree

Teaching of basic science subjects in parallel to clinical education and clinical application will be essential to modeling new patient-centered professional practices. In the study of Henzi et al,[3] students thought that "basic sciences" should be more integrated with "clinical dentistry" courses and "basic sciences" courses should be designed with a creative and innovative approach, rather than teaching them to pass exams. In our study, most of the students approved of integrated education in the evaluation of qualification of education.

CONCLUSION

The most important learning objective of dental education must be to gain competencies to make a definite evaluation of oral and dental diseases and help promote early diagnosis of systemic diseases. To reach these goals, undergraduate dental education should ensure that new dental graduates become independent practitioners and continue to develop professional knowledge, understanding, and skills.

In order for the graduate dentists achieve these required qualifications, undergraduate dental education should be modified including reducing the number of students and using student-centered learning models.

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