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Research Article

Development of Electronic Portfolio Attitude Scale

Bilge GÖK[1], Mahmut AYAZ [2*] Yasemin ERDEM [3]

[1] *Hacettepe University, Ankara, Turkey, bilge.bekci@gmail.com*
[2] *Ministry of Education, Hacibekir Secondary School, Van, Turkey mahmutzaya@hotmail.com*
[3] *Başkent University, Ankara, Turkey yaseminasuluk@gmail.com*
[*] *Corresponding Author: mahmutzaya@hotmail.com*

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Abstract

The aim of this study is to develop an electronic portfolio attitude scale (EPAS) for prospective teachers. The scale, which was prepared during the scale development phase, was applied to 524 prospective teachers studying in the third and fourth grade. Exploratory factor analysis results (EFA) showed that 40 items in the scale were gathered under three factors. These are: "benefit for the student", "denial (negation)" and "effectiveness in terms of the instructional process". The three-factor structure obtained by confirmatory factor analysis was confirmed. When these factors are evaluated together, their contribution value to the total variance is 39.37%. Factor loadings were found to vary between .33 and .71. However, according to the results obtained in the item analysis, it was determined that all the items in the scale were distinctive. In addition, it is seen that the CR value is greater than .70, and the dimensions of the scale fulfill the composite reliability requirement. In addition, as a result of ANOVA, it was revealed that the attitudes of prospective teachers towards e-portfolio differ significantly according to their knowledge about e-portfolio and their competence in using technology. The McDonald's ω coefficient (known as congeneric reliability) of the three factors in the scale were .97, .91 and .88, respectively, and the McDonald's ω coefficient for all items of the scale was .96. As a result of the reliability and validity analysis, it was concluded that the electronic portfolio attitude scale is a reliable and valid measurement tool for prospective teachers.

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Introduction

Assessment, which is an indispensable element of the education process, imposes a number of responsibilities on the teacher to follow the progress of the students. Assessment refers to a general concept that includes teachers' impressions of students' development during the teaching process, determining their students' strengths and weaknesses, discovering learning paths, and revealing learning deficiencies. In this process, it is very important for teachers to use the most appropriate assessment methods and to provide

feedback on students' knowledge and skills. In addition, assessment facilitates teachers to get to know students and see individual differences.

Designing different teaching environments by prioritizing the differences between students enables students to reveal their competence (Harden, 2007). The current system, which focuses on the learning of students from an education system that focuses on the teacher, requires the interaction of learning, teaching process and assessment dimensions. Thanks to this changing system in education, both students and teachers gain a deep understanding in reaching the goals of education (Kasap, 2023; Ma & Rada, 2005).

Two types of assessment approaches are used in education. These are handled under two headings: traditional and alternative assessment (Kutlu, et al., 2017). Traditional assessment approach which includes written probe, oral exam, multiple choice item, matching test, true-false type test, etc. is insufficient to include the knowledge of students about different learning processes today (Başol, 2019). Because traditional assessment evaluates the cognitive or learning product of the student. However, alternative assessment focuses on the process as well as the products of the students and provides information about the strengths and weaknesses of the students, and enables the students to evaluate themselves, to learn to take responsibility, and to develop high-level thinking skills (Hung, 2006).

Performance-based assessment approach, which is expressed as a complement to the traditional assessment-evaluation approach in education, has been used extensively in recent years as a result of the student-centered approach. The alternative assessment approach, which focuses on learning processes as well as the learning product, helps students find solutions to problems they will encounter in daily life (Zeybek, 2019). Portfolios are a type of assessment that is included in the alternative assessment approach and is frequently used in terms of students' learning scope, thinking process, organizing their thoughts, assuming learning responsibility and developing problem solving skills (Grady, 1996; Kutlu, Doğan, & Karakaya et al., 2017).

Portfolio, which is used as a performance based assessment, has been seen in educational institutions since the 1980s. Portfolio is seen as a valuable tool for practically monitoring and evaluating students' efforts, progress, and achievement over time (Kutlu, et al., 2017; Samaras & Fox, 2013). In addition, portfolios provide teachers with information about students' in-class and out-of-class performances, provide feedback to students for their

own learning and practice, and help students take responsibility for learning and evaluate their own progress (Wesson & King, 1996).

Portfolio is a performance measure that allows the student to organize his/her content in a way that he/she chooses and can improve on a certain skill set (Filkins, 2010). A portfolio can also be expressed as a collection of works collected in a certain process (Larson, 2003). Portfolios are files in which students' efforts in the process and achievements in different fields are exhibited (Paulsen, et al., 1991).

Due to the recent developments in computer technologies taking an active role in the teaching processes, the concept of electronic learning has emerged with the transfer of educational activities to electronic media as a different dimension in learning. In this context, electronic portfolios (e-portfolio) have been used in the teaching process in order to collect, save and store the original products created by students in electronic environment.

The use of technology in the teaching process has become even more important with the use of e-portfolio in the teaching process. The e-portfolio improves the student's performance by improving student's ability to use technology, reflective and creative thinking, supports the student's development in the process, enables student's to progress at an individual pace, and offers the student cooperation opportunities (Ayaz, 2021). Hawisher and Selfe (1997) stated the benefits of e-portfolios as follows: (1) E-portfolios increase motivation to learn. (2) E-portfolios are more portable than paper portfolios and require less physical storage space. (3) E-portfolios creation is seen not only as computer-mediated textual literacy, but also as a new art form. Therefore, e-portfolio developers are free to create a variety of formats, including audio, text, graphics, video and multimedia, rather than being limited to one connector.

The e-portfolio, which is a collection of various evidence, was expressed by Barret and Carney (2005) as a tool that enables many people to present the reflection of what one has learned over time for a specific purpose. Challis (2005, p. 3) defines e-portfolio as a collection of information that provides selective and structured collection of evidence showing the development of an individual according to specific purposes and digital storage of these evidence. Beetham (2005) sees e-portfolio as a tool that enables students to think about their development and progress, reflective thinking skills, metacognition development, and their own learning. Gülbahar and Köse (2006) defines it as collecting and storing the original products created by students during the teaching process in electronic

environment. Pullman (2002) made a definition based on the features of the e-portfolio, as it is a portable tool that enables to look at the concept of learning from a broad perspective. Based on the definitions it is stated that e portfolio is an evaluation with superior aspects such as being easy to transport and storing, low cost, safe, easy to update information instantly, easy to give feedback, increase creativity, easy display of all products and reach large masses (Alan, 2014). Learning activities included in the development of e-portfolio include determining learning goals, data collection, peer assessment, peer feedback, and reflective feedback. Collecting, organizing, rearranging information in the process, presentation, sharing, applications, accumulation, and management are specified as related activities in the development of e-portfolio. In this context, e-portfolio is a tool that enables students to systematically present their learning goals, learning processes, reflections, and accumulated works (Kasap, 2021; Krause, 1996).

E-portfolios have benefits in terms of transportation, data storage, contribution to teaching, performance tracking for use in schools compared to traditional portfolios (Polat & Köse, 2013; Pullman, 2002). E-portfolios are seen as a learning tool that supports lifelong learning towards the knowledge and skills of students, in which all the studies selected are stored and organized. In this sense, students determine their own goals, solve complex problems, think critically, and pay attention to collaborative work (Bhattacharya & Hartnett, 2007). E-portfolio is a tool that enables deep learning in the context of critical and creative thinking (Barbera, 2009). It is an assessment tool that points to 21st century skills in this sense as well.

It is much easier to collect data in e-portfolios and to make updates in the process. In addition, e-portfolio has superior aspects, there are also limitations such as high cost due to technical skills on the computer system, the necessity of internet and technological equipment (Alan, 2014). Considering the positive reflections of its positive aspects on the teaching process, first of all, providing the necessary infrastructure in terms of information technologies, teachers' experience of the traditional portfolio and then the transition to e-portfolio, and the qualifications that are accepted as limitations with the necessary professional development programs can also be transformed into positive features.

E-portfolios make it easy for teachers to monitor and evaluate their students, and in the long term, students will be recognized by different teachers in their future learning lives. However, the effective use of e-portfolio, which takes into account the holistic development

of students, may vary depending on teacher beliefs. Therefore, it is important to reveal teachers' attitudes, which are a major factor in shaping teaching activities (Kasap, 2020; Pajares, 1992). Teachers' attitudes should be positive to make the teaching process more efficient with e-portfolio.

There are studies in the literature on the positive reflections of e-portfolio on teaching processes. For example, Erice and Ertaş (2011) examined the effect of e-portfolio on writing skills in preparatory classes who are learning a foreign language. In the study, it was concluded that students who create e-portfolio are more successful in writing skills than other students. In the study conducted by Özgür (2016), the effect of the use of e-portfolio in the teaching process on the academic achievements and attitudes of prospective teachers studying at the department of computer and instructional technology education was examined. As a result of the study, it was concluded that the academic achievement of the experimental group students increased with the use of electronic portfolios and their attitudes towards the use of electronic portfolio in the teaching process were positive. In a study conducted by Demir and Kutlu (2016), it was found that the use of e-portfolio improved the research skills of secondary school students. Research skill is a feature of 21st century learners, and accordingly, e-portfolios increase students' interest and curiosity in doing research during the teaching process, which is too important to ignore. In a study conducted by Zeybek (2019), it was concluded that the use of e-portfolios positively affected the academic skills of students. As a result of the research, it is emphasized that the theoretical knowledge of the students can be considered as the equivalent in practice and the use of e-portfolio is important in terms of the development of students' application skills. For today's learners, it is very important for students who are aware of their learning capacity and learning styles to achieve success by taking responsibility for learning and to have confidence in themselves (Senemoğlu, 2013).

In order to facilitate the learning of the individual, the e-portfolio is valuable by encouraging the individual to do research within the framework of certain purposes, to ensure that the individual take an active role in the learning process, and to ensure that the process is followed up to the end by both the individual and the teacher. In a study conducted by Ayaz, et al., (2020) examining the effect of e-portfolio on academic achievement, it was seen that as well as it was easy to combine STEM activities especially for the science course with e-portfolio, the academic success of eighth grade students towards

the science course improved positively and their attitudes towards the course also improved positively with the use of e-portfolio.

There are also studies in the literature in which the opinions of prospective teachers about e-portfolio are taken. For example, in the study conducted by Çukurbaşı and Kıyıcı (2018), the opinions of prospective teacher regarding e-portfolio were taken. As a result of the study, it was seen that the prospective teachers expressed a positive opinion that e-portfolio is a functional tool. As mentioned above, it is clearly seen in the research that e-portfolio has positive effects on the development of students' skills and their academic achievement. However, it is seen that there is little coverage in the literature regarding the attitudes of prospective teachers towards e-portfolio. It is very important to examine and reveal prospective teachers' attitudes towards e-portfolio, which is an alternative assessment approach, before they start the profession. It is known that prospective teachers' current attitudes towards e-portfolio will affect their teaching activities in the future and this should not be ignored. E-portfolios, which help students discover their strengths and weaknesses, should be encouraged to be used by both prospective teachers at the higher education level and teachers in the profession. However, it is important to first evaluate teachers' existing beliefs on this issue, and to examine their attitudes towards e-portfolio. With this study, it is thought that revealing the attitudes of prospective teachers towards e-portfolio, which aims at the multi-directional development of students before starting their profession, will contribute to revealing the value of e-portfolio. For this reason, this study aims to develop an attitude scale for prospective teachers regarding e-portfolio and to present evidence in terms of validity and reliability for the scale by collecting data from a large sample. In the literature, there are the e-portfolio perception scale for teachers by Goeman (2007), the e-portfolio attitude scale for the teaching process for prospective teacher studying in computer and electronics departments by Demirli (2007), the teacher studying in the department of English language teaching by Arap (2008), e-portfolio attitude scale for prospective teachers, a perception questionnaire about the use of e-portfolio for teachers by Luyegu (2009), and an attitude scale that measures learner attitudes of e-portfolio towards computer literacy by Gömleksiz and Koç (2010). When the researches are examined, it is seen that there is no measurement tool to measure the e-portfolio attitudes of teacher candidates studying in different branches. In this study, an e-portfolio attitude scale was tried to be developed for all teacher candidates studying in different departments by including different sample

groups studying at the faculty of education. Considering the measurement tools prepared for e-portfolio in the literature, it has been observed that there is no e-portfolio attitude scale for teacher candidates studying in different branches. It is important to add a scale that can be used to determine the attitudes of teacher candidates. In the covid-19 epidemic, it can be said that the importance of technology has increased even more in both teaching and evaluation processes. The use of technology in teaching becomes more important in the distance education process (Özkul & Girginer, 2014). It is thought that teacher candidates' positive attitudes towards e-portfolio will positively affect both the teaching process and the e-assessment process when they become teachers. In addition, considering the importance of evaluation in the process of distance education, determining the attitudes of prospective teachers towards e-portfolio is also important in this respect, since the e-portfolio is digital, oriented to individual evaluation and includes outputs for students' skills. Therefore, it is extremely important to develop an e-portfolio attitude scale and add it to the literature for prospective teachers who study in different departments. In this study, it is aimed to introduce a measurement tool to the literature that will serve to reveal the attitudes of prospective teachers towards e-portfolio before starting their profession.

Method

Research Design

In the research, it was patterned according to the survey model, one of the quantitative research methods. Survey model is a study conducted on larger samples compared to other studies, in which participants' views or characteristics of interests, skills, abilities, attitudes, etc., regarding a subject or event are determined. The purpose of these studies is to make a description by taking a picture of the current situation regarding the research subject (Fraenkel, et al., 2012).

Participants

The study group was constituted from 524 voluntary prospective teachers studying in third and fourth grade in different universities at Faculty of Education in Turkey, some of whom were taking measurement and evaluation course and learn the concept of e-portfolio in this course. Due to Covid-19, the scale was prepared online and administered to teacher candidates. While 17.6% (n=92) of the prospective teachers participating in the study were male, 82.4% (n=432) of the target group were female. Descriptive information of prospective teachers participating in the study is given in Table 1.

Table 1. Descriptive information of the research participants

Variable	Category	N	%
Gender	Male	92	17.6
	Female	432	82.4
Grade Level	3rd class	268	51.1
	4th class	256	48.9
Type of the University	State	336	64.1
	Private	188	35.9
How Do You See Yourself About Using Technology?	Basic Proficiency	137	26.1
	Intermediate Proficiency	347	66.2
	Advanced Proficiency	40	7.6
Total		524	100

When Table 1 is examined, it is seen that the number of women is more than the number of men. This situation is thought to be due to the fact that the departments of the teacher candidates, where the scale was applied, were preferred more by women.

Data Collection Tool

Electronic portfolio attitude scale (EPAS) was developed to determine prospective teachers' attitudes towards e-portfolio. In order to create scale items, the relevant literature was scanned first. As a result of the literature review,95 items were obtained. The item pool consisting of 95 items is transformed into a draft form, and the items in this form were presented to opinion of the experts (n=5), (three assessment and evaluation, one curriculum development and one classroom education experts) and the experts were asked to mark one of the options "suitable", "Must remove", "Must corrected" and "be corrected" for each item. The necessary corrections were made in line with the recommendations of the field experts and a form consisting of 83 items was created. The prepared form consists of the categories of "I never agree" (1), "disagree" (2), "undecided" (3), "agree" (4), "completely agree" (5). Accordingly, the high score obtained from the scale indicates that the attitude towards e-portfolio is high.

The data collected using the data collection tool prepared for this research were assessed to determine their appropriateness for factor analysis based on several assumptions. These assumptions include sample size, missing data, normality, linearity, extreme values, and the structure and adequacy of the R matrix. The suitability of the sample size for factor analysis needs to be examined first. Researchers have not reached a consensus on the ideal sample size for factor analysis (İlhan & Çetin, 2014). However, the literature suggests that the

number of items in the scale should be three to six times the number of participants for factor analysis, with 200 participants being considered suitable and 500 participants being quite good (Cattell, 1978). As the number of participants increases, the factor structure becomes more distinct, but it is acceptable as long as it reaches five times the total number of items (Stevens, 2002).

In this study, 524 prospective teachers participated, and no missing data was found when examining the data set collected from them. To test the normality and linearity of the data set, the distribution of total scores was checked for normality. Skewness and Kurtosis coefficients were evaluated, and normality tests were conducted. In order to identify any outliers in the data set, the z-scores of each variable were examined. It was observed that the z-scores of the variables were within the range of ± 3.00, indicating the absence of outliers. Additionally, to assess extreme values in multiple variables, Mahalanobis distances were calculated, and the values of each variable were examined. No outliers were found in the data set.

To verify the factorizability of the R matrix, the KMO (Kaiser-Meyer-Olkin) value and Bartlett's Test results were analyzed. The KMO value was found to be .82, and Bartlett's test (χ^2 = 3778.11, p = .00), which assesses multivariate normality, yielded a significant result. Based on these findings, it can be concluded that the data are suitable for factor analysis.

Data Analysis

In the study, interviews were conducted with 5 different experts from the field in order to determine the content validity of the scale and content validity rates and indexes were calculated accordingly. At this stage, content validity ratio's (CVR) were calculated based on the opinions of 5 different people who are experts in their fields for all substances, and the form was created. When half of the experts express their opinion as "suitable" about the substance, CVR will be = 0, if more than half of them say "Suitable", CVR will be> 0, and if more than half of the experts do not say "Suitable", CVR will be <0. According to Veneziano and Hooper (1997), the minimum coverage reality criterion for 5 experts should be .99. The content validity index (CVI) is obtained from the total CVR average of the items that are significant at the level of ∝ = .05 (Yurdugül, 2005). In line with the opinions received from experts, it was observed that 18 items out of 95 items were insufficient in measuring the attitudes of prospective teacher towards e-portfolio. According to the opinions of the experts, 6 of the 18 items were changed based on the content validity rates; 12 of them were left out of

form. After these items expressed in this context were excluded from the test, CVI was calculated again and it was seen that the calculated value was sufficient. After the modifications made, an intelligibility study was conducted with a small group in order to test the comprehensibility of the scale. In this context, the comments of the students who answered the scale and their opinions on the comprehensibility levels of the items included in the measurement tool were taken. Finally, before the scale was made applicable, it was transferred to the electronic environment and delivered to prospective teachers on a voluntary basis. The pre-application of the scale was completed with the collected data. After the pre-application work was completed, pilot implementation was started.

After implementing the EPAS (Educational Portfolio Assessment System) with the participant group, statistical analyses were conducted to determine the measurement characteristics. Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were utilized to examine the construct validity of the developed EPAS and reveal the factor structure of the scale. It is common to employ EFA and CFA in the test development process, where it is recommended to apply EFA with half of the data and CFA with the remaining half when the sample size is sufficient (Henson & Roberts, 2006). Given the sufficient sample size of 524 participants in this study, it was decided to apply EFA to half of the data and CFA to the remaining half.

During the EFA, the correlation values between the dimensions were assessed using the direct oblimin rotation technique, which indicated a low relationship among the dimensions. Hence, it was concluded that the sub-dimensions are independent from each other. When conducting factor analysis for lowly related and independent sub-dimensions, the varimax method is recommended (Tabachnick & Fidell, 2007). The maximum likelihood factor analysis estimation method provides the advantage of reorganizing relationships between indicators in the data set for better factor analysis (Çokluk, et al., 2016). Therefore, in the exploratory factor analysis, the "maximum likelihood" was employed as the factoring method, and the "varimax" method, one of the vertical rotation methods, was used for factor rotation.

To ensure the scale's reliability, internal consistency coefficients such as Cronbach's Alpha, composite reliability, and item-total correlations were calculated for each factor and the entire scale. However, for the criterion validity of the scale, the difference between the scores of the upper 27% group and the subgroup of 27% from the total scale was analyzed

using an independent t-test. Additionally, to test validity in another way, the total scores of participants with homogeneous distribution across classes were examined to determine if they differed based on their e-portfolio experiences, knowledge about e-portfolio, and technology proficiency. The normality of the distribution was assessed before selecting an appropriate test. It was observed that the total scores exhibited a normal distribution for all considered variables ($p > .05$). Consequently, ANOVA, a parametric method for unrelated measurements, was employed to test the significance of the differences in total scores according to the mentioned variables.

Data collection was carried out through written and online methods using a data collection tool, and the data analysis was performed using the SPSS 25 and LISREL 8.7 software programs.

Findings

In this section, validity and reliability information about "Electronic portfolio attitude scale" is given.

Construct Validity

EFA and CFA were conducted to determine the structure validity of the electronic portfolio attitude scale (EPAS).

Exploratory Factor Analysis (EFA)

To assess the construct validity and determine item factor loads of the Electronic Portfolio Attitude Scale, an exploratory factor analysis (EFA) was conducted. Several criteria were used to determine the number of factors in the EFA analysis, including eigenvalue greater than 1, the ratio of total variance explained, and the scree plot (Field, 2009). From the 12 factors identified in the item collection, approximately 66.09% of the scale was explained. However, the total variance explained by 9 factors was found to be below 5%. In EFA analysis findings, it is recommended that factor loads should be above .30 (Floyd & Widaman, 1995; Tabachnick & Fidell, 2007). Accordingly, 20 items with a factor load of .30 or less were excluded from the analysis. As a result, 12 items showed overlapping factors.

Additionally, item 11 was not included in the analysis due to its item-total correlation being less than 0.30. Items with an item-total correlation of 0.30 and above are considered to differentiate individuals well, while items between 0.20-0.30 can be included if necessary, and values below 0.20 should not be included in the analysis (Büyüköztürk, 2017). Considering the research objectives and the results of the EFA, it was decided to retain the

items in three factors. The characteristics of the items based on the repeated EFA results are presented in Table 2. The eigenvalues obtained from the EFA analysis and the percentages of total variance explained are provided in Table 2, and the scree plot graph is shown in Figure 1.

Table 2. Exploratory factor analysis and announced eigenvalue results

	EFA eigenvalue results	Total variance explained
I.factor	8.49	18.70
II.factor	5.06	13.46
III.factor	2.20	7.21

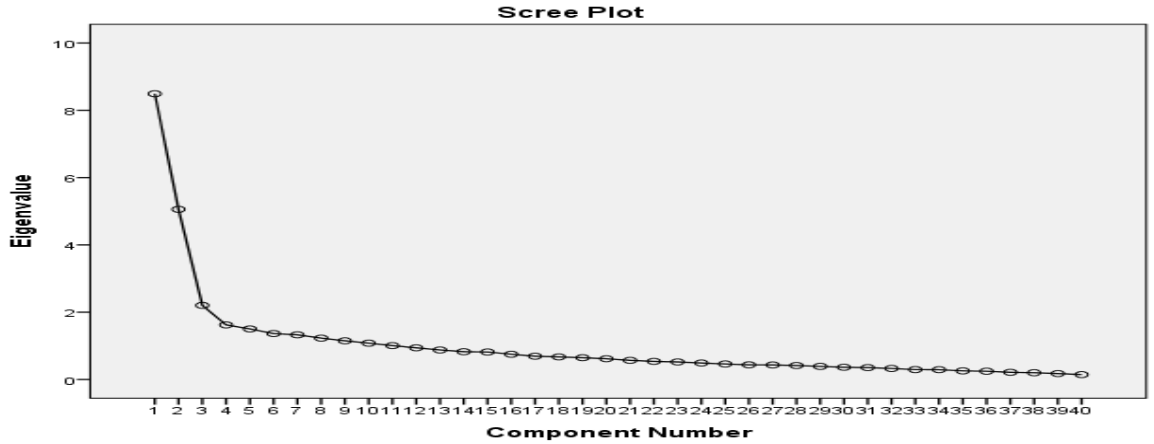

Figure 1. Line chart

When Table 2 is examined, it is seen that the items are collected in three dimensions as a result of the exploratory factor analysis. It can be said that the first dimension explains 18.70% of the total variance, the second dimension explains 13.46% of the total variance, and the third dimension explains 7.21% of the total variance. It explains 39.38% of the total variance of items collected in three dimensions. Accordingly, considering the factor analysis result, it was thought that the scale should be three-dimensional. Items and factor loads are given in Table 3 (Appendix 1).

After examining the factor loads of the items in Table 3 and considering their content and theoretical structures revealed through EFA analysis, three factors were identified. The first factor was named "Benefit to Students (Contribution)", the second factor was "Denial (Negation or Negative Perspective)", and the third factor was labeled as "Effectiveness in Terms of Instructional Process". Factor 1 explains 18.70% of the total variance and consists of 18 items. The factor loads for the items in Factor 1 range from .49 to .69, indicating their association with the sub-dimension of benefit to students. Factor 2 explains 13.65% of the

total variance and includes 16 items. The factor loads for the items in Factor 2 range from .34 to .72, reflecting their relationship with the sub-dimension of denial or negative perspective. Factor 3 explains 7.21% of the total variance and consists of 6 items. The factor loads for the items in Factor 3, related to effectiveness in terms of instructional process, range from .53 to .65.

In this study, items with factor loading values of .30 or higher were considered (Büyüköztürk, 2017). When considering these three factors collectively, it was found that the items in the scale account for 39.38% of the total variance. There was a low correlation observed among the correlation coefficients and the sub-dimensions of the scale. The correlation between Factor 1 and Factor 2 sub-dimensions was calculated to be .10, while the correlation between Factor 1 and Factor 3 sub-dimensions was .23. The correlation between Factor 2 and Factor 3 sub-dimensions was found to be .01. Based on these findings, it was concluded that the sub-dimensions are independent of each other. Consequently, in the factor analysis study, vertical rotation was considered appropriate, leading to the utilization of the varimax method as one of the vertical rotation methods. The correlation coefficients between the sub-dimensions of the scale are presented in Table 4.

Table 4. Correlation coefficients between factors

Factors	Contribution	Negation	Effectiveness
Contribution	1.00	.100	.23
Negation		1.00	.01
Effectiveness			1.00

Confirmatory Factor Analysis

To assess the accuracy of the structure comprising 40 items and three sub-dimensions obtained from the exploratory factor analysis, confirmatory factor analysis (CFA) was conducted. The fit index values for the Electronic Portfolio Attitude Scale (EPAS) are provided in Table 5. When this structure is tested, the calculated chi-square, chi-square / degree of freedom and goodness of fit indices are presented in Table 5.

Table 5. CFA results of three dimensional implicit structure established with CFA

Model	÷²	÷²/sd	NNFI	NFI	CFI	RMSEA
Three Factor Structure	1982,87	2.69	.95	.93	.96	.07
Criteria		3.0	≥.95	≥.95	≥.95	≤.08

When table 5 is examined, includes the evaluation criteria for indexes accepted according to Schermelleh-Engel, Moosbrugger and Müller (2003). The goodness-of-fit values(t-test) of the CFA result of the three-factor structure are given in Table 6.

Table 6. t-test values obtained from CFA for EPAS

Item No	t	Item No	t	Item No	t	Item No	t
Contribution1	12.76*	Contribution11	15.07*	Negation3	12.77*	Negation13	10.19*
Contribution2	15.19*	Contribution12	15.36*	Negation4	7.42*	Negation14	2.17*
Contribution3	14.11*	Contribution13	14.26*	Negation5	14.82*	Negation15	7.77*
Contribution4	16.02*	Contribution14	14.35*	Negation6	15.62*	Negation16	9.49*
Contribution5	17.41*	Contribution15	13.46*	Negation7	14.09*	Effectiveness1	8.72*
Contribution6	15.86*	Contribution16	14.00*	Negation8	13.03*	Effectiveness2	14.63*
Contribution7	16.49*	Contribution17	14.94*	Negation9	13.64*	Effectiveness3	12.00*
Contribution8	16.49*	Contribution18	12.31*	Negation10	12.00*	Effectiveness4	15.05*
Contribution9	10.78*	Negation1	7.65*	Negation11	6.74*	Effectiveness5	16.02*
Contribution10	14.00*	Negation2	11.42*	Negation12	15.10*	Effectiveness6	13.65*

*p<.01

Upon examining Table 6, it is observed that the t-test values for the first dimension range from 10.78 to 17.41, the t-test values for the second dimension range from 2.17 to 15.62, and the t-test values for the third dimension range from 8.72 to 16.02. According to statistical conventions, if the obtained t-value is greater than 2.58, it is considered significant at the 0.01 level, and if it is greater than 1.96, it is considered significant at the 0.05 level (Kline, 2011). According to the results of the t-test values calculated in CFA, it was seen that all other t values except the Negation14 item were significant at the .01 level. However, the t value of the item Negation 14 was found to be significant at the .05 level. Byrne (2010) states that items with insignificant t values should be removed from the model or the number of participants for factor analysis is considered to be low. Therefore, as the number of participants in the study is sufficient, it is understood that there are no items to be removed in the model.

It was seen that the three-factor structure obtained as a result of EFA was confirmed by CFA. Considering the literature research, it was seen that the structure created was statistically verified. The model created as a result of DFA is given in Figure 2.

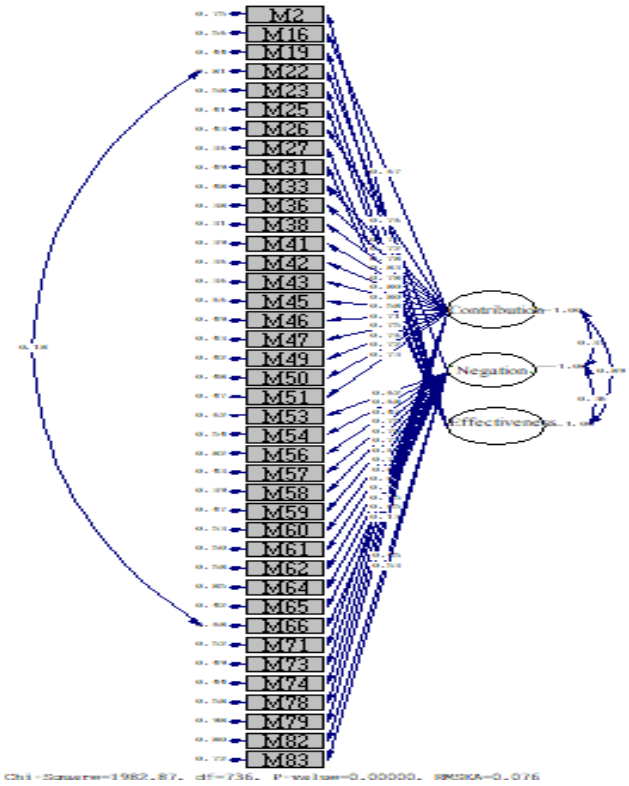

Figure 2. Measurement model for EPAS

Convergent Validity

The simulation validity of the scale was tested within the framework of composite reliability (CR) ≥ 0.70 (Hair, et al., 2006). and AVE ≥ .50 values (Fornell & Larcker, 1981). CR values for "Contribution", "Negation" and "Effectiveness" dimensions had .93, .87 and 0.76. AVE values were found as respectively; .61, .57 and .54. This conditions were being provided in this context for each dimension. According to the results obtained, it was concluded that the convergent validity of the scale is ensured.

Reliability

In this study, McDonalds reliability coefficient was calculated for the sub-dimensions of the scale and the whole scale, since the factor loads of the items were not equal (congeneric measurement) and the scale was not unidimensional (Lucke, 2005). This coefficient was obtained by DFA. The McDonald's ω coefficient (known as congeneric reliability) of the subscale dimensions in the electronic portfolio attitude scale were respectively .97, .91 and .88, and the McDonald's ω coefficient for all items of the scale was .96. Considering McDonald's ω obtained in the scale, it can be concluded that the reliability

coefficient is high. According to these findings, it was concluded that the scale is a reliable measurement tool.

Item Analysis

The corrected total correlation was calculated to determine the predictive power of the total score and to determine item discrimination. In addition, 27% of the lower-upper groups were compared. Composite reliability (CR) is the internal consistency coefficient based on error variance values and factor loads obtained as a result of confirmatory factor analysis (İlhan, et al., 2013).

When the number of items is high, the CR value can be used both as an alternative to the Cronbach's alpha coefficient and to confirm the Cronbach's alpha coefficient (Tetik-Küçükelçi, 2019). A CR value of .70 and above is recommended (Fornell & Larcker, 1981). The findings of the item analysis are given in Table 7.

Table 7. EPAS Item analysis results

Item No		Item Removed	Corrected Item Total	Average	Standard	Skewness	t	CR
New	Old	Scale Alpha	Correlation		Deviation			
Contribution1	M16	.96	.69	3.70	.897	-.95	-17.04*	
Contribution2	M26	.96	.76	3.62	.921	-.76	-20.52*	
Contribution3	M33	.96	.76	3.59	.912	-.71	-18.21*	
Contribution4	M36	.96	.76	3.52	.977	-.73	-21.69*	
Contribution5	M38	.96	.73	3.61	.962	-.69	-21.08*	
Contribution6	M41	.96	.71	3.59	.979	-.84	-19.12*	
Contribution7	M42	.96	.78	3.66	.942	-.85	-21.13*	
Contribution8	M43	.96	.75	3.56	.963	-.70	-20.18*	
Contribution9	M45	.96	.57	3.34	1.00	-.38	-13.95*	
Contribution10	M46	.96	.72	3.49	1.05	-.69	-19.08*	
Contribution11	M47	.96	.74	3.58	.93	-.75	-19.34*	
Contribution12	M49	.96	.73	3.62	.95	-.87	-19.05*	
Contribution13	M50	.96	.70	3.69	.93	-.85	-17.19*	.93
Contribution14	M51	.96	.76	3.70	.88	-.94	-19.17*	
Contribution15	M71	.96	.74	3.64	.93	-.91	-20.03*	
Contribution16	M73	.96	.73	3.60	.96	-.84	-19.19*	
Contribution17	M74	.96	.75	3.54	.95	-.70	-20.87*	
Contribution18	M78	.96	.68	3.44	.91	-.76	-18.27*	
Negation1	M22	.96	.38	3.25	1.10	-.28	-8.73*	
Negation2	M53	.96	.53	3.13	1.07	-.14	-12.34*	
Negation3	M54	.964	.59	3.48	1.00	-.59	-15.40*	
Negation4	M56	.97	.15	2.97	1.07	.17	-2.61*	
Negation5	M57	.96	.61	3.34	1.00	-.41	-14.39*	
Negation6	M58	.96	.43	3.02	.923	.006	-8.63*	
Negation7	M59	.96	.40	3.06	.963	-.02	-7.47*	
Negation8	M60	.96	.44	3.02	1.03	.03	-7.71*	.87
Negation9	M61	.96	.54	3.08	1.02	-.24	-11.08*	
Negation10	M62	.96	.32	3.06	.994	-.01	-5.37*	

Negation11	M64	.96	.31	2.71	.991	.29	-4.71*	
Negation12	M65	.96	.60	3.42	1.01	-.48	-13.98*	
Negation13	M66	.96	.37	3.31	1.12	-.17	-8.47*	
Negation14	M79	.96	.34	3.10	1.03	-.25	-5.82*	
Negation15	M82	.96	.29	2.77	.991	.19	-4.55*	
Negation16	M83	.96	.46	3.23	1.05	-.18	-10.04*	
Effectiveness1	M2	.96	.48	3.84	.84	-.81	-11.40*	
Effectiveness2	M19	.96	.66	3.47	.89	-.67	-18.94*	
Effectiveness3	M23	.96	.62	3.66	.81	-.74	-15.52*	
Effectiveness4	M25	.96	.72	3.41	.94	-.52	-19.78*	.76
Effectiveness5	M27	.96	.71	3.49	.91	-.58	- 20.06*	
Effectiveness6	M31	.96	.67	3.63	.87	-.90	-18.13*	

*p<.05

When the data results in Table 7 are examined, the t-values of the 27% item scores of the lower and upper groups are between 13.95 and 21.69 (sd=280, p <.05) in the first dimension and between 2.61 and 15.40 in the second dimension (sd=280, p <.05) and in the third dimension between 11.40 and 20.06 (sd = 280, p <.05). When Table 7 is examined, item total correlation results are ranked between .57 and .78 in the first factor, between .15 and .61 in the second factor, and between .48 and .72 in the third factor. It is accepted that the total item correlation of .30 and above is sufficient for the interpretation of the items used to distinguish the characteristics that are measured (Büyüköztürk, 2017; Erkuş, 2012). Items other than M56 and M82 items meet this value. In addition, it is seen that the t values obtained from the 27% lower-upper group comparisons are significant for the items M56 and M82. The meaningfulness of the t value used in 27% lower-upper group comparison indicates that the item is distinctive (Erkuş, 2012). Therefore, the items M56 and M82 were decided to be distinctive. According to the results obtained in the item analysis, it can be said that all the items in the scale are distinctive. It is seen that the CR value is greater than .70 and the dimensions of the scale fulfill the composite reliability requirement.

The independent sample t-test was utilized to further examine the construct validity of the scores obtained from the lower and upper groups, which constituted 27% of the participants, and to determine the difference in their total scores. To achieve this, the data collected from 524 prospective teachers were divided into lower and upper groups, each comprising 27% of the data. The t-test results, including the group statistics of each item and the scores of each group from the scale, can be found in Table 8.

Table 8. The results of item analysis based on 27% lower-upper groups of EPAS

Item	group	$\bar{X}$	t	p	Item	group	$\bar{X}$	t	p
2	Upper	4.26			50	Upper	4.31		

	Lower	3.19	11.39	.00*		Lower	2.74	17.28	.00*
16	Upper	4.34			51	Upper	4.33		
	Lower	2.81	17.60	.00*		Lower	2.72	19.29	.00*
19	Upper	4.12			53	Upper	3.99		
	Lower	2.58	19.03	.00*		Lower	2.61	12.47	.00*
22	Upper	3.36			54	Upper	4.27		
	Lower	2.76	8.81	.00*		Lower	2.88	15.42	.00*
23	Upper	4.21			56	Upper	3.31		
	Lower	2.91	15.58	.00*		Lower	2.96	2.43	.00*
25	Upper	4.15			57	Upper	3.65		
	Lower	2.45	20.00	.00*		Lower	2.79	8.47	.00*
26	Upper	4.34			58	Upper	4.16		
	Lower	2.45	20.70	.00*		Lower	2.80	14.28	.00*
27	Upper	4.20			59	Upper	3.66		
	Lower	2.55	20.26	.00*		Lower	2.87	7.31	.00*
31	Upper	4.27			60	Upper	3.69		
	Lower	2.79	18.04	.00*		Lower	2.78	7.55	.00*
33	Upper	4.25			61	Upper	3.86		
	Lower	2.66	18.15	.00*		Lower	2.66	11.05	.00*
36	Upper	4.28			62	Upper	3.62		
	Lower	2.44	21.68	.00*		Lower	2.99	5.24	.00*
37	Upper	4.40			64	Upper	3.17		
	Lower	2.54	21.34	.00*		Lower	2.59	4.67	.00*
38	Upper	4.36			65	Upper	4.28		
	Lower	2.56	21.09	.00*		Lower	2.87	13.95	.00*
40	Upper	4.33			66	Upper	3.96		
	Lower	2.71	17.61	.00*		Lower	2.91	8.47	.00*
41	Upper	4.26			71	Upper	4.35		
	Lower	2.55	18.91	.00*		Lower	2.63	19.97	.00*
42	Upper	4.38			72	Upper	4.29		
	Lower	2.60	21.08	.00*		Lower	2.54	20.30	.00*
43	Upper	4.29			73	Upper	4.34		
	Lower	2.56	20.13	.00*		Lower	2.63	19.13	.00*
44	Upper	4.31			74	Upper	4.31		
	Lower	2.69	16.99	.00*		Lower	2.55	20.88	.00*
45	Upper	4.04			78	Upper	4.11		
	Lower	2.59	13.71	.00*		Lower	2.60	18.40	.00*
46	Upper	4.26			79	Upper	3.54		
	Lower	2.41	19.06	.00*		Lower	2.83	5.61	.00*
47	Upper	4.31			82	Upper	3.24		
	Lower	2.66	19.28	.00*		Lower	2.68	4.61	.00*
48	Upper	4.39			83	Upper	3.95		
	Lower	2.51	20.82	.00*		Lower	2.81	9.99	.00*
49	Upper	4.28							
	Lower	2.61	19.00	.00*					

*p<.05

When Table 8 is examined, it is seen that there is a significant difference between the items in the upper group and the items in the lower group (p <.05). It is seen that the averages of the items in the distinctive 27% upper group are higher than the averages of the

items in the 27% sub-group. Therefore, it was concluded that there was a significant difference between the lower and upper groups and the items were distinctive.

Additionally, in order to determine construct validity of the scale, the scale was applied to prospective teachers studying in different branches in 3rd and 4th grade. The results of one-way analysis of variance (One-Way ANOVA) in the unrelated sample are given in Table 9 to determine whether the items differ according to the gender, grade level of the prospective teachers, and their competence in using technology.

Table 9. ANOVA results according to the total scores of the prospective teachers from EPAS and according to their gender, grade level and their competence in using technology

Variables	Groups	N	Mean	SS	F	p
Gender	Male	91	137.84	21.93	2.98	.08
	Female	421	142.10	21.19		
Grade Level	3	264	139.95	21.78	2.33	.13
	4	248	142.83	20.86		
Competence in Using Technology	Advanced proficiency	136	162.43	24.07	7.63	.00*
	Intermediate proficiency	337	154.16	23.95		
	Basic Proficiency	39	149.25	18.91		

*p<.05

When Table 9 is examined, the analysis results demonstrated that the differences between prospective teachers' attitude scores towards electronic portfolio were not significant in relation to the variable of the gender (F (1, 510) = 2.98, p >.05) and grade level (F(1, 510)=2.33, p>.05) and that the differences found in dependent variable of the variable of technology competence were statistically significant (F(2, 510)=7.63, p<.05). It can be said that as the prospective teachers' competence in using technology increases, their attitude towards e-portfolio increases. It is recommended to use the eta-square (η 2) correlation coefficient to determine the effect size (Büyüköztürk, 2017). The effect size takes values between 0.00 and 1.00. The values between 0.00 and 0.01are interpreted as small effect, the values between 0.01 and 0.06 as medium effect, and the values between 0.06 and 0.14 as wide effect (Büyüköztürk, 2017; Cohen, 1988). In this study, the effect size of prospective teachers' the effect size about competence in using technology was found to be 0.02. In this case, it can be said that the effect size obtained in this study has a medium effect.

Conclusion and Discussion

The main objective of this study was to develop a measurement tool to obtain valid and reliable measurements of prospective teachers' attitudes towards electronic portfolio. Initially, an item pool consisting of 83 items was created for the development of the

Electronic Portfolio Attitude Scale (EPAS). To ensure the scope and face validity of the scale, expert opinions were obtained from four experts. This process resulted in a draft measurement tool with 83 items. The items in the scale were rated on a five-point Likert scale ranging from "Fully Agree" (5) to "Never Disagree" (1). The scale was administered to prospective teachers in the 3rd and 4th grades.

To assess the structure validity of EPAS, both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted. The EFA analysis revealed a three-factor structure consisting of 40 items, explaining 39.38% of the total variance. The factors were named as "Student Benefit (Contribution)," "Denial (Negation or Negative Perspective)," and "Effectiveness in terms of Instructional Process" based on the content and theoretical structures of the items. CFA was performed to test the accuracy of the designed measurement model, and it indicated that the fit indexes of the three-factor structure of EPAS were appropriate. The variance rate explained in EFA was considered as the criterion, and values of 32% and above were deemed appropriate in the CFA. Therefore, based on the EFA and CFA results, EPAS demonstrated satisfactory structure validity.

The internal consistency reliability of the measurements obtained from EPAS was assessed using Cronbach's Alpha reliability coefficient. The McDonald's ω coefficient reliability was calculated as .97 for the "Student Benefit (Contribution)" factor, .91 for the "Denial" factor, .88 for the "Instructional Process" factor, and .96 for the entire scale. According to Liu (2003), internal consistency coefficients of .70 and above indicate that the scale can be considered reliable.

Item analysis was conducted to evaluate the predictive power of the items in EPAS for the total score and to determine their distinctiveness. The 27% lower and upper groups were compared during the item analysis, and the corrected total item correlation was examined. The results indicated that the corrected item-total correlation ranged between .57 and .78 for the "Student Benefit (Contribution)" factor, between .15 and .61 for the "Denial" factor, and between .48 and .72 for the "Effectiveness in terms of Instructional Process" factor. Additionally, all items in the scale showed significant differences between the 27% lower and upper groups, further confirming their distinctiveness. These findings suggest that all the items in EPAS are capable of effectively measuring prospective teachers' attitudes towards electronic portfolio.

In conclusion, the findings of this study demonstrate that EPAS is a valid and reliable measurement tool for assessing the electronic portfolio attitudes of prospective teachers.

Limitations

Although this scale was developed to measure prospective teachers' e-portfolio attitude levels, it has some limitations. One of these limitations is that the scale was developed only with the participation of 3rd and 4th grade prospective teachers from different departments (since the measurement and assessment course is in the 3rd grade in teacher training programs in Turkey), so its usability can be questioned for both teachers and 1st and 2nd grade prospective teachers. Another limitation scale was applied with prospective teachers in different branches. A scale for only one branch can be developed. The need for change in this study may be related to the sample. In this sense, the model can be reproduced with different examples.

Suggestions for Future Studies

This scale is limited to 3rd and 4th grade prospective teachers studying in different departments. Similar studies can be repeated with teachers working at different school levels, by choosing a sample of primary, secondary and high school students. In addition, the study can be repeated by including the sampling in 1st and 2nd grade prospective teachers'. The scale can be translated into other languages using non-Turkish participants. However, parallel analysis can be used for proposed EFA variable selection in future research.

Ethical Committee Permission Information

Name of the board that carries out ethical assessment: Van Yüzüncü Yıl University Social and Humanities Scientific Research and Publication Ethics Board

The date and number of the ethical assessment decision: 11.04.2023 -2023/09

Author Contribution Statement

Bilge GÖK: *Conceptualization, literature review, methodology, implementation, data analysis, translation, and writing.*

Mahmut AYAZ: *Conceptualization, literature review, methodology, data analysis, translation, and writing.*

Yasemin ERDEM: *Conceptualization, literature review, methodology, implementation, data analysis, translation, and writing.*

References

Alan, S. (2014). *İlköğretim 4. ve 5. sınıflarda e-portfolyo kullanımının değerlendirilmesi (Evaluation of e-portfolio usage in primary education 4th and 5th grades (Master Thesis)*. Necmettin Erbakan Üniversitesi, Eğitim Bilimleri Enstitüsü, Konya.

Arap, B. (2008). *Dil öğretmeni eğitiminde öğretmen adayları için elektronik portfolyo kullanımı (Electronic portfolio use for teacher candidates in language teacher education)* (Master Thesis). Mersin Üniversitesi Sosyal Bilimler Enstitüsü, Mersin.

Ayaz, M. (2021). *The effect of e-portfolio application on teacher competences, motivations and reflective thinking of preservice primary school teachers.* (Phd Thesis). Hacettepe Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Ayaz, M., Gülen, S., & Gök, B. STEM etkinliklerinin uygulanması sürecinde elektronik portfolyo kullanımının sekizinci sınıf öğrencilerinin fen bilimleri dersi akademik başarısına ve stem tutumuna etkisinin incelenmesi (Investigation of the effect of the use of electronic portfolio in the process of applying STEM activities on the academic achievement of eighth grade students and STEM attitude). *Journal of Yüzüncü Yıl University Faculty of Education*, *17*(1), 1153-1179.

Barbera, E. (2009). Mutual feedback in e-portfolio assessment: an approach to the netfolio system. *British Journal of Educational Technology*, *40*(2), 342-357.

Barrett, H., & Carney, J. (2005). Conflicting paradigms and competing purposes in electronic portfolio development. *TaskStream web site*, 295-314.

Başol, G.m(2019). *Eğitimde ölçme ve değerlendirme*. Pegem Akademi.

Beetham, H. (2005). E-portfolios in Post-16 Learning in the UK: Developments, Issues and Opportunities, Retrieved October 10, 2021, from, http://www.jisc.ac.uk/media/documents/themes/elearning/eportfolioped.pdf.

Bhattacharya, M. & Hartnett, M. (2007). *E-portfolio assessment in higher education*. 37th ASEE/IEEE Frontiers in Education Conference, Milwaukee, WI.

Birgin, O. (2008). Alternatif bir yöntemi olarak portfolyo uygulamasına ilişkin öğrenci görüşleri [Student views on portfolio assessment as an alternative assessment method]. *Gazi University Turkish Journal of Educational Sciences, 6* (1), 1-24.

Büyüköztürk, Ş. (2017). *Sosyal bilimler için veri analizi el kitabı (Manual of data analysis for social sciences)*. Pegem Akademi Yayınları.

Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications and programming.* Taylor and Francis Group.

Cattell, R. B. (1978). *The scientific use of factor analysis in behavioral and life sciences*. Plenum.

Challis, D. (2005). Towards the mature ePortfolio: Some implications for higher education. *Canadian Journal of Learning and Technology*, *31*(3).

Cohen J. (1988). *Statistical power analysis for the behavioral sciences*. 2nd ed. Hillsdale, Erlbaum.

Çokluk, Ö., Şekercioğlu, G., Büyüköztürk, Ş. (2016). Sosyal bilimler için çok değişkenli istatistik: SPSS ve LISREL uygulamaları (Multivariate statistics for social sciences: SPSS and LISREL applications). Pegem Akademi Yayınları.

Çukurbaşı, B., & Kıyıcı, M. (2018). Öğretmen adaylarının elektronik portfolyoya yönelik görüşlerinin incelenmesi (Examination of pre-service teachers' views on electronic portfolio): Weebly örneği. *Inonu University Journal of the Faculty of Education, 19*(1), 1-11.

Demir, B. & Kutlu, Ö. (2016). Elektronik portfolyo uygulamalarının ortaokul 6. sınıf öğrencilerinin araştırma becerilerine etkisi (The effect of electronic portfolio applications on the research skills of 6th grade middle school students). *Eğitim ve Bilim, 41* (188), 227-253.

Demirli, C. (2007) *E-portfolyo öğretim sürecinin öğrenenlerin tutumları ve algıları üzerine etkisi* (Doktora Tezi) (The effect of e-portfolio teaching process on learners' attitudes and perceptions), Fırat Üniversitesi, Sosyal Bilimler Enstitüsü, Elazığ.

Erice, D. & Ertaş, A. (2011). The impact of e-portfolio on foreign language writing skills. *Journal of Faculty of Educational Sciences*, 44, 73–94.

Erkuş, A. (2012). *Psikolojide ölçme ve ölçek geliştirme (Measurement and scale development in psychology).* Pegem Akademi.

Field, A. (2009) Discovering statistics using SPSS. 3rd Edition, Sage Publications Ltd.

Filkins, D.T. (2010). *The acquisition of electronic portfolio support staff expertise: A theoretical model.* (Doktora Tezi). Accessed from ProQuest Dissertations and Theses database. (UMI No. 3438994).

Floyd, F. J., & Widaman, K. F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment, 7*(3), 286-199.

Fornell, C., & Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39-50.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education (Edisi Kedelapan ed.). (S. Kiefer, Penyunt.)* McGraw-Hill Companies. Frontiers in Education Conference, Milwaukee, WI.

Goeman, R.L. (2007). *Teacher candidates' perceptions of traditional classroom assessments and electronic portfolio classroom assessments* (Unpublished doctoral thesis), University of Nebraska, Omaha.

Gömleksiz, M. & Koç, A. (2010). Bilgisayar okuryazarlığı becerisi ediniminde e-portfolyo sürecinin öğrenen performansına ve tutumlarına etkisi (The effect of the e-portfolio process on learner performance and attitudes in computer literacy skill acquisition). *Journal of Erzincan Faculty of Education, 12*(2), 75-96.

Grady, E. (1996). The grady profile. *Intervention in School and Clinic, 31*(4), 246-251.

Gülbahar, Y., & Köse, F. (2006). Öğretmen adaylarının değerlendirme için elektronik portfolyo kullanımına ilişkin görüşleri (Prospective teachers' views on the use of electronic portfolios for assessment). *Journal of Ankara University Faculty of Educational Sciences, 39*(2), 75-93.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis.* Pearson International Edition.

Harden, R. M. (2007). Learning outcomes as a tool to assess progression. *Medical Teacher*, *29*(7), 678-682.

Hawisher, G. E., & Selfe, C. L. (1997). *Wedding the technologies of writing portfolios and computers: The challenges of the electronic classrooms*. In K. B. Yancey & I. Weiser (Eds.), Situating portfolios: For perspectives (pp. 305). Utah State: UP.

Heath, M. (2005). Are you ready to go digital? The pros and cons of electronic portfolio development. *Library Media Connection, 23(7),* 66-70.

Henson, R., K. & Roberts, J., K. (2006). Use of exploratory factor analysis in published research: common errors and some comment on improved practice. *Educational and Psychological Measurement, 66*(3), 393-416.

Hung, W. (2006). The 3C3R model: A conceptual framework for designing problems in PBL. *Interdisciplinary Journal of Problem-Based Learning, 1*(1), 55-77.

İlhan, M., & Çetin, B. (2014). Sınıf değerlendirme atmosferi ölçeğinin (SDAÖ) geliştirilmesi: Geçerlik ve güvenirlik çalışması (Development of the classroom assessment atmosphere scale (SDAÖ): A validity and reliability study). *Education and Science, 39*(176), 31-50.

İlhan, M., Çetin, B., & Bars, M. (2013). Katılımcı değerlendirmeye yönelik inanç ölçeği'nin (KDYIÖ) Türkçe uyarlaması: Geçerlik ve güvenirlik çalışması [Turkish adaptation of the belief scale for participatory evaluation (KDYIÖ): Validity and reliability study]. *Journal of European Education, 3*(2), 17-35.

Kasap, S. (2021). Mother tongue attitude scale (MTAS). *International Journal of Kurdish Studies* 7 (1), 103-122, https://doi.org/10.21600/ijoks.834913

Kasap, S. (2020*). Uzaktan eğitim yoluyla yabanci dil eğitiminde özerk öğrenmenin yeri. Pandemi ve Eğitim,* Anı Yayıncılık.

Kline, R. B. (2011). *Principles and practice of structural equation modeling*. The Guilford Press.

Krause, S. (1996). Portfolios in teacher education: Effects on preservice teachers' early comprehension of the portfolio process. *Journal of Teacher Education,* 47(2), 130-138.

Kasap, S. (2023). The impact of musical skills on foreign language anxiety. *European Journal of English Language Teaching, 8*(2).

Kutlu, Ö., Doğan, D., & Karakaya, İ. (2017). *Ölçme ve değerlendirme: Performansa ve portfolyaya dayalı durum belirleme [Assessment and evaluation: determination based on performance and portfolio]*. Pegem Akademi Yayıncılık.

Larson, R. L. (2003). *What is a portfolio? Using portfolios to assess the impact of a curriculum. portfolio assessment uses, cases, scoring, and impact. Banta, Trudy. W. (Ed.).* Published by Jossey-Bass A Wiley Imprint, San Francisco, 7-10.

Liu, Y. (2003). Developing a scale to measure the interactivity of websites. *Journal of Advertising Research*, *43*(2), 207-216.

Lucke, J. F. (2005a). The α and ω of congeneric test theory: An extension of reliability and internal consistency to heterogeneous tests. *Applied Psychological Measurements, 29*(1), 65-81.

Luyegu, E. A. (2009). *Students' perceptions of assessment and the electronic portfolio project in the college of education* (Unpublished doctoral thesis). University of South Alabama, Alabama, The USA.

Ma, X., & Rada, R. (2005). Building a web-based accountability system in a teacher education program. *Interactive Learning Environments, 13(1-2),* 93-119.

Özkul, A. E. & Girginer, N. (2014). Uzaktan eğitimde teknoloji ve etkinlik. *Sakarya University Journal of Faculty of Education, 3*,107-117.

Özgür, H. (2016). Facebook sosyal ağına entegre e-portfolyo yazılımının akademik başarı ve öğretim sürecinde kullanımına yönelik tutuma etkisi [The effect of e-portfolio software integrated into Facebook social network on academic achievement and attitude towards its use in the teaching process]. *Sakarya University Journal of Education*, *6*(1), 38-56.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307-332.

Paulson, F.L., Paulsen, P.R. & Meyer, C.A. (1991). What makes a portfolio? *Educational Leadership, 48* (5), 60-63.

Polat, M. & Köse, Y. (2013). Perceptions of primary education teachers towards the use of e-portfolio as a tool of performance evaluation in schools. *Journal of Computer and Education Research, 1 (1),* 57-82.

Pullman, G. 2002. Electronic portfolios revisited: The e-portfolios project. *Computers and Composition, 19* (2), 151–69.

Samaras, A., P., & Fox, R., K. (2013). Capturing the process of critical reflective teaching practices through e-portfolios, *Professional Development in Education,39(*1), 23-41.

Schermelleh-Engel, K., Moosbrugger, H. & Müller, H. (2003). Evaluating the fit of structural equation models: Test of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research-Online, 8*(2), 23-74.

Senemoğlu, N. (2013) *Gelişim, öğrenme ve öğretim kuramdan uygulamaya*, Yargı Yayınevi.

Stevens, J. (2002). *Applied multivariate statistics for the social sciences* (4th Edition). Lawrence Erlbaum Associates.

Tabachnick, B. G., & Fidell, L.S. (2007). *Using multivariate statistics* (5th ed.). Allyn and Bacon.

Tetik-Küçükelçi, D. (2019). Hastane anksiyete ve depresyon ölçeği (HADS) üzerine bir çalışma [A study on the hospital anxiety and depression scale (HADS)]. *Life Skills Psychology Journal*, *3*(5), 85-91

Tezbaşaran, A.A. (1997). *Likert tipi ölçek hazırlama kılavuzu [Likert type scale preparation guide],* Türk Psikologlar Derneği,

Wesson, C., & King, R. (1996). Portfolio assessment and special education students. *Teaching Exceptional Children, 28*, 44-48.

Zeybek, Ü. G. (2019). Veritabanı organizasyonu dersinde elektronik portfolyo uygulamalarının akademik başarıya etkisi [The effect of electronic portfolio applications on academic success in database organization course]. *Afyon Kocatepe University Journal of Social Sciences*, *21*(4), 1045-1058.

Appendix 1

Table 3. *Factors and factor loadings resulting from EFA*

Factor 1 (Benefit (contribution) to the student) Cronbach Alpha = 0.97 Explained variance = 18.70%			
	Factor Load		
	1	**2**	**3**
16) I believe that students will learn about their own achievements and abilities in the e-portfolio evaluation process.	.54		
26) I think the e-portfolio will reveal the strengths and weaknesses of the students.	.62		
33) I believe that e-portfolio will improve students' sense of responsibility.	.61		
36) I believe that e-portfolio will increase students' self-confidence.	.61		
38) I think the e-portfolio will contribute to the development of students' sense of taking responsibility.	.63		
41) I believe that the e-portfolio will encourage students to work systematically.	.57		
42) I believe that the e-portfolio will contribute to the student's self-awareness.	.68		
43) I believe that students' high-level thinking skills will improve thanks to the e-portfolio.	.66		
45) I think that the e-portfolio application will increase the cooperation between students.	.49		
46) I believe that the e-portfolio application will increase the interaction between student and teacher.	.64		
47) I believe that the e-portfolio will improve students' self-esteem.	.67		
49) I believe that the e-portfolio will enable students to make self-criticism at an early age.	.67		
50) I think e-portfolio will be useful in future career choices as it enables students to get to know themselves.	.59		
51) I believe that the e-portfolio will contribute to the facilitation of the students' future learning experiences based on their previous learning experiences.	.55		

71) I think the e-portfolio will help students see their personal development.	.67
73) I believe that the e-portfolio application will give students learning responsibility.	.69
74) I believe that e-portfolio will increase students' self-confidence.	.60
78) With the e-portfolio, I think students can apply what they learn in the course in daily life.	.46
Factor 2 (Denial / Negation or negative perspective) Cronbach Alpha = 0.91 Announced variance = 13.65%	

	Factor Load		
	1	**2**	**3**
22) The thought of constantly using technology in the evaluation process with the e-portfolio overwhelms me.		.41	
53) I believe that e-portfolio will prevent students from socializing.		.50	
54) I believe that e-portfolio will be a waste of time for students and teachers.		.55	
56) I do not believe that using e-portfolio will make my lessons fun.		.35	
57) I believe that it will be difficult for a teacher to choose content for students in the e-portfolio process.		.70	
58) I believe that e-portfolio evaluation will lower academic standards.		.69	
59) I think it will be difficult to plan the e-portfolio evaluation.		.72	
60) I think that e-portfolio will not be suitable for most courses and subjects.		.62	
61) I believe that the e-portfolio will fall short in achieving important cognitive goals		.63	
62) In the e-portfolio application, I think I will have difficulties as the responsibility of the teacher will be too much.		.76	
64) I believe that e-portfolio will push students towards individuality.		.42	
65) I think that the e-portfolio will hinder teaching.		.68	
66) I think that I will have difficulties because e-portfolio application requires technological skills.		.56	
79) I believe that e-portfolio consists of transferring all learning experiences and activities in and out of school to the computer.		.41	
82) I think students will have difficulties in the process because of the e-portfolio application requires technological skills.		.52	
83) I don't think e-portfolio will be useful for students with medium or low achievement levels.		.34	
Factor 3 (Effectiveness in terms of instructional process) Cronbach Alpha = 0.88 Explained variance = 7.21%			

	Factor Load		
	1	**2**	**3**
2) I think the e-portfolio will provide faster feedback to students than traditional assessment.			.53
19) I think that knowing that they will be evaluated with e-portfolio will motivate students more to the lesson.			.65
23) I believe that the e-portfolio will make it easy to evaluate the course outcomes.			.60
25) I believe that I will enjoy teaching more with the e-portfolio.			.55
27) I believe that students' interest in the lesson will increase thanks to the e-portfolio.			.58
31) I think I will use time effectively and efficiently with the e-portfolio.			.63
TOTAL VARIANCE ANNOUNCED %	**39.38**		