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Abstract

Background Understanding the complex, multifaceted, and often subconscious emotional and cognitive perspectives of undergraduate dental students regarding their education is crucial. Personality types and stress levels are believed to play a significant role in shaping these perceptions. Employing metaphors—using a familiar and concrete concept to explain an unfamiliar or abstract one—is an effective cognitive transfer technique for exploring students' views on dental education. This cross-sectional study aims to investigate dental students' perceptions of their education through metaphor analysis. Additionally, it aims to examine the relationship between students' personality types and stress levels, offering deeper insights into the factors influencing their educational experiences.

Methods This cross-sectional study included 1038 undergraduate dental students enrolled in faculties of dentistry at three universities in Türkiye during the 2023–2024 academic year. Data were collected via an electronic survey consisting of four sections. The first section gathered demographic information (gender, age, academic level, and occupational preference). In the second section, participants completed the sentence: "Dental education is similar to ... because ..." to illustrate their mental representations of dental education. The third section included the Perceived Stress Scale (PSS) to assess stress levels, while the fourth section comprised a personality inventory to determine personality types. All survey data were transferred to Excel for analysis. Metaphors were systematically evaluated, and the most representative ones were identified. Data analysis incorporated both qualitative (metaphor analysis and chi-square tests) and quantitative (linear regression) methods.

Results Metaphors were categorized into seven conceptual groups: 'master-apprentice training,' challenging process-race', 'art-skill-creativity', 'patience-labor', 'union of differences', 'discipline-order-power', and 'unknowability-incomprehensibility-indispensability'. A significant gender difference was observed (p = 0.013): female students predominantly used metaphors in the 'patience-labor' category, while male students favored the 'art-skill-creativity' category. Academic year differences were also significant (p < 0.001), with advanced students more frequently using 'discipline-order-power' metaphors. Stress levels did not significantly differ among groups (p = 0.127), with 72.1% of participants reporting moderate stress, most commonly linked to the 'challenging process-race' category. The majority of participants (64.5%) exhibited a Type B personality. A statistically significant regression model was found between PSS scores and both age (p < 0.001) and personality type scores (p = 0.011).

Conclusion This study highlights the influence of personality types and stress levels on dental students' perceptions of their education. Metaphor analysis proved to be an effective tool for identifying these perceptions. The most

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frequently reported category was 'challenging process-race'. A significant association was found between students' metaphorical categories and their gender and academic level. However, no significant relationships were observed between metaphor categories and occupational preference, stress levels, and personality types.

Keywords Dental education, Metaphor, Stress, Personality type

Background

Undergraduate dental education consists of a comprehensive five-year curriculum integrating both theoretical and practical components [1]. The initial three years emphasize preclinical education, encompassing core dental disciplines through a combination of theoretical and practical courses. The final two years include hands-on patient treatment in clinical settings supervised by experienced counsellors [2]. Pre-clinical laboratory courses are very important for students to acquire and develop adequate manual skills at an introductory level to dental practice, as well as teaching basic professional practices [3]. Clinical training skills are a fundamental component of dental education, enhancing students' critical thinking, problemsolving abilities, and application of conceptual skills while reinforcing and consolidating the knowledge and skills acquired in preclinical courses [4]. This experiential learning used in clinical education constitutes an important component of the teaching process. This learning method, which takes place at the bedside, is completely different from the traditional learning processes carried out in the classroom environment. Each encounter with a new patient can be defined as a learning process in which previously acquired knowledge and experiences are applied and newly learned information is internalised [5].

The concept of experiential learning was first introduced by Kolb in 1984 through a cyclical model consisting of four interconnected stages [6]. According to this model, individuals begin by reflecting on concrete experiences (concrete experience) to derive personal meaning from them (reflective observation). Subsequently, they develop abstract conceptualizations (abstract conceptualization) based on these reflections. Finally, these conceptualizations are applied and tested in real-life contexts (active experimentation), resulting in new concrete experiences. This iterative process completes the cycle and initiates a continuous loop of learning and development [7]. In addition to Kolb's experiential learning model, Lave and Wenger's concept of situated learning provides a deeper understanding of clinical education. Situated learning emphasizes that knowledge is not merely acquired in isolation but is actively constructed through the processes of understanding, discussing, and applying lived experiences [8]. In clinical settings, learning occurs through social interactions and practical experiences, allowing students to engage with real-world scenarios

and internalize knowledge within a meaningful framework. A previous study [9] further highlighted the critical role of relationships and interactions between newcomers and more experienced individuals, framing learning as a dynamic process involving guidance, support, and the co-construction or reconceptualization of practice [10]. By participating in these guided interactions, students not only enhance their skills but also develop a strong sense of professional identity and competence in dental education, essential for their development in dental education.

This demanding and rigorius nature of dental education often contributes to significant stress and anxiety among students [11]. Upon entering university, students may encounter challenges such as adapting to their assigned department, unmet expectations, and a disconnect between their aspirations and reality. Research indicates that social, cultural, and economic transitions during university life can exacerbate the incidence of depression and other psychiatric disorders among students [12]. Various studies have evaluated dental students' perceptions of their education, their experiences within the system, and the stress levels associated with these educational methods [13–15]. Perceived Stress Scale (PSS) being commonly used for this purpose [16]. The number of studies examining dental students ' perspectives on their education is relatively limited, and most of these studies have primarily used stress scales to measure students' stress levels [17-21]. However, these studies have not focused on students' views of dental education.

As well as students' stress levels, their personality types influence their perspectives on education. Holland's theory posits that individuals seek environments that align with their personality types, aiming to engage in professions where their talents can be fully utilized [22]. The concept of personality, which can be defined in many different ways in many different sources, has been tried to be explained by researchers with various theories [23]. One of these theories is the Type A and Type B personality typologies developed by Friedman and Rosenman [24]. Type A individuals are characterized by their ambition and high-stress levels, whereas Type B individuals tend to be less stressed and more patient, placing less emphasis on success [25].

Conceptual Metaphor Theory (CMT), first proposed by George Lakoff and Mark Johnson in 1980, argues that metaphors are not only linguistic tools but also cognitive frameworks that reveal individuals' deeper perceptions and values [26]. Metaphors facilitate cognitive transfer by explaining an unknown or abstract concept through a known and tangible concept. With these features, they stand out as powerful tools in qualitative research [27, 28]. Basing concepts on concrete experiences facilitates the explanation, clarification and development of processes and outcomes and paves the way for a deeper understanding. There are several studies that have used metaphors to explore dental students' perspectives on patients, to reveal perceived knowledge, skills and interests, or to describe professional identity formation in a medical context [26, 28]. However, no study appears to have specifically explored dental students' perspectives on their education through the use of metaphors.

The use of metaphors offers unique advantages over traditional quantitative or descriptive methods. Scales and questionnaires provide numerical data or general trends; however, these methods, which limit the answers to questions to options (is not flexible), may not fully reflect the complex, nuanced and often unconscious perspectives of respondents [29]. These methods are more suitable for collecting superficial information. In contrast to these methods, the metaphor approach allows participants to convey their thoughts in their own words, offering richer and more insightful data [28]. In other words, metaphors can uncover students' emotional and cognitive associations with their training, revealing underlying challenges, motivations, and values that may not surface through conventional approaches.

Dental students are known to experience high levels of stress throughout their education, which can negatively impact both their academic performance and overall well-being [30]. Additionally, personality traits play a significant role in stress levels. Studies on university students have shown that individuals with Type A personality tend to experience higher stress levels and employ different coping strategies [31]. Based on these findings, identifying dental students' stress coping mechanisms through metaphors, considering both their educational experiences and personality traits, is considered crucial. Relatively few studies have explored dentistry students' perspectives on their education and the associated stress [17, 18]. However, no research currently examines students' perspectives on their education through metaphors in relation to their personality types and stress levels. Using this approach could be especially beneficial in understanding and addressing the unique challenges faced by dentistry students. The present study aims to explore dental students' perceptions of dental education through the use of metaphors. Additionally, it seeks to gather about the relationship between personality types,

stress levels and their metaphorical perceptions of dental education. The hypotheses of this study are as follows: (a) There is a significant difference in the metaphorical perceptions of dental students toward dental education, and (b) there is a significant relationship between the stress levels and personality types of dental students and their metaphorical perceptions.

Materials and methods

The current study was undertaken between January and February 2024, employing a web-based survey methodology. The research protocol received approval from the Ethics Committee of Nuh Naci Yazgan University, ensuring compliance with the contemporary ethical standards delineated in the Declaration of Helsinki. Furthermore, adherence to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines was upheld consistently throughout the course of the investigation.

Participants

This cross-sectional study comprised 1079 undergraduate dental students enrolled at three universities in Türkiye; Sivas Cumhuriyet University, Mersin University, and Nuh Naci Yazgan University, Faculty of Dentistry during the academic year 2023-2024. The inclusion criteria required participants to be undergraduate students currently enrolled in a dental program, have attained the age of majority, voluntarily consent to participate, complete the full questionnaire, demonstrate proficiency in the local language, and maintain overall mental and physical well-being. The participants gave their informed consent to participate in the research. The informed consent form is presented in Supplementary Material 1. The exclusion criteria for the study were that individuals who did not agree to sign the informed consent form, and those under the age of 18. The sample size was determined using the G*Power package (v. 3.1.9.6), resulting in a total sample size of 898 participants, assuming a mean effect size of 0.10 difference in the mean of the parameters administered, with an alpha significance level of 0.05 and 85% power. Adopting a 20% increase for dropouts and missing data, the sample consisted of 1079 participants.

Data collection

To construct the electronic questionnaire, a semi-structured format was employed utilizing Google Forms. This instrument was developed by adapting previously validated questionnaires [28, 32]. In this study, previously validated and reliability-tested Turkish versions of the selected scales [Perceived Stress Scale (PSS) and Personality Typology Inventory] were used. These scales had already undergone rigorous translation, validation, and reliability analyses in previous studies, ensuring their applicability within the Turkish population. Given that the instruments had been psychometrically adapted and validated in Turkish, no additional cross-cultural adaptation process was required. The study utilized these validated versions directly, maintaining their original structure and scoring system. Additionally, a pilot study involving 30 participants revealed no necessity for modifications. The questionnaire was prepared in Turkish, the native language of the students. The English version of questionnaire form is presented in Supplementary Material 2.

In order to improve the understanding of the nature of metaphors and to emphasise the importance of validating the formulated metaphors, the researchers organised a face-to-face pre-briefing session for students at all academic levels in the three participating universities. Selection of respondents for the web-based survey was achieved through probability distribution from a pre-established list of closed populations. Additionally, a reminder message was dispatched two days later to augment participation rates and mitigate potential biases. One week later, participation in the survey was terminated.

After providing an overview of the objectives of the survey, the information given to the participants about the metaphor technique in the face-to-face information meeting was given again in detail in written form. The questionnaire developed consisted of four sections. The first section focused primarily on collecting demographic information from the participants. The second section of the questionnaire was designed to eliciting dental students' perceptions of dental education through the utilization of metaphors. In order to increase clarity regarding the relationship between the 'subject of the metaphor' and the 'source of the metaphor', the concept of 'because' was included and participants were asked to provide justifications for their metaphors. At the second section, participants were asked to complete the sentence "A dental education is like ...; because ...". The third section of the questionnaire included the 10-item Perceived Stress Scale (PSS-10) to assess students' stress levels of dental students. The PSS-10 gauges participants' thoughts and emotions over the preceding month, utilizing a response scale ranging from 0 to 4 [33]. The scale has two factors: the first factor comprises six negative items assessing an individual's perception of stress, while the second factor encompasses four positive items evaluating coping mechanisms or adaptation to stress. Responses to questions 1, 2, 3, 6, 9, and 10 are evaluated with the scale 0-4 (0-never; 1-hardly ever; 2-sometimes; 3-often; and 4-very often), with scores assigned accordingly: 0-0; 1-1; 2-2; 3-3; and 4-4. Conversely, responses to the remaining Page 4 of 14

questions are scored in reverse order. Individual scores on the PSS-10 range from 0 to 40 (Table 1), with higher scores indicative of heightened levels of perceived stress. Interpretation of the scores delineates three categories: 0-13 suggesting low perceived stress, 14-26 indicating moderate stress, and 27-40 signifying high perceived stress [34]. In the final section of the questionnaire, participants' personality typologies were assessed using Friedman and Rosenman's (1974) Type A and Type B Personality Typology Inventory. This inventory, designed to delineate Type A and Type B personality typologies, comprises seven polarized statements. The scoring mechanism involves multiplying the sum of scores attributed to responses given for items within the scale by 3. The aggregate score obtained by each participant on the personality scale may range from 21 to 168. Individuals with a total score below 100 are classified as possessing a Type B personality, whereas those with a score exceeding 100 are categorized as having a Type A personality.

An alphabetical list of all metaphors provided by the participants was made. In this step, the name of the metaphor (art, military, combination of profession, etc.) was coded. In addition, a sequence number was given for each questionnaire and the personal information about who produced the metaphor was coded in brackets immediately after the metaphor in question. The initial letter of the university where the education was received was coded as "N" for Nuh Naci Yazgan University, "S" for Sivas Cumhuriyet University, "M" for Mersin University. Academic years were expressed as numbers for 1st, 2nd, 3rd, 4th and 5th grades. Gender was denoted by the letters "F" for female and "M" for male. Finally, the age of the participant was added. For example, participant #1, from Nuh Naci Yazgan University in the second academic year, a male student at 20-year-old, was indicated as 1N2M20.

The subject denotes the object of the metaphor (i.e., dental education), while the tool represents the term used to compare with the subject. The ground refers to the nature of the relationship between the subject and the tool. This analytical approach facilitated the deconstruction and examination of each metaphor by identifying salient features/images, common elements, and similarities among the various metaphors. Data from 41 participants who either failed to provide a clear definition, did not mention a metaphor, mentioned a metaphor but could not be justified, understood or placed under a conceptual theme were excluded from the study.

The second parts of the metaphorical sentences created by the participants were analyzed by two independent researchers (A.T.E.A and E.D). A total of 58 metaphors, classified as "well-expressed metaphors" were coded into appropriate conceptual categories. Based on previous studies in the literature, seven conceptual categories

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Conceptual category	Frequency (%)	Metaphor (frequency)	Main theme	Sample metaphor
Master-apprentice-training	94 (9.1)	Craft (5), master-apprentice (51), education (38)	Dental education involves a seasoned practi- tioner (master) imparts knowledge and skills to a less-experienced counterpart (apprentice) Dentistry education continues throughout life	Dental education is like a master-apprentice rela- tionship, because people who are more experienced than you in this profession develop and progress as you add something (24751 F18) Dentistry education is a never-ending education. Because it means being able to keep up with a constantly flowing cycle (394M5F22)
Challenging process-race	315 (30.3)	Marathon (53), path (43), food (10), alpinism (36), exam (33), adventure (53), disease (8), nightmare(7), mine (8), punishment (24), game (37), sea (4)	Dental education is a difficult education Difficulty increases gradually from the first year to the last year of education, but when gradu- ated, it leads to the beauties that make these difficulties worth it Dental education is very stressful There is a competitive environment among stu- dents in dental education, especially in practical training	Dental education is alike climbing Everest. As one approaches the summit of the mountain, it becomes increasingly challenging, much like each subsequent year of dental school being more demanding than the last. And just as reaching the summit offers unique beauty, graduating from dental school provides access to similar beauties (1952F19) Dental education is like a permanent exam because you continue to live with constant excitement and stress (748N4F23) Dental education is like a nightmare because you scream, but no sound comes out (535M5M24) Dental education is like a punishment for students because in order to really become a dentst, we are trained under really difficult conditions in material, spiritual and mental terms (5884M22)
Art- skill-creativity	195 (18.8)	art (123), sculptor (30), construction (5), engineering/architecture (14), carpentry (9), workshop (12), sport (1), design (1)	Dental education develops manual skills It is important to have an aesthetic point of view in dentistry and that physicians help individuals who have lost their dental aesthetics by reshap- ing them All trainings taken step by step form the basis of each other and all steps must be completed correctly	Dentistry is like art because no matter how much we develop. I think that every dentist has an innate dexterity (16152F19) Dental education is similar to sculpture because it redesigns the lost aesthetics in accordance with the individual (18351F19) It's like a construction site. In any endeavor that doesn't rest on solid foundations, you can fall with a sudden shake. You need to progress step by step. If the lower step isn't built solidly, the one above won't be stable either, potentially setting you back to square one. Without properly processing each step, every task you think you've completed ends up hav- ing a flaw somewhere (94S3F21)
Patience-labour	146 (14.1)	artistry (15), grow plants (24), puzzle (26), knit- ting (12), childcare (12), excavate (7), earnings (15), tunnel (18), cocoon (14), drug (3)	Dental education requires discipline and hard work Learning takes place by first listening to the educators, watching and then applying it on one's own Combining all the information received throughout the education is important Patient effort throughout education brings success	Dental education is like growing flowers. Because it requires a lot of effort, labour, patience and disci- pline. (418M1F19) Dental education is like a tunnel. Because the end of every road you are patient is bright. (791N4F21) Dental education is like a puzzle because it makes sense when you combine the information you have learnt throughout your education. (866N2F22)
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Table 1 (continued)				
Conceptual category	Frequency (%)	Metaphor (frequency)	Main theme	Sample metaphor
Union of differences	91 (8.8)	profession combination (39), evolution (18), specialize (6), orchestra (5), honrey (3), reading book (6), talent (9), amusement park (5)	Dental education is multifaceted Knowledge and skills from many different areas should combined in dental education	Dental education is the teaching of many profes- sions together because denistry is the only profes- sion where medicine, engineering, and artistry are realised. (512M3F21) Dental education is like a bee landing on different types of flowers and making honey. Because in den- tistry education, the dentistry student can learn and practice the profession of dentistry after receiving education and knowledge in many different fields such as sculpture, psychology, art and craft as well as dentistry education. (23851F20) Dental education is like an "amusement park" because "sometimes you are faced with disosters that you do not know will happen to you like in a horr train (such as the ghost of compensation" reflected on the radiogram of the overflow nilling made in endodontics) and sometimes you experi- ence exciting moments like a roller coaster preparing for landing. Favourite theoretical lectures are like being on a Feri's wheel, liying swings or a merry-go- round, they go on with pleasure. In practical courses, the passing of the work delivered is like cotton candy handed out by a clown, and I am sure that gradu- ation is like a flying balloon released into the sky. (760N3F20)
Discipline-order-power	71 (6.8)	military (53), political administration (6), disci- pline (7), chess (2), pragmatism (1), compass (1), traffic (1)	Dental education requires a sense of responsi- bility and discipline There is a subordinate-superior relationship in dentistry education Requires planned and organised work Dental education is a guide for future profes- sional life	Dental education is like military service because it requires discipline and requires you to always be ready for duty, whether we have practical homework or exams, it is difficult in short, but the beautiful thing is to achieve the difficult. (417M3M26) Dental education is like traffic. When it is busy, we complain a lot and feel unhappy, but in general it regularises our lives. (292M2M21) Dental education is like a compass because it shows us the way and direction in our professional life. (913N4F22)

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Conceptual category	Frequency (%)	Metaphor (frequency)	Main theme	Sample metaphor
Unknowability-incompre- hensibility-indispensability	126 (12.1)	life (18), family (8), ocean (25), forest (4), route (12), technology (2), black hole (19), swamp (8), closed box (11), risk (12), matryoshka (4), dream (3)	Dental education is a process full of infinite knowledge/experience Education life is full of unpredictable things Sometimes there is more than one way to get to the truth External factors are also important in dental education	Dental education is like a closed box because you never know what, where and when awaits you. (5954F23) Dentistry education is like life because what will hap- pen is not only in your hands but also environmental influences. (11152F21) Dentistry education is like a forest because there are many ways to get out of the forest, but no matter where you turn, you are still in the forest, so there is no one right way. (11652F19) Dental education is like being in a black hole. Because during training you feel like you are on a dark and unknown path. (43714F22)

were identified through inductive analysis [32, 35]. Subsequently, two different researchers (S.A and B.B) were given a complete list of the metaphors and asked to assign them to the seven conceptual categories. To ensure validity and reliability, the compatibility of the categorizations made by the experts was examined and a consensus was reached. Following these adjustments, the consistency of the analysis results was calculated as 92% using the Miles and Huberman formula (Reliability=[agreement/ (agreement+disagreement)] × 100).

Statistical analysis

The data were imported into SPSS 28 software (version 22.0; Statistical Package for Social Sciences, SPSS Inc., Chicago, IL, USA). The data were subjected to a mixedmethod analysis encompassing both qualitative (metaphor analysis and chi-square) and quantitative (Pearson correlation) approaches. Pearson's chi-squared test ($\chi 2$) was utilized to examine variations between the seven conceptual categories concerning gender, educational level, and occupational preference. In the chi-square analysis, the Monte Carlo method was employed. If the minimum expected count was less than 25, the Pearson Chi-Square *p*-value was reported, whereas if the minimum expected count exceeded 25, the Fisher-Freeman-Halton *p*-value was utilized. The Monte Carlo method provided a 95% confidence interval (CI) for the *p*-values. Furthermore, linear regression analysis was performed to investigate the relationship between dental students' stress scores, age, and personality type scores. The statistical significance level was set at 0.05.

Results

Qualitative findings

Fifty-eight sample metaphors reflecting 1038 valid metaphors produced by participants were grouped into seven conceptual categories that defined the concept of dental education as (1)master-apprentice-training, (2)challenging process-race, (3)art- skill-creativity, (4) patience-labour, (5)union of differences, (6)disciplineorder-power and (7)unknowability-incomprehensibility-indispensability. Table 1 represents the distributions and frequencies, main themes, and sample metaphors of seven conceptual categories. 'Challenging process-race' category constituted the majority (30.3%) of the metaphors reported. One of the sample metaphors that best represents this category was 'marathon', and as a rationale for this was that dental education is full of difficulties and obstacles, but the result is worth all the difficulties. The closest category to this was 'art-skill-creativity', which accounted for 18.8% of the total. The less commonly reported metaphors belonged to the 'union of differences' (8.8%) and 'discipline-order-power' (6.8%) categories.

The main rationales that the participants wanted to emphasise in the 'patience-labour' and 'master-apprentice-training' categories were that dental education requires hard work, that learning takes place by first listening to the educators, watching and then applying it on one's own, and that if one makes a patient effort throughout one's educational life, the result can be achieved. The metaphors that best represented the category of 'unknowability-incomprehensibility-indispensability' were 'ocean' and 'black hole'.

Quantitative findings

Table 2 presents a cross tabulation of the dental students' perceptions of dental education after stratification of the data according to sex, grade level, occupation preference, PSS level and personality type.

A total of 1038 students participated in this study. 41 (3.8%) participants who did not produce an appropriate metaphor in the survey were excluded. The main age of the participants was recorded as 21.3 ± 2.2 years, with 632 individuals (60.9%) identified as female. The distribution of the participants included in the study among Sivas Cumhuriyet, Mersin and Nuh Naci Yazgan universities was 382 (36.8%), 390 (37.6%) and 266 (25.6%), respectively. Dentistry emerged as the primary preference for 54.4% (565) of students in the university entrance examination. Furthermore, the distribution of students across different academic years was as follows: 20% (209) first-grade, 23.6% (245) second-grade, 19.0% (197) third-grade, 22.1% (229) fourth-grade, and 15.2% (158) fifth-grade students.

When the conceptual categories were assessed based on the sex of the participants, a statistically significant difference was observed (p=0.0013), primarily driven by variances within the categories 'patience-labor' and 'artskill-creativity'. While women (%16.5) tended to describe dental education more frequently in the 'patience-labor' category, men (%22.7) were more inclined to define dental education in the 'art-skill-creativity' category.

There was a statistically significant difference between the groups in terms of educational level (p < 0.001). Participants at the preclinical education level used the category 'art-skill-creativity' to describe dental education at a significantly higher rate than participants at the clinical education level. It was observed that the use of metaphors in the 'discipline-order-power' and 'challenging process-race' category increased as the educational level increased.

In terms of occupation preference, there was no statistically significant difference between the groups (p=0.084). The both those whose first choice is dentistry and those whose first choice is a profession other than dentistry mostly defined dental education in the category

level and per	sonality type													
Conceptual category	Sex n (%)		Education n (%)	al level				Occupation p n (%)	reference	PSS-10 n (%)			Personality ty n (%)	be
	Female	Male	First	Second	Third	Fourth	Fifth	Dentistry	Non-	Гом	Moderate	High	А	B
			Preclinica			Clinical			Dentistry					
Master- apprentice- training	51(8.1)	43(10.6)	36(17.2) ^a	11(4.5) ^b	11(5.6) ^b	21 (9.2) ^{ab}	15(9.5) ^{ab}	39(6.9)	55(11.6)	8(11.3)	75(10.0)	11(5.0)	28(7.6)	66(9.9)
Challenging process-race	204(32.3)	111(27.3)	52(24.9)	76(31.0)	61(31.0)	74(32.3)	52(32.9)	171(30.3)	144(30.4)	14(19.7)	219(29.3)	82(37.4)	116(31.4)	199(29.7)
Art-skill- creativity	103(16.3) ^a	92(22.7) ^b	55(26.3) ^a	50(20.4) ^a	41(20.8) ^a	25(10.9) ^b	25(15.8) ^b	104(18.4)	92(19.5)	16(22.5)	141(18.9)	38(17.4)	62(16.8)	133(19.9)
Patience- Iabour	104(16.5) ^a	42(10.3) ^b	24(11.5)	37(15.1)	34(17.3)	34(14.8)	16(10.1)	82(14.5)	63(13.3)	14(19.7)	102(13.6)	30(13.7)	63(17.1)	83(12.4)
Union of dif- ferences	55(8.7)	36(8.9)	21(10.0)	23(9.4)	19(9.6)	18(7.9)	10(6.3)	57(10.1)	34(7.2)	5(7.0)	70(9.4)	16(7.3)	26(7.0)	65(9.7)
Discipline- order-power	41(6.5)	30(7.4)	3(1.4) ^a	16(6.5) ^{ab}	11(5.6) ^{ab}	23(10.0) ^b	18(11.4) ^b	44(7.8)	27(5.7)	6(8.5)	47(6.3)	18(8.2)	27(7.3)	44(6.6)
Unknowabil- ity-incompre- hensibility- indispensa- bility	74(11.7)	52(12.8)	18(8.6)	32(13.1)	20(10.2)	34(14.8)	22(13.9)	68(12.0)	58(12.3)	8(11.3)	94(12.6)	24(11.0)	47(2.7)	79(11.8)
Total	632(60.9)	406(39.1)	209(20.0)	245(23.6)	197(19.0)	229(22.1)	158(15.2)	565(54.4)	473(45.6)	71(6.8)	748(72.1)	219(21.1)	369(35.5)	669(64.5)

Table 2 Crosstabulation of the dental students' methaphorical perceptions (conceptional category) of dentistry education by sex, grade level, occupation preference, PSS-10 <u>S</u>

* Pearson Chi-Square test using Monte Carlo method p-value derived from Chi-Square Analysis

* Fisher-Friedman-Halton Exact test using Monte Carlo method, Based on 10000 sampled tables with starting seed 2000000, Bold p-values signify statistically significant associations (p<0.05)

p=0.187* (95% Cl:0.177–0.192)

p=0.127** (95% CI:0.148-0.163)

p=0.084* (95% Cl:0.0076-0.0087)

p<**0.001**** (95% Cl:<0.001-<0.001)

p=**0.013*** (95% CI:0.011-0.015)

^{a-b} There is a difference between column categories that have different letters for each row, There is no lettering between columns that do not have a significant difference for each row

Abbreviations: PSS Perceived Stress Scale, CI Confidence Interval

of 'challenging process-race' (30.3%) and (30.4%), respectively. In terms of PSS level, the participants with high stress levels defined dental education in the category of 'challenging process-race'.

There was no statistically significant difference between the groups in terms of personality type inventory scores (p=0.187). However, participants with high scores (Type A) more frequently employed metaphors categorized under 'patience-labor' when describing dental education compared to those with low scores (Type B). Conversely, participants with low scores (Type B) more frequently used metaphors categorized under 'unknowability-incomprehensibility-indispensability' compared to those with high scores (Type A). Nevertheless, the most commonly employed metaphors by participants of both personality types to describe dental education were categorized under 'challenging process-race'.

Table 3 summarizes the results of the linear regression analysis between the PSS score, age, and personality type score. The regression model was found to be statistically significant (F=12.629, p<0.001, p=0.011). Age had a significant effect on the PSS score (p < 0.001), with a oneunit increase in age leading to a 0.360 increase in the PSS score. Similarly, personality type had a significant effect on the PSS score (p < 0.001), where a one-unit increase in the personality type score resulted in a 0.027 increase in the PSS score. Age and personality type together accounted for 2.2% of the variation in students' PSS scores. A very weak positive relationship was observed between the PSS score and both age and personality type score (Zero-order values: 0.133 and 0.083, respectively). Partial correlation analysis also indicated a very weak positive relationship between the PSS score and age, as well as between the PSS score and personality type score (Partial values: 0.130 and 0.079, respectively).

Discussion

There is a consensus in the dental education literature that students' perceptions of their education should be considered [36]. In the existing literature, there is no specific study examining the direct relationship of metaphor perception with stress level and personality type. However, relatively few studies of dental education have focused on students' perceptions of their learning experiences and environments [17, 37]. In a previous study that determined dental students' perceptions of the pediatric dentistry clinic through metaphors, as a result of the metaphors collected in 4 conceptual categories, the researchers concluded that metaphor analysis is a useful measurement tool in determining students' perceptions [38]. Another previous study investigated the thoughts and meanings of medical faculty and dentistry faculty students towards anatomy course through metaphors. The researchers concluded through metaphors that this course is a great burden on students and a source of stress [30]. An important methodological contribution and strength of this study is the use of metaphor analysis, a qualitative method that is relatively unknown and uncommon in the dental literature [32]. This technique helps to uncover the nuanced and often hidden beliefs of participants, providing a multifaceted understanding of their views [28, 32]. The findings of this study are expected to add a new and valuable dimension to the literature on dental education, shedding light on students' experiences and perceptions from an innovative angle.

Contemporary dental education demands that students possess a variety of qualities, including robust theoretical knowledge, strong social communication skills, and the ability to complete demanding clinical training [39]. The process of attaining these educational objectives is markedly different from the life experiences students have encountered prior to entering dental school. As a result of these differences, in the present study, the majority of metaphors generated by students to describe dental education were categorized under the 'challenging process-race' category. This categorization underscores the demanding nature of dental education and the significant challenges students face.

Previous research highlights that dental students frequently express concerns about the lack of user-friendliness within the dental school environment, the persistent ranking and comparison of students, and the rigidity of the dental school structure [40]. Furthermore, the transition from preclinical to clinical training in dental education significantly reduces students' leisure time and shifts them from the secure classroom environment to a more stressful setting. This transition involves increased responsibilities, which are significant stress factors

Table 3 Linear regression analysis results between PSS score and age and personality type score

	B (%95 CI)	Beta	t	р	Zero-order	Partial
Constant	11.936 (7.945–15.928)		5.868	<0.001		
Age	0.360 (0.193–0.526)	0.130	4.231	<0.001	0.133	0.130
Personality Type score	0.027 (0.006–0.047)	0.078	2.542	0.011	0.083	0.079

B: Unstandardized coefficient, Beta: Standardized coefficient, F=12.629, p<0.001, Adjusted R²=0.022, Standart Error=6.073 Abbreviations: PSS Perceived Stress Scale

contributing to heightened emotional tension. In the present study, it was observed that as students progressed in their education, they more frequently categorized dental education under 'discipline-order-power.' This finding aligns with the existing literature, indicating that clinical students, in particular, feel under constant supervision, with this perception intensifying as they advance through their education [41]. However, among all the categories, 'discipline-order-power' was the least utilized category, indicating that this perception is not very common among the students.

Evaluating seven categories formed from the metaphors reflecting the students' perceptions of dental education reveals that these categories can be classified as structural-oriented, process-oriented, and outcome-oriented. The categories 'master-apprentice training' which illustrates the traditional and structured nature of education, and 'discipline-order-power' which expresses the rigid and regulatory aspects of education, can be classified as structural-oriented. The categories 'challenging process-race' which highlights the competitive and demanding nature of education, and 'patience-labor' which describes the nature of education requiring intensive work and effort, can be combined into the processoriented category. The categories 'art-skill-creativity' symbolizing the aspects of education that encourage creativity and skill development, 'union of differences', which signifies the capacity of dental education to integrate various perspectives and talents, and 'unknowability-incomprehensibility-indispensability, which describes the complex and indispensable outcomes of education, can be classified as outcome-oriented. This classification can help in understanding the different dimensions of the educational process and enable educators to develop more specific strategies targeting these dimensions.

There are differences between men and women in terms of personality traits, career choices, and skills [42]. Men are typically depicted as competitive, independent, rude, dominant, and insensitive. Conversely, women are often perceived as embodying traits such as compassion, concern, dependency, emotionality, sensitivity, and submissiveness. Moreover, there is a common notion that men are inclined towards activities focused on objects, while women are more inclined towards activities centered on people [43]. However, these characteristics, which are generalized for men and women, may vary across different geographical regions and cultural contexts. Differences also exist in how educational experiences are perceived by the two sex [44]. The results of the present study align with existing literature, indicating that there are sex differences in the perception of dental education. Notably, female students tend to emphasize qualities such as patience and hard work and are significantly represented in the 'patience and labour' category. Conversely, male students show a stronger preference for ability related qualifications and are significantly represented in the 'art-skill-creavity' category.

The importance of documenting student perceptions of the strengths and weaknesses of the dental education system has been reported in previous studies [37, 45]. The primary objective of preclinical education in dental schools is to develop the fine motor hand skills and visualization abilities necessary for performing clinical dental procedures and being recognized as competent professionals [46]. In the present study, the metaphor category of 'art-skill-creativity' showed a significantly higher distribution at the preclinical education level than at the clinical education level. The reason for the high number of metaphors in the 'art-skill-creavity' category in the 1st, 2nd, and 3rd grades is thought to be due to the fact that sculpting works such as plaster and wax are more related to art and skill in preclinical education. In addition, the use of the metaphorical categories of 'disciplineorder-power' increased as the grade level increased. In consistent with our results, a previous study interpreted that as they moved to higher grades, their self-confidence increased and they had no problems in expressing their opinions, which led them to look at their environment more critically [18]. In the current study, it could be concluded that that students at the clinical level felt stronger with this increase in self-confidence supports this result.

The motivations behind students choosing dentistry as their first choice or for other reasons affect their perceptions of dental education [45]. A previous study showed that students who do not choose dentistry as their first choice experience higher levels of occupational stress and dissatisfaction [47]. Unlike previous literature, this study found no statistically significant difference in the metaphor categories formed among groups based on their order of professional preference. However, it was observed that students whose first professional choice was not dentistry produced more metaphors in the 'master-apprentice-training' category. This can be interpreted as these students having a greater need to consult a mentor at every stage of their educational process.

There are three commonly used instruments for measuring stress: The Stress Assessment Scale, the Impact of Event Scale and the PSS, which is the most frequently used [48]. It was originally created as a 14-item scale that assessed participants' perceptions of stressful events and situations experienced in the previous month [49]. Later, shorter versions, the PSS-4 and PSS-10, were developed. In our study, we preferred the PSS-10 because of the possibility that participants might get bored and distracted by the large number of questions. On the other hand, we thought that the PSS-4 was not sensitive enough to measure stress levels. In the current study, the difference between the groups in terms of PSS was significant and the metaphors in the category of 'challenging processrace' were used more by students with high stress levels. Furthermore, there was a very weak positive correlation between age and PSS scores. Dentistry undergraduate programmes constitute a stressful and challenging learning environment due to the acquisition of clinical skills, patient care responsibility and the process of passing the class [50]. It should be taken into consideration that this situation is the reason for the prevalence of this metaphor among dental students. In contrast to this study, a previous study evaluating the psychometric properties of the perceived stress scale with business and accounting students reported that PSS scores decreased with age [51]. The fact that the first years of the education process in faculties other than health are more challenging than the last years can be interpreted as a reason for this. Additionally, this difference may be due to country, living conditions and cultural differences.

Several studies have shown that stress levels increase with the progression of students' level of training (from preclinical to clinical) in dental programmes [19, 52, 53]. Due to the different demands in each year of the programme, sources of stress also vary [53]. Preclinical students state that examinations and fear of failure are the biggest source of stress, while clinical students state that clinical training and its requirements are the main stressors [52]. Naidu et al. [54] and Kumar et al. [55] also found that students' stress levels gradually increased during the first year of their undergraduate programmes, reaching a peak in the third year of the five-year programme. This may be attributed to the transition from preclinical to clinical training in the third year, during which students encounter changes in the learning environment and teaching methods.

The concept of personality, which can be defined in many different ways in many different sources, has been tried to be explained by various theories by researchers [23]. The results of the current study align with the literature, revealing a significant difference in the 'patiencelabour' category based on personality type. Specifically, it was observed that students with Type A personalities were more likely to create this metaphor category compared to students with Type B personalities. Additionally, in the current study, personality type was found to have a significant effect on PSS and personality type score. Consistent with this finding, Varo et al. [56] reported that personality typology has provided valuable information about individuals' differences in coping with academic stress, and it has been shown that this information can help to guide specific strategies for managing stress.

The findings of the present study are limited to a specific population, namely undergraduate dental students. The first limitation of the study is its focus exclusively on undergraduate dentistry students studying at only three different dentistry faculties in Türkiye, excluding perspectives from graduates and postgraduate students. Including these groups in future research could provide a more comprehensive understanding of metaphorical views on dental education across different stages of professional development. The second limitation is that the study has a cross-sectional design and therefore may limit the assessment of causality. However, the methodology and conceptual themes described in this study can be a reference for further longitudinal studies that will also investigate causal and mediating relationships. Finally, the potential influence of various factors, including geographical and cultural differences, on participants' perceptions should be further examined in subsequent studies.

For future research, students could be asked to focus on and produce two types of metaphors, an experiential image and an imagined idealised image. Comparing these two metaphors may provide avenues for understanding the discrepancies between 'real' and 'idealised' images of education in the dental education system. Such studies could contribute to the development of more individualized and effective teaching methods in dental education. In addition, studies to be conducted with graduate students as well as undergraduate students can provide information on whether the opinions of individuals in different academic level have a positive or negative effect on their success in business life. On the other hand, by considering students' personality types and stress levels, a more flexible, personalized, and psychology supportive curriculum can be developed in dental education. When educational processes are designed to be more student-centered, adaptable, and cognitively accessible, they can better prepare future dental professionals by enhancing their awareness, resilience, and motivation. Therefore, restructuring the curriculum and educational framework to account for students' cognitive representations and individual differences is of paramount importance.

Conclusion

The data obtained from this study and the identified conceptual categories can play an important role in designing educational activities aimed at understanding and enhancing dental students' perceptions. Considering the students' personality types and stress levels, understanding their perceptions of dental education can help them develop more positive and sustainable views in their professional lives. Additionally, this study concluded that metaphor analysis is an effective tool for identifying dental students' perceptions. Future studies involving more participants from different dental schools, cities, and countries could increase the generalizability of the results and reveal the impact of cultural differences on educational perceptions.

Abbreviations

PSS Perceived Stress Scale STROBE Strengthening the Reporting of Observational Studies in Epidemiology

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Clinical trial number

Not applicable.

Authors' contributions

Conceptualization: S.A., A.T.E.A., E.D., B.B.; Methodology: A.T.E.A., E.D., B.B.; Software: A.T.E.A., E.D.; Validation: A.T.E.A., E.D., Investigation: A.T.E.A., E.D.; Resources: A.T.E.A., E.D.; Data curation: A.T.E.A., E.D., S.A.,; Writing – original draft preparation: A.T.E.A., E.D.; Writing – review and editing: A.T.E.A., E.D., S.A., B.B.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The research protocol received approval from the Ethics Committee of Nuh Naci Yazgan University, 2023/010–001, ensuring compliance with the contemporary ethical standards delineated in the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

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