

The Effect of Clinical Education Level on Professional Empathy in Dentistry: A Cross-Sectional Study

Kübra TÖRENEK AĞIRMAN¹, Nazgol RAVANBAKHS^{2*}, Fatma ÇAĞLAYAN³

Abstract

Empathy is an important skill in healthcare and significantly affects doctor-patient relationships, patient satisfaction, and clinical outcomes. This study aims to evaluate how clinical education affects empathy levels among dental students and specialists using the Jefferson Scale of Physician Empathy-Student version (JSPE-S). This descriptive study included a total of 495 participants: 380 undergraduate students, 96 postgraduate students, and 19 specialist physicians. Data were collected through the JSPE-S and demographic questionnaires, both in paper and online formats. Statistical analyses were performed using SPSS 20.0, applying independent t-tests, ANOVA, and Posthoc Tamhane's T2 tests to evaluate group differences. Internal consistency was assessed with Cronbach's alpha. The significance level was set at $p < 0.05$. The average empathy score was numerically higher in female participants (72.00 ± 12.43) than male participants (70.02 ± 12.39), although this was not statistically significant ($p = 0.084$). Undergraduate students (75.90 ± 9.66) showed significantly higher empathy scores compared to postgraduate students (55.84 ± 6.96) ($p < 0.001$). Among undergraduates, fourth and fifth-year students demonstrated the highest empathy levels ($p < 0.05$). Specialists and postgraduate students had the lowest empathy scores ($p < 0.001$). The JSPE-S showed good internal consistency (Cronbach's alpha = 0.873). Empathy reaches its highest level during the first patient encounters in dental education and appears to decline in the later phases. These findings demonstrate the importance of empathy-enhancing training (seminars, role-playing, etc.) both before and after graduation to ensure high-level empathic patient care.

Keywords: Dentistry, empathy, Jefferson empathy scale, clinical education, dentistry students

Diş Hekimliğinde Klinik Eğitim Düzeyinin Mesleki Empati Üzerindeki Etkisi: Kesitsel Çalışma

Öz

Empati, sağlık hizmetlerinde önemli bir beceridir ve doktor-hasta ilişkilerini, hasta memnuniyetini ve klinik sonuçları önemli ölçüde etkiler. Bu çalışma, klinik eğitimin diş hekimliği öğrencileri ve uzmanları arasında empati düzeylerini Jefferson Hekim Empati Ölçeği-Öğrenci versiyonu (JSPE-S) kullanarak nasıl etkilediğini değerlendirmeyi amaçlamaktadır. Bu tanımlayıcı nitelikteki çalışmada 380 lisans öğrencisi, 96 lisansüstü öğrencisi ve 19 uzman doktor olmak üzere toplam 495 katılımcı çalışmaya dahil edilmiştir. Veriler JSPE-S ve demografik anketler aracılığıyla hem kâğıt üzerinde hem de çevrimiçi formatlarda toplanmıştır. İstatistiksel analizler SPSS 20.0 programında, gruplar arasındaki farklılıkları değerlendirmek için bağımsız t-testi, ANOVA ve Posthoc Tamhane'nin T2 testleri uygulanarak gerçekleştirilmiştir. İç tutarlılık Cronbach'ın alfa testi kullanılarak değerlendirilmiştir. İstatistiksel anlamlılık düzeyi $p < 0.05$ alındı. Ortalama empati puanı kadın katılımcılarda ($72,00 \pm 12,43$) erkeklerden ($70,02 \pm 12,39$) sayısal olarak daha yüksekti, ancak istatistiksel olarak anlamlı değildi ($p = 0,084$). Lisans öğrencileri ($75,90 \pm 9,66$), lisansüstü öğrencilere ($55,84 \pm 6,96$) kıyasla önemli ölçüde daha yüksek empati puanları sergilediler ($p < 0,001$). Lisans öğrencileri arasında, dördüncü ve beşinci sınıf öğrencileri en yüksek empati seviyelerini gösterdi ($p < 0,05$). Uzmanlar ve lisansüstü öğrenciler en düşük empati puanlarına sahipti ($p < 0,001$). JSPE-S ölçeği iyi bir iç tutarlılık gösterdi (Cronbach alfa = 0,873). Diş hekimliği eğitiminde hasta ile ilk temasta empatik yaklaşım en yüksek seviyeye ulaşırken ilerleyen dönemlerde empatinin düştüğü görülüyor. Bu bulgular, yüksek düzeyde empatik hasta bakımı sağlamak için hem mezuniyet öncesi hem de mezuniyet sonrası dönemde empatik yaklaşımı güçlendirici eğitimlerin (seminer, drama oyunları vs) önemli bir gereklilik olduğunu göstermektedir.

Anahtar Kelimeler: Diş hekimliği, empati, Jefferson empati ölçeği, klinik eğitim, diş hekimliği öğrencileri

¹Assistant Professor, Department of Oral, Dental and Maxillofacial Radiology, Faculty of Dentistry, Atatürk University, Erzurum, 25240, Türkiye, ktorenek@gmail.com, ORCID: 0000-0001-7200-3436

²Postgraduate Student, Department of Oral, Dental and Maxillofacial Radiology, Faculty of Dentistry, Atatürk University, Erzurum, 25240, Türkiye, nazgolrnb@gmail.com, ORCID: 0009-0000-1075-4226

³Professor, Department of Oral, Dental and Maxillofacial Radiology, Faculty of Dentistry, Atatürk University, Erzurum, 25240, Türkiye, facagla@gmail.com, ORCID: 0000-0002-0666-8824,

1. Introduction

The word empathy (from Greek *empathia*) is defined as the ability of a person to place themselves in someone else's position and understand their emotions, thoughts, and behaviors.¹ Cognitive empathy refers to understanding a person's thoughts, while emotional empathy refers to understanding their emotions. In the healthcare sector, understanding the emotions, thoughts, and experiences of patients is referred to as clinical empathy. It can be described as a cognitive/behavioral skill that encompasses understanding a patient's symptoms and how those symptoms affect them, and conveying this understanding effectively to the patient (Arshad et al., 2024).

Medicine is a profession that requires one-on-one relationships with people. A physician's role is to identify and treat diseases. While performing this duty, the physician should remember that the patient is a person and establish an empathetic relationship with them. An empathetic relationship between the physician and patient increases patient satisfaction and can positively influence the patient's health status (Balos Tuncer et al., 2021). Furthermore, it enables the physician to make more effective and accurate diagnoses and to behave more ethically toward patients. Hardee et al. reported that physicians with empathetic tendencies are less likely to be sued (Brekalo Prso et al., 2020). In a study by Keshtkar et al (Candan et al., 2015), it was stated that empathy is a concept that changes over time and can thus be learned, noting that empathy values decrease toward the final years of medical school. The same study also reported that women tend to have higher empathy skills than men. Diseker et al. found a decline in empathy skills over time in medical students. A positive relationship has been reported between empathy and intelligence, socioeconomic status, and parenting style (Díaz-Narváez et al., 2024).

Empathy also plays a critical role in dentist-patient relationships. The American Dental Education Association has emphasized that empathy is the second most important clinical competence in dental education and should be included in dental school curricula (Ghardallou et al., 2022).

There are several scales available to measure empathy in the general population, but the Jefferson Scale of Physician Empathy (JSPE) was specifically developed to measure empathy in physicians (Hardee & Platt, 2010). Two versions are widely used: one for physicians/other health professionals and one for students. The JSPE is a validated instrument for assessing empathy in dental students as well as medical students (Arshad et al., 2024).

This cross-sectional study aims to assess the empathy levels of undergraduate and postgraduate students, as well as specialist physicians at Atatürk University Faculty of Dentistry, using the Jefferson Scale of Physician Empathy-Student version (JSPE-S).

2. Materials And Methods

The study was approved by the Ethics Committee of Atatürk University Faculty of Dentistry (Decision No: 57/2023), and all procedures were carried out in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants.

2.1. Population and Sample

The study included undergraduate and postgraduate students and specialist physicians (assistant professor, associate professor, professor) from Atatürk University Faculty of Dentistry in the

2023-2024 academic year.

Although the entire population was targeted, the study ultimately included 380 undergraduate students, 96 postgraduate students, and 19 specialist physicians. The sample represented 37.38% of all undergraduate students and 34.43% of all postgraduate students and specialists in the faculty. To compare pre-graduation and post-graduation groups, the minimum sample size for each group was calculated as 88 using the G-Power 3.1 program (Universität Kiel, Germany) (effect size: 0.5; α : 0.05; power: 0.95).

2.2. Data Collection Tools and Procedure

Data for this descriptive study were collected in two ways:

1. By distributing paper forms to participants for completion.
2. By providing forms through online data collection tools (Google Forms).

The forms included questions on age, education level, gender, and the empathy assessment scale. This scale comprises 20 items divided into three subdimensions: perspective-taking (10 items), compassionate care (7 items), and standing in the patient's shoes (3 items). The first 10 items of the scale are positively worded, and the next 10 are negatively worded. Negative items are reverse-scored when calculating the total empathy score. Higher scores indicate greater empathic consistency.

2.3. Statistical Analysis

Data analysis was conducted using SPSS for Windows (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean and standard deviation (SD). Independent t-tests were used to compare empathy scores between two groups, while one-way analysis of variance (ANOVA) was applied for comparisons between three or more groups, followed by the Posthoc Tamhane's T2 test. Internal consistency reliability was evaluated with Cronbach's alpha. A p-value of less than 0.05 was considered statistically significant.

3. Results

Of the participants, 190 were male (38.38%) and 305 were female (61.62%). The study included 380 undergraduate students (102 first-year, 18 second-year, 74 third-year, 87 fourth-year, and 99 fifth-year students), 96 postgraduate dental students, and 19 specialists. Descriptive statistics of the participants are presented in Table 1.

When empathy levels were compared by gender, the average empathy score for males was 70.02 ± 12.39 and for females 72.00 ± 12.43 . Although the difference was not statistically significant ($p=0.084$), empathy scores were numerically higher among female participants (Table 2).

Comparison of Empathy Scores in Undergraduates and Postgraduates

Undergraduate students' empathy scores (75.90 ± 9.66) were significantly higher than those of postgraduate dental professional (postgraduate dental students and specialist physicians) (55.84 ± 6.96) ($p < 0.001$; Table 3).

Comparison of Empathy Scores by Undergraduate Classes, Postgraduate Dental Students, and Specialists Physicians

Empathy scores for each undergraduate classes, postgraduate dental students, and specialist physicians are shown in Table 3. Fourth (77.52 ± 8.94) and fifth-year (77.57 ± 9.20) students had significantly higher empathy scores compared to other groups ($p < 0.05$). Postgraduate dental students (55.71 ± 7.35) and specialist physicians (56.69 ± 3.72) had significantly lower empathy scores than other class groups.

Comparison of Empathy Scores in Preclinical Students, Clinical Students, and Postgraduate Dental Professional

When evaluating empathy levels among preclinical students (first, second, and third years), clinical students (fourth and fifth years), and specialist physicians, statistically significant differences were observed ($p < 0.001$). The highest empathy levels were observed in clinical students (77.54 ± 9.06), while the lowest were in specialist physicians (55.84 ± 6.96) (Table 4).

The internal consistency reliability of the JSPE-S scale administered to dental students was found to be good (Cronbach's alpha = 0.873) (Table 5).

4. Discussion

In this study, factors affecting the empathy levels of dental students were examined comprehensively and compared with findings from research conducted at other universities. In general, many studies have shown that empathy levels vary during the educational process and differ according to gender, age, and individual/family characteristics.

Studies examining empathy levels among undergraduate and postgraduate dental students have produced differing results. For instance, Baloş Tuncer et al (Hojat et al., 2001) observed a significant decrease in empathy levels after graduation. This finding largely aligns with the results of our study. This situation can be explained by factors such as increased clinical responsibilities, professional role expectations, and greater time pressure in patient interactions. Additionally, as students progress through their education, a shift from empathic approaches to technical skills and task-oriented attitudes may also contribute to this decline. However, there are also studies reporting higher empathy scores after graduation (Javed, 2019; Javed et al., 2025). These conflicting findings may be due to methodological differences in the studies, cultural and educational structures of sample groups, measurement tools, the nature of the clinical environment, and the participants' personal interpretation of empathy. In particular, in some educational systems, clinical education may reinforce empathy by increasing students' exposure to real patient experiences and placing greater emphasis on patient-centered communication. Therefore, when evaluating differences in empathy levels, not only numerical data but also contextual and cultural dynamics should be considered. The current literature highlights the need for more multicenter and longitudinal studies on this topic.

Some studies have found that empathy levels are higher at the beginning of the educational process, particularly among preclinical students (Jolliffe, 2002; Kam Hepdeniz et al., 2023). The findings indicating a decline in empathy as students enter the clinical period have been associated with factors such as the measurement tools used, the patient responsibilities assigned to students, increasing stress levels, and the prioritization of technical skills over empathy during training. In our study, the highest empathy levels were observed among clinical students,

while the lowest were among specialist physicians. This can be explained by the increased patient contact experienced by clinical students, which helps improve their communication skills and reinforce their empathy competencies. When examining the relationship between academic year and empathy, studies have reported that fourth- and fifth-year students tend to have the highest empathy levels (Arshad et al., 2024; Hojat et al., 2001). These findings are also consistent with the results of our study.

In the context of gender differences, results in the literature are mixed. Many studies have reported that females possess higher empathy levels than males (Keshtkar et al., 2024; Teke et al., 2010). This has been attributed to women's greater emotional sensitivity and tendency to empathize. However, some studies have reported no statistically significant difference between genders, or even higher empathy scores among male students (Arshad et al., 2024; Tziolla et al., 2023). These findings suggest that cultural, individual, and pedagogical factors affecting empathy can yield different results in different contexts. In our study, although the empathy scores of females were numerically higher than those of males, this difference was not statistically significant.

Family structure also stands out as a factor influencing empathy levels. Baloş Tuncer et al (Hojat et al., 2001). reported that students with siblings exhibited higher empathy levels. This result suggests that experiences of emotional interaction with others from childhood may play an important role in empathy development. In our study, the number of siblings was not taken into account.

There are also findings in the literature indicating that empathy levels decline as professional seniority increases (Javed et al., 2025). This demonstrates that increasing technical responsibilities and workload in medical practice may cause empathic communication skills to be neglected. Moreover, empathy levels have been reported to vary across specialties. For example, pediatric dentistry specialists were found to have higher empathy scores compared to other branches (Javed et al., 2025). This may be directly related to the patient profiles in different areas of practice. In our study, differences between departments were not considered.

This study has some limitations. Firstly, the data were collected from a limited number of university students within a specific time frame. This limits the generalizability of the findings to all dental students. Furthermore, the study's reliance predominantly on undergraduate student participants and relatively fewer postgraduate participants provides limited insight into how empathy levels evolve in clinical practice after graduation. Therefore, it is recommended that future research include larger-scale, comparative studies involving both students and practicing dentists. Another limitation lies in the use of self-report questionnaires as the data collection tool. This carries the risk that participants may not fully reflect their true thoughts and emotions due to social desirability bias. Additionally, individual and environmental variables affecting participants' empathy perceptions and attitudes (such as duration of clinical experience, education type, and cultural background) could not be analyzed in depth, which constitutes another limitation of the study.

Table 1. Descriptive statistics of the participants (Ntotal=495)

		N	%
Gender	Male	190	38.38
	Female	305	61.62
Groups			
Undergraduate students	1.class	102	20.61
	2.class	18	3.64
	3.class	74	14.95
	4.class	87	17.58
	5.class	99	20.00
Postgraduate students		96	19.39
Specialist physicians		19	3.84

Table 2. Comparison of empathy scores according to gender and graduation status

	Gender	Mean±SD	t	p
Empathy score	Male	70.02±12.39	-1.733	0.084
	Female	72.00±12.43		
Graduation status				
Empathy score	Undergraduate	75.90±9.66	20.693	0.000*
	Postgraduate	55.84±6.96		

*: p<0.001, SD: standard deviation, t: Student t-test

Table 3. Comparison of empathy scores in different grades, asistants and experts.

	N	Mean±SD	Minimum	Maximum	p
Grade 1	102	72.28±9.48 ^{a,b}	54	95	0.000*
Grade 2	18	76.22±11.18 ^{a,b}	60	94	
Grade 3	74	76.68±9.86 ^{a,b}	52	100	
Grade 4	87	77.52±8.94 ^{a,b}	56	97	
Grade 5	99	77.57±9.20 ^b	52	95	
Asistant	99	55.71±7.35 ^c	20	69	
Expert	16	56.69±3.72 ^c	52	63	
Total	495	71.24±12.44	20	100	

*: p<0.001, N: sayı, SD: standart sapma, ^{a,b,c}: Indicate values that are significantly differentat 0.05% probability level (Posthoc Tamhane's T2 test)

Table 4. Comparison of empathy scores in preclinical students, clinical students and specialists.

	N	Mean±SD	Minimum	Maximum	p
Preclinic	194	74.32±9.98 ^a	52	100	0.000*
Clinic	186	77.54±9.06 ^b	52	97	
Expert	115	55.84±6.96 ^c	20	69	
Total	495	71.24±12.44	20	100	

*: p<0.001. ^{a,b,c}: Indicate values that are significantly differentat 0.05% probability level (Posthoc Tamhane's T2 test)

Table 5. Scale expressions and internal consistency of the scale

		Mean	SD	N
Compassionate care				
11	My understanding of how my patients and their families feel does not influence my medical or surgical treatmenta	3.48	1.148	495
12	I try not to pay attention to my patients' emotions in history taking	3.45	1.174	495
13	Attentiveness to my patients' personal experiences does not influence treatment outcomesa	3.72	1.075	495
14	Patients' illnesses can be cured only by medical or surgical treatment; therefore, emotional ties to my patients do not have a significant influence on medical or surgical outcomes	3.70	1.063	495
15	Asking patients about what is happening in their personal lives is not helpful in understanding their physical complaints	3.57	1.039	495
16	I believe that emotion has no place in the treatment of medical illness.	3.76	1.077	495
17	I do not enjoy reading non-medical literature or the artsa	3.70	1.075	495
Standing in patient's shoes				
18	It is difficult for me to view things from my patients' perspectives	3.71	.942	495
19	Because people are different, it is difficult for me to see things from my patients' perspectives	3.54	.999	495
20	I do not allow myself to be influenced by strong personal bonds between my patients and their family members	2.76	1.090	495
Internal consistency coefficient (Cronbach alpha)			0.873	
Perspective taking				
1	My patients feel better when I understand their feelings	3.73	1.416	495
2	I consider understanding my patients' body language as important as verbal communication in caregiver-patient relationships	3.79	1.338	495
3	I have a good sense of humor that I think contributes to a better clinical outcome	3.41	1.165	495
4	try to imagine myself in my patients' shoes when providing care to them	3.67	1.192	495
5	My patients value my understanding of their feelings which is therapeutic in its own right	3.59	1.111	495
6	I try to understand what is going on in my patients' minds by paying attention to their non-verbal cues and body language	3.63	1.152	495
7	Empathy is a therapeutic skill without which my success in treatment is limited	3.58	1.131	495
8	An important component of the relationship with my patients is my understanding of their emotional status, as well as that of their families	3.43	1.140	495
9	I try to think like my patients in order to render better care	3.58	1.171	495
10	I believe that empathy is an important therapeutic factor in medical or surgical treatment	3.45	1.356	495

SD: Standart Sapma, N: sayı

5. Conclusion

Empathy levels are influenced by numerous factors, including personal characteristics, cultural background, educational processes, and professional experiences. Developing and sustaining empathic communication skills in dental education not only increases patient satisfaction but also enhances dentists' professional satisfaction and sense of ethical responsibility. Based on

the findings of this study, it is recommended that specifically structured training programs be implemented in dental education to preserve and enhance empathic skills. These programs should incorporate activities aimed at fostering empathy, such as communication seminars, role-playing exercises, drama techniques, and case analyses. Moreover, empathy training should not be confined to preclinical periods but should also continue throughout clinical practice. Integrating such applications into the training processes of both students and postgraduate dentists would ensure the sustainability of an empathic approach during both pre- and post-graduation periods. Additionally, future comparative studies conducted with larger samples from different universities could contribute to a more comprehensive and in-depth understanding of the factors underlying changes in empathy levels.

Çıkar Beyanı: Yazarların herhangi bir çıkar çatışması bulunmamaktadır.

Etik Beyanı: Bu çalışmanın tüm hazırlanma süreçlerinde etik kurallara uyulduğunu yazarlar beyan eder. Aksi bir durumun tespiti hâlinde Avrasya Üniversitesi Sağlık Bilimleri Dergisi'nin hiçbir sorumluluğu olmayıp, tüm sorumluluk çalışmanın yazarlarına aittir.

Yazar Katkısı:

NR: Çalışma fikrinin oluşturulması, literatür taraması, veri toplama, istatistiksel analiz ve makale taslağının hazırlanması.

KTA: Çalışmanın metodolojik tasarımı, veri toplama sürecine katkı, istatistiksel değerlendirme ve sonuçların yorumlanması.

FÇ: Çalışmanın bilimsel denetimi, metodolojik katkılar, tartışma bölümünün geliştirilmesi ve makalenin son halinin onaylanması.

1. yazarın katkı oranı: %50 2. yazarın katkı oranı: %25 3. yazarın katkı oranı: %25.

Conflict of Interest: The authors have no conflict of interest.

Ethical Approval: The authors declare that ethical rules are followed in all preparation processes of this study. In the case of a contrary situation, Avrasya University Journal of Healthy Sciences has no responsibility, and all responsibility belongs to the study's authors.

Author Contributions:

NR: Developing the study idea, literature review, data collection, statistical analysis, and drafting the article.

KTA: Methodological design of the study, contribution to the data collection process, statistical evaluation, and interpretation of the results.

FÇ: Scientific supervision of the study, methodological contributions, development of the discussion section, and approval of the final version of the article.

First author contribution rate: 50%, Second author contribution rate: 25%, Third author contribution rate: 25%.

Kaynaklar

- Arshad, M., Sriram, S., Khan, S., Gollapalli, P. K., & Albadrani, M. (2024). Mediating role of physician's empathy between physician's communication and patient's satisfaction. *Journal of Family Medicine and Primary Care*, 13(4), 1530–1534. https://doi.org/10.4103/jfmipc.jfmipc_1615_23
- Baloş Tuncer, B., Canigür Bavbek, N., Arslan Avan, B., ÇeliK, B., & Tuncer, C. (2021). The influence of clinical training level on the empathy levels of undergraduate and postgraduate dental students. *Acta Odontologica Turcica*, 38(1), 1–7. <https://doi.org/10.17214/gaziaot.669976>
- Brekalo Prso, I., Mocny-Pachońska, K., Trzcionka, A., Pezelj-Ribaric, S., Paljevic, E., Tanasiewicz, M., & Persic Bukmir, R. (2020). Empathy amongst dental students: An institutional cross-sectional survey in Poland and Croatia. *European Journal of Dental Education*, 24(4), 687–694. <https://doi.org/10.1111/eje.12557>
- Candan, M., İdacı, M., & Yılmaz Karaman, İ. G. (2015). The Effect of Clinical Education Levels of Undergraduate Dental Students on Dental Anxiety and Empathy Levels Diş Hekimliği Lisans Öğrencilerinin Klinik Eğitim Düzeylerinin Dental Anksiyete ve Empati Düzeylerine Etkisi. *Aydın Dental*, 9(3), 53–60. https://doi.org/10.17932/IAU.DENTAL.2015.009/dental_v09i3006
- Díaz-Narváez, V. P., Huberman-Casas, J., Nakouzi-Momares, J. A., Alarcón-Ureta, C., Jaramillo-Cavieres, P. A., Espinoza-Retamal, M., Klahn-Acuña, B. P., Epuyao-González, L., Leiton Carvajal, G., Padilla, M., Vilca, L. W., Reyes-Reyes, A., & Reyes-Reyes, F. (2024). Levels of Empathy in Students and Professors with Patients in a Faculty of Dentistry. *Behavioral Sciences*, 14(9), 817. <https://doi.org/10.3390/bs14090817>
- Ghardallou, M., Zedini, C., Sahli, J., Ajmi, T., Khairi, H., & Mtiraoui, A. (2022). Psychometric properties of a French version of the Jefferson Scale of Empathy. *International Journal of Medical Education*, 13, 205–214. <https://doi.org/10.5116/ijme.62d2.8497>
- Hardee, J. T., & Platt, F. W. (2010). Exploring and overcoming barriers to clinical empathic communication. *Journal of Communication in Healthcare*, 3(1), 17–23. <https://doi.org/10.1179/cih.2010.3.1.17>
- Hojat, M., Mangione, S., Nasca, T. J., Cohen, M. J. M., Gonnella, J. S., Erdmann, J. B., Veloski, J., & Magee, M. (2001). The Jefferson Scale of Physician Empathy: Development and Preliminary Psychometric Data. *Educational and Psychological Measurement*, 61(2), 349–365. <https://doi.org/10.1177/00131640121971158>
- Javed, M. (2019). The evaluation of empathy level of undergraduate dental students in Pakistan: A cross-sectional study. *Journal of Ayub Medical College Abbottabad*, 31(3), 402–406.
- Javed, M. Q., Ahmad, Z., Muhammad, M., Ali, K., Riaz, A., & Glanville, R. (2025). Beyond the Drill: Understanding Empathy Among Undergraduate Dental Students. *European Journal of Dental Education*, 29(1), 116–123. <https://doi.org/10.1111/eje.13054>
- Jolliffe, I. T. (2002). *Principal Component Analysis*. Springer-Verlag. <https://doi.org/10.1007/b98835>
- Kam Hepdeniz, Ö., Temel, U. B., & Uğurlu, M. (2023). Bir diş hekimliği fakültesinde lisans öğrencilerinin empati düzeylerinin değerlendirilmesi. *SDÜ Tıp Fakültesi Dergisi*, 30(2), 235–244. <https://doi.org/10.17343/sdutfd.1287519>
- Keshtkar, L., Ward, A., Winter, R., Leung, C., & Howick, J. (2024). Does empathy decline in the clinical phase of medical education? A study of students at Leicester medical school.

PEC Innovation, 5, 100316. <https://doi.org/10.1016/j.pecinn.2024.100316>

Teke, A. K., Cengiz, E., & Demir, C. (2010). Hekimlerin empatik özelliklerinin ölçümü ve bu ölçümlerin demografik değişkenlere göre değişimi. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 19(3), 505–516.

Tzialla, N., Boka, V., Menexes, G., Kotsanos, N., & Arapostathis, K. (2023). Psychometric properties of the Greek version of the Jefferson Scale of Empathy and empathy levels in Greek dental postgraduate students. *European Archives of Paediatric Dentistry*, 24(6), 691–700. <https://doi.org/10.1007/s40368-023-00826-x>