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Araştırma Makalesi– Research Paper

TURKISH VERSION OF THE ZOOM EXHAUSTION AND FATIGUE SCALE: VALIDITY AND RELIABILITY STUDY

ZOOM TÜKENMİŞLİK VE YORGUNLUK ÖLÇEĞİNİN TÜRKÇE VERSİYONU: GEÇERLİK VE GÜVENİRLİK ÇALIŞMASI

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Özet

Yüz yüze eğitim faaliyetleri son iki yıldır çevrimiçi ortamlara taşınmıştır. Video konferans sistemleri ile gerçekleştirilen eğitimde öğrencilerin tükenmişlik ve yorgunluk düzeylerinin belirlenmesi önemlidir. Risk grubunda yer alan öğrencilerin ekran yorgunluğunu ölçmek amacıyla "Zoom Tükenmişlik ve Yorgunluk Ölçeği" nin geçerlik ve güvenirlik çalışması yapılmıştır. Bu metodolojik ve tanımlayıcı araştırma 317 öğrenci ile gerçekleştirilmiştir. Ölçeğin psikometrik analizleri ve Türkçe'ye uyarlanması yapılmıştır. Araştırmaya %82,3'ü (n=261) kız olmak üzere toplam 317 öğrenci katılmıştır. Yaşlarının ortalaması 20,02±1,52'dir. Ölçeğin geçerlik ve güvenirlik analizleri sonucunda ölçek 15 madde ve 5 alt boyuttan oluşmaktadır. Doğrulayıcı faktör analizi sonuçları kabul edilebilir uyum iyiliği indekslerini göstermiştir. Ölçeğin Cronbach Alfa Katsayısı 0,89 olarak bulunmuştur. Ölçeğin uyarlanmış halinin güvenirlik ve geçerlik açısından iyi sonuçlar vermesi, öğrencilerin eğitiminde derslerde kullanılan video konferans sistemlerine bağlı oluşabilecek zoom yorgunluğunu ölçmek için kullanılabilecek uygun bir araç olduğunu kanıtlamaktadır.

Anahtar Kelimeler: Zoom, Yorgunluk, Ölçek, Geçerlik ve Güvenirlik, Hemşirelik

Abstract

Face-to-face education activities were transferred to online environments for the last two years. It is important to determine the exhaustion and fatigue levels of students in the education performed with video conferencing systems. The validity and reliability study was conducted to measure screen fatigue of students in the risk group of "Zoom Exhaustion and Fatigue Scale".

This methodological and descriptive study were conducted with 317 students. Psychometric analyses of the scale and its adaptation to Turkish were carried out. A total of 317 students, 82.3% (n=261) female participated in the research. The mean age was 20.02±1.52. The validity and reliability analyzes of the scale were determined to consist of 15 items and 5 subscales. Confirmatory factor analysis results indicated acceptable goodness-of-fit indices. The Cronbach's Alpha Coefficient of the scale was found to be 0.89. Turkish version of the scale is an appropriate tool which can be used to measure the zoom fatigue that may occur because of the video conferencing systems used in courses in the education of students.

Keywords: Zoom, Fatigue, Scale, Validity and reliability, Nursing

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1. INTRODUCTION

Scientists predicted that video conferencing technology would interrupt the progress of the traditional work, the practices of teaching and taking education, and the way that people socialize. Since the World Health Organization (WHO) proclaimed COVID-19 a pandemic (World Health Organisation, 2020, pp.1); measures such as curfews and closure of eating and drinking places were implemented to prevent the spread of Covid-19. As a result of all of these measures, it revealed the necessity that regular activities, which individuals usually did outside their homes such as work, the practices of teaching and taking education, should be performed at home (Nussbaumer-Streit et al., 2020, pp. 12-13). The outbreak of the pandemic having been going on for over a year has caused an enormous increase in the number of video conference meetings (Nussbaumer-Streit et al., 2020, pp 2-3). Because the use of zoom and video conferencing systems, which are easy to access such as zoom, are easy to use, the number of the users has rapidly increased and still continue to increase (Dean, 2020). While the number of users of Zoom, which was 10 million in March 2020, suddenly increased to 300 million in April, in the Zoom annual meeting records, the length of meeting time increased at a rate of 3300% in the third quarter of 2021 fiscal year when compared to the same quarter of the previous year (Iqbal, 2021). It is reported that a significant increase has occurred in the number of users of similar applications (Dean, 2020; Iqbal, 2021).

By ending face-to-face higher education on March 6, 2020 in Turkey, it was decided to continue education with distance education as of March 23, 2020 (YÖK, 2020). It was reported that the most commonly used video conferencing systems in synchronous lessons are Big Blue Button, Perculus, Microsoft Teams, Zoom and Google meeting platforms (Durak, Cankaya, Izmirli, 2020, pp. 789-790). The ubiquity of the Zoom platform has caused the genericization and made it popular to use the word "Zoom" as a verb instead of video conferencing.

In higher education, students who study at the departments in the Faculties of Health sciences in universities take theoretical and practical courses in the form of asynchronous and synchronous courses in distance education (Durak et al., 2020, pp. 790-791; Oducado et al., 2021, pp. 1-3). They spend a long time in front of the screen because of comprehensive education and training curriculum (Fauville et al., 2021a, pp. 1-26). When it comes to technology as a discussing situation, technology may generate some undesirable results as well as the opportunities it provides (Durak et al., 2020, pp. 788-789; Oducado et al., 2021, pp. 1-3). Although video conferencing methods are a basic tool for productivity, learning, and social interaction, attending video conferencing all day also increased mental and physical fatigue and exhaustion in individuals and brought the emergence of a new concept called "zoom fatigue" (Fauville et al., 2021a, pp. 1-2). Zoom Fatigue is a new concept describing the fatigue, anxiety and worry caused by excessive use of video call applications during the day (Fauville et al., 2021a, pp. 1-2). Although Live Video Conference applications are considered to be synchronous, these meetings are not fully synchronized and creates a delay of millisecond level

(Bloom et al., 2021, pp.2-3). The brain notices this delay, thinks that something is wrong, and tries to fix it. Besides voice, we use gestures and body movements in face-to-face communication, and try to read the reactions of the other party (Bailenson, 2021, pp. 1-2; Bloom et al., 2021, pp. 2-3). However, we do not have the clues of nonverbal communication in virtual platform (Bloom et al., 2021, pp. 2-3). For this reason, we give more attention to understand the facial expressions, the tone and level of voice, and body language (Bloom et al., 2021, pp 1-2; Oducado et al., 2021, pp. 1-3). Also, when we get together with people outside, happiness hormones such as dopamine and oxytocin are secreted in our bodies (Bloom et al., 2021, pp. 2-3). A big face and prolonged eye contact are perceived as a threat by our brain in video conversations, and causes cortisol (stress hormone) to be produced (Bloom et al., 2021, pp. 2-3). As far as is known, there are few studies that examined the psychological and physiological effects of this increase in video conferencing (Bailenson, 2021, pp 3-4; Fauville et al., 2021b, pp. 25; Oducado et al., 2021, pp. 5-6). As the term "Zoom Fatigue" rapidly spreads in the popular media, it may also become a part of the growing concerns about exhaustion due to the changes it creates in human psychology and physiology. The validity and reliability study was conducted to measure screen the fatigue and exhaustion associated with video conferencing in students in the risk group with the “Zoom Exhaustion and Fatigue Scale" (ZEF Scale), which was developed by Fauville et al. (2021, pp 2-3).

2. MATERIAL AND METHODS

2.1 Aim

The aim of the study was to test validity and reliability of the Zoom Exhaustion and Fatigue Scale (ZEF Scale).

2.2. Study Design

A scale adaptation to Turkish and cross-sectional validation study was conducted.

2.3. Participants

The sample of the study consisted of 317 students who were studying in the field of health sciences between May-June 2021 and voluntarily accepted to participate in the research. A purposive sample of students was recruited. The reason for reaching 317 students in the sampling number is that it was stated in the literature that the sampling size is inadequate up to 100, moderate up to 200, good up to 300 for scale development, validity, and reliability studies (Morgado, Meireles, Neves, Amaral, Ferreira, 2017, pp. 5-6; Watkins, 2018, pp. 219-246). The inclusion criteria for the study are to be a student in the faculty of health sciences and participate in a video conference at least once a day. Those who did not accept to participate in the study and those who were visually and hearing impaired were not included in the study.

2.4. Data Collection

The data collection tool of the study is an online questionnaire that consists of two sections. The first section of the questionnaire consists of socio-demographic questions. Age, gender, department, and video conferencing experience parameters were included in this section. The second section of the questionnaire was generated from the ZEF. The report of this study followed The CHERRIES Checklist (Checklist for Reporting Results of Internet E-Surveys) (Eysenbach, 2004, pp. 1-6).

The ZEF Scale was developed by Fauville et al. (2021, pp, 2-3). The scale measures exhaustion and fatigue feelings resulting from participating in video conference calls. The scale includes a 5-point Likert scale (1- Not at all, 5- Extremely), 15 items and 5 dimensions of fatigue (General Fatigue, Visual Fatigue, Social Fatigue, Emotional Fatigue, Motivational Fatigue). The ZEF scale was developed on university students. The Cronbach's alphas of the original scale were calculated (ZEF Score α = .95, general fatigue: α = .88, visual fatigue: α = .88, social fatigue: α = .84, motivational fatigue: α = .83, emotional fatigue: α = .86). (Fauville et al., 2021a, pp. 3-4).

2.5. Procedure

The reliable online questionnaire form creation links were examined by the researchers. The questionnaire sent to the sampling group was created with the "google forms" for the purpose of protecting the confidentiality of the data. It takes 5 minutes to complete the Google form. In total, each student was allowed to fill out the online form only once. The data of the study were collected with closed survey as online questionnaire form via students groups on WhatsApp between May 2021 and June 2021. The closed survey link was reminded twice a week via WhatsApp and the data form was asked to be answered online on a voluntary basis within a month.

2.6. Adaptation to Turkish

ZEF scale was adapted using the cross-sectional adaptation stages (Çapık et al., 2018, pp. 199-210). The scale was translated into Turkish by two experts independently of each other. Translations from experts were synthesized in a single file and discrepencies in translation were resolved. The first version of the scale in Turkish was generated by unanimously vote. After this version, the backward translation was performed by two native English translators. Expert opinions were obtained from 8 experts consisting of 3 Nursing Department faculty members, 2 Medical Education Department faculty members, 2 Computer and Instructional Technologies Education Department faculty members, and 1 Psychology Department faculty members. Content Validity Index (CVI) was determined by Davis Technique to evaluate the concordance scores given by the experts and Kendall Coefficient of Coefficient (W) was calculated (Bıkmaz Bilgen and Dogan, 2017, pp. 63-78).

2.7. Validity of ZEF scale

The pilot application of the scale was announced via WhatsApp student groups and the students were informed about the study. The aim of the pilot scheme is to check the content and comprehensibility of the scale. The ZEF Scale was applied over 30 students who wanted to voluntarily participate in the pilot scheme as an online questionnaire form with an interval of 15 days. The students were requested to use pseudonyms to ensure the anonymity of the data. 15 days after the first application was carried out, the application was repeated to assess whether the responses remained the same over time or not. After the test-retest application, the application results were calculated with the Pearson Moments coefficient and t-test analysis. Because of the normal distribution, Pearson Correlation Analysis was performed, and a strong positive significant relation (r:0.891, p:0.000) was found between the first application and the second application. T-test analysis was performed to see if there was a significant difference between the first application and the second application after 15 days, and no statistically significant difference was found (t: -1.209, p:0.237). After the pilot application, a descriptive study was conducted with the participation of 317 students.

2.8. Ethical Considerations

The permission to use the ZEF scale was obtained from the scale owner. Written permission is gained from the Ethics Committee of the İzmir Bakırçay University (IRB:247-227-2021/04-01), and from the management of the faculty of health sciences. Also, informed consent was obtained from the students online. Students anonymously filled out the data collection tools.

2.9. Data Analysis

Descriptive data were analysed with measures of central tendency. The construct validity of the ZEF scale was tested with Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed on the same sample. Although there are studies in the literature that CFA and EFA can be performed on separate samples in scale development studies (Yaşlıoğlu, 2017, pp. 75), it is also stated that they can be performed on the same sample (Worthington and Whittaker, 2006, pp. 222-223).

The purpose with the Exploratory Factor Analysis is to identify the common factors that explain the order and structure among the variables measured (Watkins, 2018, pp. 219-246). Before the EFA, Kaiser-Meyer-Olkin (KMO) and Bartlett Sphericity Test were performed. (Watkins, 2018, pp. 219-246). The Principal Components Method and the Varimax Rotation Method were used to determine the construct validity of the scale. An eigenvalue is calculated for every resulting factor to show the amount of variance explained by relevant factor apart from all other factors (Watkins, 2018, pp. 220). Eigenvalues >1 were used in determining the

factors (Watkins, 2018, p. 220). In this study, the minimum factor load of 0.30 was accepted for the aim of determining under which factor a certain item would be. In the factorization results, it was determined how many factors the items were grouped into. Confirmatory Factor Analysis (CFA) is performed to determine the factor structure of the scale (Kelava, 2016, pp. 1-2). To evaluate this accuracy, the Chi-Square (X^2), X^2/df, Adjusted Goodness of Fit Index (AGFI), Goodness of Fit Index (0.90<GFI <0.95), Normed Fit Index (0.90<NFI <0.95), Incremental Fit Index (0.90<IFI <0.95), Comparative Fit Index (0.90<CFI <0.95), and Root-Mean-Square Error of Approximation (RMSEA) (0.05< RMSEA <0.08) were observed (Kelava, 2016, pp. 1-2; Marsh et al., 2020, pp. 102-119). Tukey test was used for the additive properties of the subscales.

In order to determine the reliability of the scale, item-total score correlation, Cronbach's alpha coefficient (acceptable value>0.70), Spearman-Brown and Guttman split half reliability coefficients and correlation analysis between two halves were used. Whether the responses of the individuals to the scale items were equal or not was evaluated with Hotelling T-test. The Statistical significance level of $p<0.05$ was used to analyse the data by using IBM SPSS 25.0 and Amos 26.0 software packages.

3. RESULTS

3.1. Content Validity

The opinions of 8 experts were taken for the scale whose linguistic validity was achieved. The scores of 8 experts were evaluated with Davis content validity analysis. I-CVI ranges from 0.87 to 1.00, and S-CVI is 0.98. Kendall's W coefficient was 0.350 p:0.000 and concordance was detected.

3.2. Construct Validity

At the results of factor analysis, the KMO coefficient was 0.849, Barlett's test X^2 value was 2747.63 and $p<0.001$. It was found that the ZEF Scale consisted of five sub-dimensions as "General fatigue", "Visual Fatigue", "Social fatigue", "Emotional Fatigue" and "Motivational Fatigue" (Table 1).

Table 1. Results of The Explanatory Factor Analysis (N= 317)

Items	Sub Dimensions				
	First Subdiemsion General Fatigue	**Second Subdiemsion Visual Fatigue**	**Third Subdiemsion Social Fatigue**	**Fourth Subdiemsion Emotional Fatigue**	**Fifth Subdiemsion Motivational Fatigue**
s1	0.875				
s2	0.882				
s3	0.497			0.467	
s4		0.865			
s5		0.873			
s6		0.847			
s7			0.643	0.362	
s8			0.905		
s9			0.876		
s10	0.304			0.781	
s11				0.835	
s12				0.851	
s13				0.575	0.426
s14					0.875
s15				0.341	0.719
Explained variance (%)	20.305	16.956	14.329	14.242	10.967
Eigenvalue	6.037	1.974	1.478	1.042	1.001

A total of 20.30% of variance was explained with the first dimension, 16.96% with the second, 14.33% with the third, 14.24% with the fourth, 10.97% with the fifth sub-dimension and 76.79% of the total variance was explained (Table 1).

EFA and CFA: Factor loads for sub-dimensions range from 0.42 to 0.90 (Table 1). After the CFA, it was determined that the factor structure of the original scale was valid, without the need for any modifications; however, the suggested error covariance was applied to improve results. One modification was made between Items 14 and 15. CFA results indicated acceptable goodness-of-fit indices (Table 2, Figure 1). In the original scale, item 13 is included in the motivational fatigue subdimension. After the CFA analysis performed, the factor load of item 13 shows that it can be included in both the fourth subscale and the fifth subdimension. Since the meaning of item 13 is related to motivational fatigue, it was found appropriate to remain in the fifth subdimension. Tukey's additive test was used to determine the reliability of the subscales, and the result was $F = 1.025$ and $p = 0.311$. It was found that the scale had additivity feature. Hotelling's T-square value was used to determine the absence of response bias, and as a result, Hotelling's T-square value was 724,491, $F = 49.620$, and $p<0.01$.

Table 2. Model goodness of fit indices of The Zoom Exhaustion and Fatigue Scale

	X^2	DF	X^2/DF	RMSEA	GFI	CFI	IFI	RFI	NFI	TLI
Five Factor Model	204.575	79	2.589	0.071	0.93	0.95	0.95	0.90	0.93	0.94
Acceptable fitting value range			2≤ X2/DF ≤3	< 0.08	>0 0.90	>0.90	>0.90	0.90≤ RFI ≤0.95	>0.90	0.90≤ TLI ≤0.95

DF:Degree of freedom, RMSEA: Root mean square error of approximation, GFI: Goodness of fit index, CFI:Comparative fit index, IFI:Incremental fit index, RFI:Relative fit index, NFI:Normed fit index, TLI (NNFI): Trucker–Lewis Index.

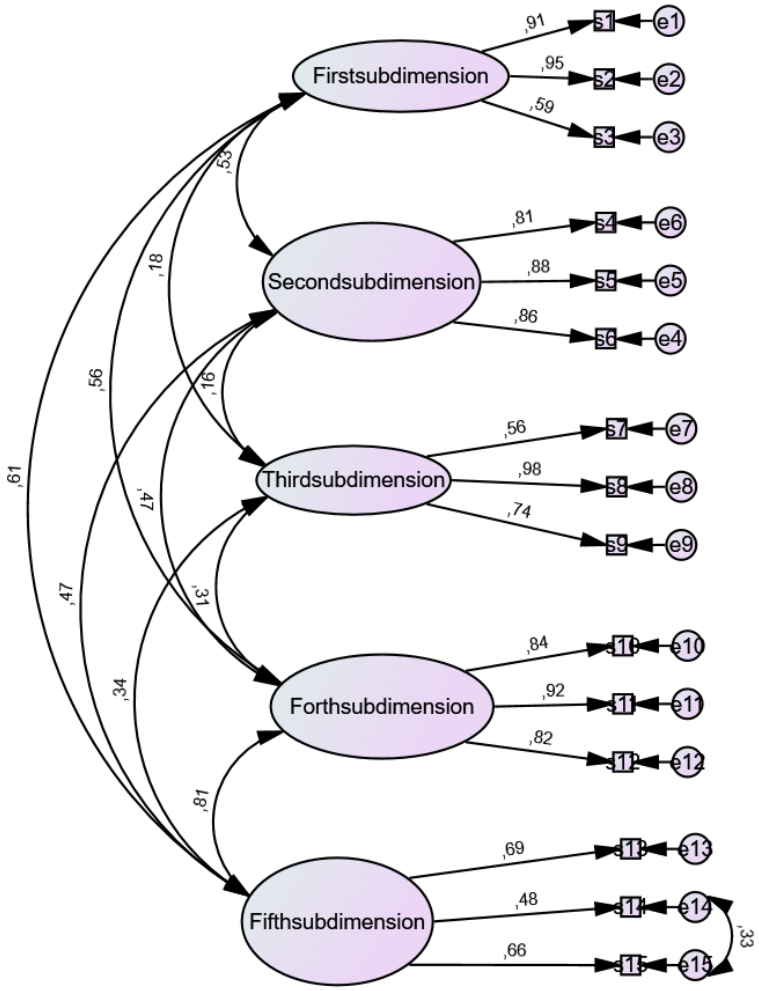

Figure 1. Confirmatory Factor Analysis of The Five Factor Model

3.3. Reliability

The Cronbach's Alpha Coefficient of the scale was found to be 0.89. The Cronbach's Alpha Coefficient of the sub-dimensions were 84, 0.89, 0.78, 0.89, and 0.71, respectively. Results of the two halves analysis, the Spearman-Brown coefficient, the Guttman split-half coefficient, the correlation coefficient between the two halves and The item-scale total score correlation was shown in Table 3 and Table 4.

Table 3. Results of the reliability analysis of the scale and sub-dimensions (n = 317)

Sub-dimensions	Cronbach α	First half of Cronbach α	Second half of Cronbach α	Spearman-Brown	Guttman split half	Correlation between two halves	M±SD (min-max)
Scale Total	0.89	0.81	0.81	0.80	0.80	0.68	3.56±0.72 (1.73-5)
First sub-dimension	0.84						4.01±0.84 (1-5)
Second sub-dimension	0.89						3.38±1.13 (1-5)
Third sub-dimension	0.78						3.20±1.11 (1-5)
Fourth sub-dimension	0.89						3.86±1.05 (1-5)
Fifth sub-dimension	0.71						3.33±0.91 (1-5)

Table 4. Correlations of the item–total score (n= 317)

Items	X±SD	Corrected Item-Total Correlation (r)
1. How tired do you feel after the video conference?	3.85±1.03	0.597
2. How exhausted do you feel after the video conference?	3.85±1.00	0.617
3. How mentally exhausted do you feel after the video conference?	4.32±0.83	0.594
4. How blurry is your vision after the video conference?	3.23±1.15	0.511
5. How irritated do you feel your eyes after the video conference?	3.30±1.31	0.569
6. How much do your eyes hurt after the video conference?	3.60±1.27	0.586
7. How much do you tend to avoid socializing after videoconferencing?	3.07±1.31	0.460
8. How long do you want to be alone after the video conference?	3.21±1.35	0.416
9. How much do you need to spend time alone after the video conference?	3.33±1.31	0.326
10. How emotionally drained do you feel after the video conference?	4.04±1.08	0.683
11. How restless do you feel after the video conference?	3.75±1.20	0.706
12. How pessimistic do you feel after the video conference?	3.80±1.20	0.643
13. How reluctant are you to do things after the video conference?	2.84±1.27	0.551
14. How often do you not want to do anything after the video conference?	3.44±1.07	0.437
15. How often do you feel too tired to do something after a video conference?	3.73±1.08	0.569

3.4. Cross-Sectional Study

A total of 317 students, 82.3% (n=261) female and 17.7% (n=56) male, participated in the research. The mean age was 20.02±1.52. It was found out that the students participated in the video conference for an average of 12.22±6.94 hours per week and 2.84±2.30 hours per day. It was also detected that they watched video an average of 14.35±10.93 hours a week. Apart from lessons, it was determined that they spent an average of 4.59±3.12 hours on the screen daily. It was also found out that they spent an average of 5.68±6.59 hours a week in front of the screen for homework. A total of 62.5% (n:198) of the students participate in video conferencing with computer, 32.5% (n:103) with smart phone, and 5% (n:16) with tablet. Regarding the mean scores of each sub-dimension of the ZEF scale, it was found that the students had high scores in all sub-dimensions and had zoom fatigue.

4. DISCUSSION

The content validity of the scale that had linguistic validity was evaluated by 8 experts. The values of I-CVI and S-CVI were calculated between 0.87-1 in this study. Kendall's W coefficient also showed the agreement among the experts (0.350; p:0.000). The I-CVI and S-CVI results and the Kendall's W coefficient indicated that there was a consensus among the experts. It has been shown that the scale provides content validity. The validity of the structure of the scale was tested. The Bartlett's Sphericity Test and KMO were used for factor analysis (Watkins, 2018, pp. 220). In this study, the Bartlett's Sphericity Test value X^2 value was found as: 2747.63 and is significant $p<0.001$, and KMO value was 0.84. These showed that the sampling size were adequate for factor analysis (Marsh et al., 2020, pp. 102-119; Watkins, 2018, pp. 221). In this study, the sampling size and datasets were created in similar manner to the original scale of Fauville et al., (2021, pp. 2-3). To determine the number of factors, the eigenvalue was accepted as 1 and above, (Seeger, 2018, pp. 205-225) and it was seen that the ZEF scale consists of 5 sub-dimensions. The 5-factor structure of the ZEF scale explained 76.79% of the total variance of the scale. Since the total variance is over 40%, the scale has a strong structure in terms of construct validity (Akdeniz Kudubeş ve Bektas, 2020, pp. e57-63; Watkins, 2018, pp. 221). As a result of the analyzes made, it was determined that the scale had construct validity. The EFA results indicate that the factor loads of the 5 subscales varies between 0.49 and 0.90. In general, the factor load should be >.30 (Marsh et al., 2020, pp. 102-119; Watkins, 2018, pp. 221). The factor loads of the sub dimensions are >.30. Fauville et al., (2021) measured the factor loads of the items in the 5-dimensional scale as 0.94. The factor loads of the original scale and of the present study are similar. It has been determined that the Turkish version of the scale has a strong factor structure. The structure provided with EFA should be analyzed with CFA After the structure of the scale is revealed with EFA, CFA analysis should be performed. (Thakkar, 2020, pp. 150). Similar to the original scale, the suggested scale consists of 5 subscales. In this way, the CFAs with 5 factors were performed.

For the 5-factor CFA, the factor loads of the subscales were as >0.30, and goodness-of-fit indices were >0.90, and RMSE was <0.080. A significant and positive correlation was determined between the scale and its sub-dimensions. The CFA results in this study are compatible with the model's fit indicators reported in the literature and original scale (Fauville et al., 2021a, pp. 1-26; Thakkar, 2020, pp. 150). The 5-factor structure was approved with this model. In this study, the EFA and CFA results suggested that the scale is a valid tool. These results prove that the 5-factor structure is suitable for Turkey sampling. The Cronbach's Alpha Coefficient is expected that this value is close to 1 as much as possible (Bujang et al, 2018, pp. 85-99). In the present study, The Cronbach Alpha values of the scale and its subscales were found to be 0.89 and were found to be highly reliable (Bujang et al., 2018, pp. 85-99). Fauville et al., (2021, pp. 2-3), determined the Cronbach Alpha Value of the ZEF scale to be 0.70.

Therefore, the scale in this study is similar to its original structure and has a strong internal consistency. As a result of the analyzes carried out for the internal validity of the scale in this study, it was determined that the scale had a strong internal consistency. The results could not be compared because Fauville et al. (2021, pp. 2-3) did not perform split-half analysis on the original scale.

Responder bias is the evaluation of whether people's responses to scale items are equal or not. Experiencing this situation affects the reliability, and therefore the validity of the scale adversely, albeit indirectly. It was found that with the Tukey's Additivity Test that the scale is additive. Hotelling's T-Square test statistic found out that there is no reaction bias in the scale. The tests proved that the participants responded according to the items. The fact that the scale has additivity and no response bias demonstrates that the scale is reliable (Irwing et al., 2018, pp. 985). The Item-Total Score Analysis explains the relations between the scores. It reveals the relationship between the total score of the scale and the score of each scale item (Zijlmans et al., 2019, pp. 1-12). This value should be 0.20-1 and positive (Irwing et al., 2018, pp. 986; Zijlmans et al., 2019, pp. 1-12). In the study, the correlation coefficients of both the item-total score and the item-subscale total score had a high correlation. In the original study, the correlation coefficients of both the item-total score and the item-subscale total score were similar in our study. Also, the findings showed that this study had a high internal consistency level, as in the original scale.

Although the present study has many strengths, the study can be generalized to the sampling included. Secondly, the scale that was newly developed, and was used for the first time creates difficulty to discuss and compare with other studies.

5. CONCLUSION

The Zoom Exhaustion and Fatigue (ZEF) Scale was adapted into Turkish and a 15-item scale divided into 5 sub-dimensions was formed as in the original scale. Turkish version yielded good results in terms of reliability and validity and shows to be an adequate tool to evaluate the

Zoom Exhaustion and Fatigue, which may occur because of the video conferencing systems used most commonly in courses in the education of students in higher education. The ZEF scale can be accepted as a psychometrically appropriate measurement tool in evaluating the fatigue and exhaustion of zoom in university students.

It is recommended that it should be tested in different samplings and used in studies to determine the Zoom Fatigue and Exhaustion scores experienced by health science students.

Ethical Approval: The permission to use the ZEF scale was obtained from the scale owner. Approval was obtained from the Ethics Committee of the İzmir Bakırçay University (IRB:247-227-2021/04-01).

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6. REFERENCES

Akdeniz Kudubeş, A., Bektas, M. (2020). Orginal Article: Psychometric Properties of the Turkish Version of the Healthy Lifestyle Belief Scale for Adolescents. *Journal of Pediatric Nursing*, *53*, e57–e63. https://doi.org/10.1016/j.pedn.2020.02.006

Bailenson, J. N. (2021). Nonverbal overload: A theoretical argument for the causes of Zoom fatigue. *Technology, Mind, and Behavior*, *1*(3), 1–13. https://doi.org/10.1037/tmb0000030

Bıkmaz Bilgen, O., Dogan, N. (2017). The Comparison of Interrater Reliability Estimating Techniques. *Eğitimde ve Psikolojide Ölçme ve Değerlendirme Dergisi*, *8*(1), 63–78. https://doi.org/10.21031/epod.294847

Bloom, N., Davis, S. J., Zhestkova, Y. (2021). COVID-19 Shifted Patent Applications Toward Technologies that Support Working from Home. In *SSRN Electronic Journal* (No. 2020–133). https://doi.org/10.2139/ssrn.3695191

Bujang, M. A., Omar, E. D., Baharum, N. A. (2018). A review on sample size determination for cronbach's alpha test: A simple guide for researchers. *Malaysian Journal of Medical Sciences*, *25*(6), 85–99. https://doi.org/10.21315/mjms2018.25.6.9

Çapık, C., Gözüm, S., Aksayan, S. (2018). Intercultural Scale Adaptation Stages, Language and Culture Adaptation: Updated Guideline. *FNJN Florence Nightingale Journal of Nursing*, *26*(3), 199–210. https://doi.org/10.26650/fnjn397481

Dean, B. (2020). Zoom User Stats: How Many People Use Zoom in 2021? Retrieved from Backlinko website: https://backlinko.com/zoom-users

Durak, G., Cankaya, S., Izmirli, S. (2020). Examining the Turkish Universities' Distance Education Systems During the COVID-19 Pandemic. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education*, *14*(1), 787–810. https://doi.org/10.17522/balikesirnef.743080

Eysenbach, G. (2004). Improving the quality of web surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *Journal of Medical Internet Research*, *6*(3), 1–6. https://doi.org/10.2196/jmir.6.3.e34

Fauville, G., Luo, M., Queiroz, A., Bailenson, J. N., Hancock, J. (2021a). Zoom Exhaustion & Fatigue Scale. *SSRN*, 1–26. Retrieved from http://dx.doi.org/10.2139/ssrn.3786329

Fauville, G., Luo, M., Queiroz, A. C. M., Bailenson, J. N., Hancock, J. (2021b). Nonverbal Mechanisms Predict Zoom Fatigue and Explain Why Women Experience Higher Levels than Men. *SSRN Electronic Journal*, 1–18. https://doi.org/10.2139/ssrn.3820035

Iqbal, M. (2021). Zoom revenue and usage statistics (2021). Retrieved from Business of apps website: https://www.businessofapps.com/data/zoom-statistics/

Irwing, P., Booth, T., Hughes, D. J. (2018). *The Wiley handbook of psychometric testing: A multidisciplinary reference on survey, scale and test development.* USA: John Wiley & Sons.

Kelava, A. (2016). A Review of Confirmatory Factor Analysis for Applied Research (Second Edition). *Journal of Educational and Behavioral Statistics*, *20*(10), 1–5. https://doi.org/10.3102/1076998616631747

Marsh, H. W., Guo, J., Dicke, T., Parker, P. D., Craven, R. G. (2020). Confirmatory Factor Analysis (CFA), Exploratory Structural Equation Modeling (ESEM), and Set-ESEM: Optimal Balance Between Goodness of Fit and Parsimony. *Multivariate Behavioral Research*, *55*(1), 102–119. https://doi.org/10.1080/00273171.2019.1602503

Morgado, F. F. R., Meireles, J. F. F., Neves, C. M., Amaral, A. C. S., Ferreira, M. E. C. (2017). Scale development: Ten main limitations and recommendations to improve future research practices. *Psicologia: Reflexao e Critica*, *30*(3), 1–20. https://doi.org/10.1186/s41155-016-0057-1

Nussbaumer-Streit, B., Mayr, V., Dobrescu, A., Chapman, A., Persad, E., Klerings, I., Zachariah, C. (2020). Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review (Review). *Cochrane Database of Systematic Reviews*, (9), 1–22. https://doi.org/10.1002/14651858.CD013574.pub2.www.cochranelibrary.com

Oducado, R. M. F., Fajardo, M. T. R., Parreño-, G. M., Maniago, J. D., Villanueva, P. M. B., Asuncion, M., Montano, H.C., Robite, E. E. (2021). Is Videoconference " Zoom " Fatigue Real among Nursing Students ? *Journal of Loss and Trauma*, *0*(0), 1–3. https://doi.org/10.1080/15325024.2021.1950987

Seeger, A. (2018). Complementarity eigenvalue analysis of connected graphs. *Linear Algebra and Its Applications*, 205–225. https://doi.org/10.1016/j.laa.2017.12.021

Thakkar, J. J. (2020). *Structural Equation Modelling: Application for Research and Practice (with AMOS and R)*. Singapore: Springer Nature.

Watkins, M. W. (2018). Exploratory Factor Analysis: A Guide to Best Practice. *Journal of Black Psychology*, *44*(3), 219–246. https://doi.org/10.1177/0095798418771807

World Health Organisation. (2020). Joint ICAO- WHO Statement on COVID-19. Retrieved from International Civil Aviation Organization website: https://www.icao.int/Security/COVID- 19/Pages/Statements.aspx

Yaşlıoğlu, M. M. (2017). Sosyal bilimlerde faktör analizi ve geçerlilik: Keşfedici ve doğrulayıcı faktör analizlerinin kullanılması. *Istanbul University Journal of the School of Business*, *46*(2), 74–85.

YÖK. (2020). *Basın Açıklaması: Yükseköğretim Kurulu Başkanı Prof. Dr. M. A. Yekta Saraç*. Ankara: T.C. Yükseköğretim Kurulu. Retrieved from https://covid19.yok.gov.tr/Documents/alinan-kararlar/03-uzaktan-egitime-iliskin-alinan-karar.pdf

Zijlmans, E. A. O., Tijmstra, J., van der Ark, L. A., Sijtsma, K. (2019). Item-score reliability as a selection tool in test construction. *Frontiers in Psychology*, *9*(JAN), 1–12. https://doi.org/10.3389/fpsyg.2018.02298