Kocatepe Veterinary Journal

Kocatepe Vet J. (2024):17(4):359-367

DOI: 10.30607/kvj.1479278

RESEARCH ARTICLE

Development of a Scale to Assess Veterinary Medicine Students' Attitudes Toward Biochemistry Course

Abdurrahman Fatih FİDAN[1], İjlal OCAK[2], Gülcan AVCI[1], Barış DENK[1*]

[1]*Department of Biochemistry, Faculty of Veterinary Medicine, Afyon Kocatepe University, Afyonkarahisar, Türkiye*
[2]*Department of Science Education, Faculty of Education, Afyon Kocatepe University, Afyonkarahisar, Türkiye*

ABSTRACT

Biochemistry stands as a pivotal subject in the curriculum of veterinary medicine education, warranting an assessment of veterinary students' attitudes towards this course. This study aims to develop a scale to gauge veterinary students' sentiments regarding biochemistry. The sample comprises 220 students enrolled in a veterinary medicine program. Initially, a preliminary test form with 49 items was created through a thorough review of relevant literature and expert consultation. A pre-test form was administered to 20 veterinary students to assess item clarity, grammar, and response duration, followed by necessary adjustments. Subsequently, the trial form was distributed to the 220 enrolled students. The data collected were analyzed, revealing a Kaiser-Meyer-Olkin (KMO) value of 0.794, indicating the adequacy of the scale. Exploratory factor analysis showcased factor loadings ranging from .582 to .812. Moreover, a reliability analysis demonstrated a Cronbach's Alpha coefficient of .761, surpassing the threshold of .70, signifying the scale's reliability. Thus, based on the findings, it can be concluded that the scale developed is both valid and reliable for assessing veterinary students' attitudes towards biochemistry.

Keywords: Attitude, Biochemistry, Scale development, Veterinary medicine

***

Veteriner Hekimliği Öğrencilerinin Biyokimya Dersi Konusundaki Tutumlarını Değerlendirmek İçin Bir Ölçeğin Geliştirilmesi

ÖZ

Veteriner hekimlik eğitiminde, biyokimya temel bir ders olarak kabul edilir. Bu nedenle, veteriner hekimlik öğrencilerinin biyokimya dersine karşı davranışları ve duyarlılıkları, bu dersle ilgili tutumlarının ölçülmesini gerektirir. Bu araştırmanın amacı, veteriner hekimlik öğrencilerinin biyokimya dersine yönelik tutumunu ölçen bir ölçek geliştirmektir. Örneklemini, veteriner hekimlik fakültesinde eğitim gören 220 öğrenci oluşturdu. Araştırma kapsamında, öncelikle ilgili literatür tarandı, bir soru havuzu oluşturuldu ve 49 maddeden oluşan bir ön test formu uzman görüşü alınarak hazırlandı. Bu ön test formu, ölçek maddelerinin anlaşılabilirliği, dilbilgisi ve cevap süresi gibi faktörler açısından değerlendirilmek üzere 20 veteriner fakültesi öğrencisine uygulandı ve gerekli düzenlemeler yapılarak deneme formu veteriner fakültesindeki ve devam eden 220 öğrenciye uygulandı. Elde edilen veriler bilgisayar ortamına aktarılarak analiz edildi. Ölçeğin Kaiser-Meyer-Olkin (KMO) değeri .794 olarak belirlendi. Yapılan açıklayıcı faktör analizi sonucunda, ölçek maddelerinin faktör yüklerinin .582 ile .812 arasında değiştiği görüldü. Ayrıca, 16 maddeden ve 4 alt boyuttan oluşan bir ölçek elde edildi. Cronbach Alfa iç tutarlılık ve güvenirlik katsayısı .761 olarak bulundu. Bu değer, Cronbach Alfa katsayısı .70'in üzerinde olduğu için gelişitirilen ölçeğin güvenilir olduğunu göstermektedir.

Anahtar kelimeler: Biyokimya, Ölçek geliştirme, Tutum, Veteriner Hekimliği

To cite this article: Fidan A.F. Ocak İ. Avcı G. Denk B. Development of a Scale to Assess Veterinary Medicine Students' Attitudes Toward Biochemistry Course. Kocatepe Vet J. (2024):17(4):359-367

Submission: 06.05.2024 **Accepted**: 09.10.2024 **Published Online**: 25.11.2024

ORCID ID; *AFF: 0000-0003-1443-9025, İO: 0000-0001-6976-5747, GA: 0000-0001-8767-4507, BD: 0000-0002-7586-0895*
*Corresponding author e-mail: bdenk@aku.edu.tr

INTRODUCTION

Biochemistry is an interdisciplinary field where experts from various professions such as chemists, physicists, biologists, medical doctors, veterinarians, dentists, pharmacists, agronomists, etc., collaborate (Yeğin 1973). It is an essential subject in medical education, requiring students to understand organismal functions at macroscopic, microscopic, and especially submicroscopic (molecular) levels. However, transitioning between these organizational levels can be challenging for students (Basağa et al. 1994; Schönborn and Anderson 2006).

Awareness of how genetic and environmental factors influence the biochemical aspects of the human body is crucial for modern medical practice, as medical advancements parallel developments in biochemistry. Despite its importance, many medical students and practitioners perceive biochemistry as unnecessary, viewing it as burdensome with minimal relevance to daily medical practice (Afshar and Han 2014). Many students entering medical faculties have already received introductory biochemistry education in high school, leading to biases and a lack of appreciation for the subject. However, integrating prior knowledge with medical applications is indispensable in medical education (Bottomley and Denny 2011).

A study emphasizes the need for biochemistry education in aligning with medical problems encountered in students' future careers, advocating for student-centered and problem-based teaching methods to bridge the gap between theoretical knowledge and clinical practice (Moreland 1996). Clinical decisions in medical diagnosis, prognosis, and treatment heavily rely on objective assessments conducted in clinical biochemistry laboratories. Technological advancements have streamlined biochemical analyses, enhancing the laboratory's significance in healthcare (Sönmez 2013).

Educational institutions in healthcare tailor curricula and strategies to facilitate active learning, enabling students to apply acquired knowledge comprehensively in their professional lives (Surapaneni 2010; Nair et al. 2013). Attitude and motivation are crucial in science education, influencing student success. Attitude towards a subject is a complex sensory attribute that guides behavior and decision-making, affecting learning outcomes (Huyugüzel Çavaş and Çavaş 2014; Najdi 2013). Educational institutions continually update teaching strategies to adapt to evolving needs, emphasizing the assessment of students' attitudes towards subjects as a vital aspect of curriculum design (Pehlivan and Köseoğlu 2011). In medical education, understanding students' attitudes towards biochemistry is essential for educators to enhance student engagement and foster positive attitudes towards the subject (Kaya 2013).

This study aims to develop a measurement tool to assess the attitudes of veterinary medical students towards Biochemistry. Given the lack of such a tool in the literature, this research seeks to address this gap by developing a specific measurement instrument.

MATERIAL and METHOD

In this study, validity and reliability procedures were conducted to develop a scale measuring the attitudes of veterinary medical students towards the Biochemistry course. The scale was designed in accordance with the five-point Likert scale model (Köklü, 1995) and the general survey model has been employed in this study. To ensure validity, content validity was assessed through expert opinion, while construct validity was evaluated using exploratory factor analysis (EFA). For reliability, the internal consistency of the scale was measured using Cronbach's Alpha coefficient. Both methods were applied to confirm the robustness of the scale before use.

Sample group

The study group comprised a total of 220 veterinary medical students who took the Biochemistry course at Afyon Kocatepe University Faculty of Veterinary Medicine during the 2017-2018 academic year. Among these students, 73 were female, and 147 were male. Kline (1994) suggested that a group of 100 people would be sufficient for the study (Pearson and Mundform, 2010). Therefore, the size of the sample has been decided as sufficient.

Scale Development Process

Item Pool Formation Stage

During this stage, research related to scale development was conducted by the project team. Based on a literature review and data obtained from student interviews, a pool of potential items for the scale was created. The scale was decided to be a five-point Likert scale, with ratings ranging from "Strongly Agree" to "Strongly Disagree" (Table 7). It has been ensured that a balanced number of positive and negative items, resulting in a draft scale consisting of 49 items.

Expert Consultation and Pilot Testing Stage

The questions in the item pool were evaluated by a panel of experts consisting 3 person in Biochemistry and curriculum development and assessment. Based on the experts' feedback on the items, the draft scale was revised, resulting in a 49-item scale comprising five dimensions. In the pilot testing stage, the scale was administered to 20 randomly selected veterinary medical students at Afyon Kocatepe University Faculty of Veterinary Medicine. Following the pilot testing, the clarity, comprehensibility, and completion time of the scale were assessed, and necessary adjustments were made to finalize the draft scale.

Final Testing Stage

The developed 49-item five-point Likert scale was administered to a total of 220 veterinary medical students who had taken the Biochemistry course at Afyon Kocatepe University Faculty of Veterinary Medicine during the 2017-2018 academic year. Students were informed about the research purpose of the administration and the importance of providing sincere responses regarding their attitudes towards the Biochemistry course. Subsequently, data analysis for scale development commenced with a sample size of 220.

A crucial aspect of factor analysis is the adequacy of the sample size for analysis. Different scholars have expressed varying opinions regarding the required sample size for factor analysis. For instance, while Nunnally (1978) suggests that the sample size should be ten times the number of items for factor analysis, Kass and Tinsley (1979) report the necessity for the sample size to be 5 to 10 times the number of items if the sample size is below 300. Comrey and Lee (1992) evaluate the sample size as weak if below 100, appropriate if around 200, good if around 300, very good if around 400, and excellent if 1000 or more.

Data Analysis

Validity Analyses

Factor analysis was employed for the validity assessment of the measurement tool in the study. Factor analysis is a multivariate analysis technique that elucidates many intercorrelations, structurally grouping correlated items into relatively independent factors. Exploratory factor analysis is conducted when attempting to reveal new structures or functional definitions of concepts using factor loading values of items (Büyüköztürk 2005).

Additionally, the suitability of data for factor analysis is determined by the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. The KMO test assesses the adequacy of sampling, ranging from 0 to 1, while Bartlett's Sphericity Test indicates the possibility of factor analysis if the significance value is below 0.05. Thus, if the KMO measure is above 0.6 and Bartlett's Test is significant, it suggests the suitability of data for factor analysis (Büyüköztürk 2008).

Reliability Analyses

The reliability of a test or measurement tool is associated with how accurately it measures what it is intended to measure. Cronbach's Alpha coefficient was utilized to assess the reliability of Likert-type scales. Cronbach's Alpha coefficient provides information regarding the internal consistency/homogeneity of the adapted scale and its subscales.

Data analysis in the study was conducted using statistical software, with a significance level set at < 0.05 for all statistical analyses.

RESULT

In order to determine the grouping of items (factors) primarily for the validity study, factor analysis was conducted. During the factor analysis, KMO and Bartlett values were determined, followed by principal component analysis, and finally, varimax rotation procedures were performed.

Evaluation of Suitability for Factor Analysis of the Data

The KMO measure obtained in this study is 0.794, indicating a high value. Additionally, the Bartlett's test of sphericity yielded a significant chi-square value, affirming the appropriateness of the data for factor analysis. Based on the results of the preliminary analysis conducted to determine the suitability of the data for factor analysis, the KMO value was found to be 0.794, and the Bartlett's Test of Sphericity yielded a significant result ($p < 0.05$). The chi-square value was 3691.043 with 1176 degrees of freedom (Df) (Table 1).

Table 1. Results of KMO and Bartlett Test

Kaiser-Meyer-Olkin (KMO) coefficient		0.794
Bartlett Sphericity Test	Approx. Chi-Square	3691.043
	Degree of freedom	1176
	Significance	0.000

Determination of Factor Number and Identification of Factor Items

The analysis of the scale consisting of 49 items was initiated through factor analysis. According to the obtained data, it was observed that some items in the scale had low factor loadings while others loaded onto multiple factors. Items with factor loadings less than 0.40 and a difference of less than 0.10 between the two largest values were excluded from the scale, resulting in 33 items being removed through factor analysis. To determine the number of factors that could indicate the correlation among items, the Scree plot graph, eigenvalues, and variance percentages

were utilized (Çokluk et al. 2012). Based on the main breaking points on the Scree plot graph, the scale was restricted to four factors. After determining the number of factors in the scale, the distribution of items across factors was investigated. The remaining items formed 4 factors. As a result of the item removal process, the contributions of the first, second, third, and fourth sub-dimensions to the total variance after rotation were 16.225%, 14.046%, 13.818%, and 11.130%, respectively. Through factor analysis, it was observed that the total variance explained by the 4 factors obtained was 55.217%.

To determine which factors exhibit strong correlations with the items, a rotated component matrix was constructed, and the congruence and factor loading values of the items were examined. The table and Scree plot graph regarding eigenvalues and variance percentages are provided below (Figure 1 and Table 3).

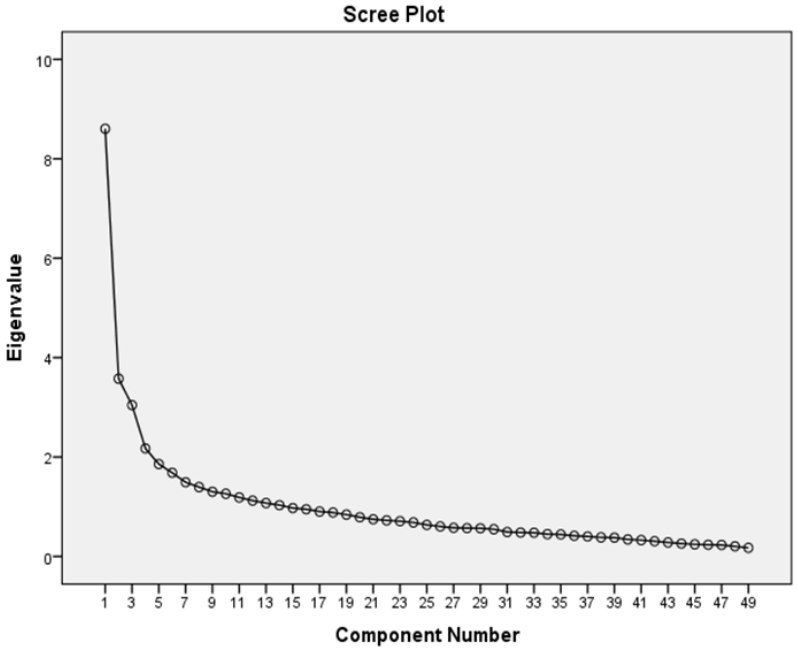

Figure 1: Line graph of attitude scale

In this study, the varimax (orthogonal rotation) method was employed for factor analysis. It is observed that the remaining items contribute to 55.217% of the total variance. Upon examining Table 2, it is noted that factor loadings range between .582 and .812. According to the analyses conducted, the first factor comprises items related to interest in the course, including items numbered 8, 14, 22, 9, and 13 (new item numbers: 1, 2, 3, 4, and 5), forming the interest subscale. The factor loadings of these 5 items range from .627 to .812, with item-total score correlations ranging from .328 to .632.

Additionally, the second factor pertains to expressions concerning laboratory work in the course, encompassing items numbered 43, 47, 26, and 37 (new item numbers: 6, 7, 8, and 9), forming the Application subscale. The factor loadings of these 4 items range from .582 to .807, with item-total score correlations ranging from .259 to .385.

Furthermore, the third factor addresses concerns related to the course, comprising items numbered 4, 5, 2, and 35 (new item numbers: 10, 11, 12, and 13), forming the Anxiety subscale. The factor loadings of these 4 items range from .623 to .809, with item-total score correlations ranging from .328 to .372.

Lastly, the fourth factor concerns the importance attributed to the course, consisting of items numbered 24, 15, and 16 (new item numbers: 14, 15, and 16), forming the Importance subscale. The factor loadings of these 3 items range from .618 to .786, with item-total score correlations ranging from .203 to .312.

As presented in Table 2, the contributions of the factors to the total variance are as follows: 16.225% for the first factor, 14.046% for the second factor, 13.817% for the third factor, and 11.130% for the fourth factor, totaling 55.217%. Acceptance of a variance explained between 40% and 60% is deemed sufficient in multifactorial designs (Çokluk et al. 2012).

Table 2. Rotated component matrix table of the attitude scale

Item Pool No	New Item No	F1	F2	F3	F4	Item Total Correlation	Common Factor Variance
M8	**1**	.812				.409	**.670**
M14	**2**	.717		.328		.448	**.635**
M22	**3**	.639				.366	**.447**
M9	**4**	.632	.321			.632	**.610**
M13	**5**	.627				.328	**.429**
M43	**6**		.807			.335	**.657**
M47	**7**		.733			.259	**.553**
M26	**8**		.693			.385	**.518**
M37	**9**		.582			.356	**.462**
M4	**10**			.809		.328	**.675**
M5	**11**		.464	.662		.344	**.501**
M2	**12**	.343	.370	.653		.372	**.606**
M35	**13**			.623		.344	**.434**
M24	**14**				.786	.203	**.630**
M15	**15**				.690	.312	**.537**
M6	**16**		.787		.618	.287	**.471**
Eigenvalue		3.685	1.939	1.752	1.458	**Total variance**	**55.217**
Explained Variance		**16.225**	**14.046**	**13.817**	**11.130**		

Reliability Findings for the Scale

Reliability analyses for the subscales and the overall scale, based on the final version comprising 16 items, are presented in Table 3. Upon examining Table 3, the Cronbach's alpha coefficient for the 1st factor is 0.757, for the 2nd factor it is 0.701, for the 3rd factor it is 0.674, and for the 4th factor it is 0.575. The total Cronbach's alpha value for the scale is 0.761.

Table 3. Number of items and Cronbach's alpha reliability coefficients for the attitude scale

Factors	Item Count	Cronbach's Alpha
1st Factor	5	0.757
2nd Factor	4	0.701
3rd Factor	4	0.674
4th Factor	3	0.575
Total	16	0.761

The environmental and correlation coefficients related to the factors in the attitude scale towards biochemistry course for veterinary medicine students are provided in Table 4. In Table 4, the second, third, and fourth factors show positive low-level significant correlations of .309, .304, and .181, respectively, with the total score, indicating a significantly reliable positive relationship of .752. The first, third, and fourth factors exhibit positive low-level significant correlations of .309, .129, and .156, respectively, with the total score, showing a significantly reliable positive relationship of .608. The first, second, and fourth factors demonstrate positive low-level significant correlations of .304, .129, and .218, respectively, with the total score, indicating a significantly reliable positive relationship of .659. The first, second, and third factors reveal positive low-level significant correlations of .181, .159, and .218,

respectively, with the total score, indicating a significantly reliable positive relationship of .536.

Table 4. Averages and correlation coefficients for sub-factors of the attitude scale

Factors	N	1st Factor	2nd Factor	3rd Factor	4th Factor	X	S.D.
1st Factor	220	-	.309	.304	.181	12.33	3.86
2nd Factor	220	.309	-	.129	.156	14.05	3.06
3rd Factor	220	.304	.129	-	.218	11.21	3.39
4th Factor	220	.181	.156	.218	-	8.60	2.57
Total	220	0.752	0.608	0.659	0.536	46.20	8.39

The arithmetic mean values for participants' responses to factors and the total score in the developed scale were 12.33, 14.05, 11.21, 8.60, and 46.20, respectively, with standard deviation values of 3.86, 3.06, 3.39, 2.57, and 8.39.

The top and bottom 27% group averages were determined based on the total score. Upper 27% (n = 59) and lower 27% (n = 59) groups were formed. A t-test was conducted to examine significant differences between the identified groups. The results regarding the discriminative capacity of the 16-item test are presented in Table 5. Based on the results presented in Table 5, it was found that all items were statistically significant at the 0.05 level between the upper and lower groups.

Table 5. Results of t-test for item means of scale items in lower and upper groups

Item Pool No	Groups	N	X	S.D.	t	p
M2	Upper Group	59	1.97	1.098	-6.620	.00
	Lower Group	59	3.34	1.154		
M4	Upper Group	59	2.10	1.140	-6.785	.00
	Lower Group	59	3.56	1.193		
M5	Upper Group	59	2.56	1.134	-6.159	.00
	Lower Group	59	3.80	1.047		
M6	Upper Group	59	2.31	1.193	-4.600	.00
	Lower Group	59	3.25	1.044		
M8	Upper Group	59	1.24	.506	-8.665	.00
	Lower Group	59	2.64	1.141		
M9	Upper Group	59	1.80	.761	-12.188	.00
	Lower Group	59	3.54	.795		
M13	Upper Group	59	2.02	1.042	-6.173	.00
	Lower Group	59	3.17	.985		
M14	Upper Group	59	1.78	.832	-9.919	.00
	Lower Group	59	3.39	.929		
M15	Upper Group	59	2.12	1.052	-5.838	.00
	Lower Group	59	3.37	1.272		
M22	Upper Group	59	1.61	.851	-7.135	.00
	Lower Group	59	3.02	1.252		
M24	Upper Group	59	2.49	1.165	-3.809	.00
	Lower Group	59	3.36	1.297		
M26	Upper Group	59	3.00	1.203	-6.020	.00
	Lower Group	59	4.12	.768		
M35	Upper Group	59	2.03	1.098	-6.613	.00
	Lower Group	59	3.31	.987		
M37	Upper Group	59	2.93	.980	-6.549	.00
	Lower Group	59	4.10	.959		
M43	Upper Group	59	2.97	1.231	-5.453	.00
	Lower Group	59	4.07	.944		
M47	Upper Group	59	2.90	1.199	-5.218	.00
	Lower Group	59	3.92	.896		

Naming of Factors

Upon evaluating the results in Table 6, it was observed that the items grouped under Factor 1 pertained to interest, those under Factor 2 related to application, those under Factor 3 reflected anxiety, and those under Factor 4 were indicative of the importance attributed to the course. Accordingly, these factors were named. The total score from the scale and its subscale are commented according to the highest and lowest point. Higher point shows a higher attitude and the lower point shows lower attitudes.

Table 6. Naming of factors

	ATTITUDE SCALE TOWARDS BIOCHEMISTRY COURSE AMONG VETERINARY MEDICINE STUDENTS	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
INTEREST						
1	I am considering pursuing postgraduate education in the Department of Biochemistry in the future.	□	□	□	□	□
2	I believe I am more eager to study for the Biochemistry course compared to other courses.	□	□	□	□	□
3	I think the hours allocated for the Biochemistry course are insufficient.	□	□	□	□	□
4	I enjoy reading studies related to Biochemistry.	□	□	□	□	□
5	I feel upset when I cannot attend or will not be able to attend the Biochemistry course.	□	□	□	□	□
PRACTICAL CLASS						
6	I believe that experiments conducted in the laboratory during practical sessions are beneficial for Biochemistry.	□	□	□	□	□
7	I feel that I am doing an important job when conducting experiments in the laboratory on Biochemistry topics.	□	□	□	□	□
8	I think that the practical hours of the Biochemistry course increase the efficiency of the course.	□	□	□	□	□
9	I believe that the knowledge I have gained in clinical biochemistry facilitates my understanding of the procedures and reasons for diagnosis and treatment of diseases.	□	□	□	□	□
ANXIETY						
10	I think Biochemistry is one of the subjects I am very afraid of.	□	□	□	□	□
11	Attending Biochemistry class makes me nervous.	□	□	□	□	□
12	Biochemistry class doesn't scare me.	□	□	□	□	□
13	No matter how much I study, I fail in Biochemistry exams.	□	□	□	□	□
IMPORTANCE						
14	I don't believe that what I learn in Biochemistry class will be useful in my medical profession.	□	□	□	□	□
15	I cannot establish a connection between the theoretical knowledge I learned in Biochemistry class and treating patients in practice.	□	□	□	□	□
16	I think other courses in Veterinary Medicine education are more important than the Biochemistry course.	□	□	□	□	□

Table 7. Score range of the developed scale

Range	Option
1.00-1.80	Strongly Disagree
1.81-2.60	Disagree
2.61-3.40	Undecided
3.41-4.20	Agree
4.21-5.00	Strongly Agree

DISCUSSION

The significant value of the KMO measure and the Bartlett's test of sphericity indicates that the factor analysis can continue to refine the scale development. With a chi-square value of 3691.043 and Df of 1176, the data demonstrate suitability for exploratory factor analysis.

Upon examining the scree plot graph, where eigenvalues are depicted on the vertical axis and

factors on the horizontal axis, it is observed that after the fifth point, the steep decline in variance contribution diminishes. The downward trend from the first point illustrates the degree of contribution to variance with points, and each interval between two points represents a factor (Çokluk et al. 2012). Even after the fifth point, the contributions of components to variance decrease, and additional variances' contributions appear to be close to each other.

Upon reviewing the factor loadings in the developed scale, it can be observed that all items exhibit high factor loading values. The scale comprising four factors reflects the headings formed as a result of literature review during the scale development stages.

Bayram (2004) reported that a Cronbach's Alpha value above 0.70 is sufficient for reliability. The analysis revealed a significant and positive relationship between groups at a highly reliable level. Thus, it can be concluded that the developed scale exhibits a highly reliable level of reliability.

When examining the mean and correlation coefficients for the Subfactors of the Attitude Scale, it is evident that there is a significant correlation between the developed scale and the factors themselves, as well as with the total score. These findings serve as evidence of construct validity.

CONCLUSION

In this study, a 49-item measurement tool developed to assess the attitudes of veterinary faculty students towards the biochemistry course was initially prepared as a pilot form for content validity by consulting experts. The pilot form, comprising 49 items, was administered to 20 veterinary faculty students to assess comprehensibility, grammar, and adequacy of response time, and necessary adjustments were made thereafter. Subsequently, the pilot form of the scale was administered to 220 students currently attending the veterinary faculty. Factor analysis was performed for the data collected through the scales, resulting in 16 items collected under four factors in the scale. In addition, reliability coefficients (Cronbach's α) for the entire scale and sub-dimensions, discriminative validity analyses at the item level, and inter-factor correlation analyses were calculated. According to the eigenvalue criterion in the developed biochemistry course attitude scale, the total variance explained by the four significant factors is 55.217%. Following Varimax rotation analysis, the factor loadings of the items range between .582 and .812. The identified factors were named as "interest," "application," "anxiety," and "importance," respectively. The Cronbach's α coefficient for the entire scale was calculated as 0.761, indicating the overall consistency of the scale since Cronbach's α coefficients above 0.70 signify the scale's internal consistency. The statistically significant differences found for all items in the discriminative analysis across the entire scale ($p < .05$) demonstrate the discriminative nature of the item scores. The positive significant correlation observed among all factors and between all factors and the total score in the correlation analysis indicates that all factors in the scale share the same underlying structure. Based on all these validity and reliability procedures, it is concluded that this scale is a valid and reliable measurement tool that can be used to determine veterinary faculty students' attitudes towards the biochemistry course.

Conflict of interest: The authors have no conflicts of interest to report.

Authors' Contributions: AFF and İO contributed to the project idea, design and execution of the study. AFF, İO and GA contributed to the acquisition of data. AFF and İO analysed the data. AFF, İO, GA, and BD drafted and wrote the manuscript. AFF, İO, GA, and BD reviewed the manuscript critically. All authors have read and approved the finalized manuscript.

Ethical approval: This study is not subject to the permission of HADYEK in accordance with the "Regulation on Working Procedures and Principles of Animal Experiments Ethics Committees" 8 (k). The data, information and documents presented in this article were obtained within the framework of academic and ethical rules.

Acknowledgement: In this study would like to thank the Afyon Kocatepe University Scientific Research Projects Coordinatorship with the study entitled "Developing a Scale to Measure Veterinary Medicine Students' Attitudes toward Biochemistry Lessons", Project No: 18.KARİYER.124.

Explanation: We have presented as an oral presentation at the Hands-on science: advancing science, improving education (2018).

REFERENCES

Afshar, M., Han, Z. (2014). Teaching and learning medical biochemistry: perspectives from a student and an educator. Medical science educator, 24(3), 339-341.

Anderson, L.W. (1988). Attitudes and their measurement educational research, methodology and measurement: An International Handbook (Ed: John P. Keeves), New York: Pergomon Pres.

Basağa, H., Geban, Ö., Tekkaya, C. (1994). The effect of the inquiry teaching method on biochemistry and science process skill achievements. Biochemical Education, 22(1), 29-32.

Bayram, N. (2004). Sosyal bilimlerde spss ile veri analizi, Ezgi Kitabevi, Bursa.

Bottomley, S., Denny, P. (2011). A participatory learning approach to biochemistry using student authored and evaluated multiple-choice questions. Biochemistry and Molecular Biology Education, 39(5), 352-361.

Büyüköztürk, Ş. (2005). Sosyal bilimler için veri analizi el kitabı: istatistik, araştırma deseni, spss uygulamaları ve yorum, Ankara: Pegem Akademi Yayıncılık.

Büyüköztürk, Ş. (2008). Veri analizi el kitabı, istatistik, araştırma deseni SPSS uygulamaları ve yorum, 9. Baskı, Pegem-AKADEMİ: 31(37): 167-182.

Can, A. (2013). Spss ile bilimsel araştırma sürecinde nicel veri analizi (1. Baskı), Ankara: Pegem Akademi.

Comrey, A. L., Lee, H. B. (1992). A first course in factor analysis. (2th Edition), Hillsdale, Lawrence Erlbaum Associates Publishers, New Jersey.

Çokluk, Ö., Şekercioğlu, G., Büyüköztürk, Ş. (2012). Sosyal bilimleriçin çok değişkenli istatistik: spss ve lisrel uygulamaları, Pegem Akademi Yayıncılık, Ankara.

Erkuş, A. (2003). Psikometri üzerine yazılar: ölçme ve psikometrinin tarihsel kökenleri, güvenirlik, geçerlik, madde analizi, tutumlar. Türk Psikologlar Derneği Yayınları, Ankara.

Huyugüzel Çavaş, P., Çavaş, B. (2014). Science teaching. Anagün, Ş.S. & Duban, N. (Ed.). Affective Characteristics in Science Education: Attitude and Motivation. Ankara: Anı Publishing.

Kass, R. A., Tinsley, H. E. A. (1979). Factor analysis. Journal of Leisure Research, 11, 120-138.

Kaya, M. F. (2013). Sürdürülebilir kalkınmaya yönelik tutum ölçeği geliştirme çalışması. Marmara Coğrafya Dergisi, sayı: 28, s. 175-193

Köklü, N. (1995). Tutumların ölçülmesi ve likert tipi ölçeklerde kullanılan seçenekler. Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi, 28(2), 81-93.

Moreland B. H. (1996). How much biochemistry should a good doctor know? Biochem. Educ. 24, 79–93.

Morgan, C.T. (1991). Psikolojiye giriş. 8. Baskı (Çev. Arıcı, H., Aydın, O. ve ark.), Ankara, Hacettepe Üniversitesi Psikoloji Bölümü Yayınları.

Nair, S. P., Shah, T., Seth, S., Pandit, N., Shah, G. V. (2013). Case based learning: a method for better understanding of biochemistry in medical students. Journal of clinical and diagnostic research: JCDR, 7(8), 1576.

Najdi, S. (2013). Students attitude toward learning chemistry. Journal of Al-Quds Open University for Educational and Psychological Research and Studies, 336(2316), 1-42.

Nunnally, J. C. (1978). Psychometric theory, NewYork: McGraw Hill.

Olatunde, Y. P. (2010). Class size and students' mathematics achievement of senior secondary schools in South-western Nigeria. The Social Sciences, 5(2), 108-112.

Oskamp, S., Schultz, P. W. (2005). Attitudes and opinions, Psychology Press.

Pearson, R. H., and Mundform, D. J. (2010). The recommended sample size for conducting exploratory factor analysis on dichotomous data. Journal of Modern Applied Statistical Methods, 9(2), 359-368.

Pehlivan, H., Köseoğlu, P. (2011). Fen lisesi öğrencilerinin kimya dersine yönelik tutumları ile akademik benlik tasarımlarının incelenmesi. Dokuz eylül Üniversitesi Buca Eğitim Fakültesi Dergisi, (29), 90-102.

Schönborn, K. J., Anderson, T. R. (2006). The importance of visual literacy in the education of biochemists. Biochemistry and molecular biology education, 34(2), 94-102.

Siragusa, L. Dixon, K. (2008). Planned behaviour: student attitudes towards the use of ıct interaction in higher education. Proceeding Ascilite, 942-951.

Sönmez, H. A. (2013). Geçmişten günümüze biyokimya laboratuvarı, hastalıkların tanı ve izlenmesinde biyokimya laboratuvarı. İstanbul Üniversitesi Cerrahpaşa Tıp Fakültesi Sürekli Tıp Eğitimi Etkinlikleri Sempozyum Dizisi No: 81, 1. basım.

Surapaneni, K. M. (2010). The effect of integrated teaching with case based learning (CBL) in the biochemistry of undergraduate medical curriculum. J Clin Diagn Res, 5, 3058-63.

Yeğin, M.M. (1973). Biyokimya eğitiminin bazı dış ülkelerdeki ve bizdeki durumları ile tavsiyelerimiz. 11-13 Kasım 1976, I. Ulusal Biyokimya Kongresi.