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Agile School Scale: Validity and Reliability Study*

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ABSTRACT

This study emphasizes the importance of educational organizations being agile to adapt to changing information and technology conditions and aims to develop a valid and reliable scale to measure the agility levels of schools. The research was conducted with a three-stage working group. In the first stage, the 55-item draft scale was applied to 437 participants and its construct validity was examined with exploratory factor analysis (AFA). In the second stage, the 33-item scale obtained as a result of AFA was applied to 683 participants and its construct validity was tested with confirmatory factor analysis (CFA). In the third stage, 78 school administrators and teachers were sampled for test-retest application and criterion validity. It was determined that the scale has a four-dimensional structure. These dimensions are named as agile leader, agile teacher, agile school environment and agile communication with external stakeholders. The proposed four-dimensional structure was validated with CFA and the fit indices were found to be at an acceptable level. The overall Cronbach Alpha reliability coefficient of the scale was calculated as 0.95. In addition, independent groups t-test, item total and item residual correlation analysis, inter-factor correlation analysis and test-retest correlation analysis were performed for the reliability of the scale. As a result of these analyses, the reliability and validity of the scale were ensured and it was named the School Agility Scale.

Keywords
Agile, organizational agility, school agility, agile school characteristics

1. Introduction

Technological developments are changing the critical factors that provide competitive advantage. The globalizing economic environment forces organizations to acquire agile skills, develop innovative organizational structures and adapt to the dynamic business processes of the age. This situation leads to the fact that the economic system based on digital information resources increases its socio-economic role, of which education is an important function. Therefore, opportunity and risk management ability (i.e. agility) is a key factor for schools to fulfill this role, specifically for educational organizations.

Schools have maintained the same basic model for more than a century (Lim, Halim & Ramayah, 2022). This model consists of a structure where teachers and students come together in physical locations, take courses and eventually graduate. Gupta and Bharadwaj (2013) liken schools to a production-oriented model, where students come as input, are processed by teachers, who are information experts, and provide output (graduation). This model can be considered successful because it standardizes mass education in the industrial age (Baker, 2013). However, this industrial school model is insufficient to meet the future expectations and needs of individuals after the industrial age (Rose, 2012). In particular, it has been observed that the

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importance of information and communication infrastructure has increased during the Covid-19 pandemic process. This process has created turbulence in all organizations, including schools. The confusion and uncertainty brought by turbulence have turned the general norms that determine the behavior of organizations into uncertain and complex. Organizations in this situation had to go through this unpredictable process without planning and control. For this reason, as the interaction between globalization and information technologies increases, schools, like other organizations, have to enter a process of change and transformation. Because technological innovations such as simulations, augmented realities, cloud technology and blockchains strengthen the non-classroom role of information (Hazzan & Dubinsky, 2014). In other words, the "one size fits all" approach that dominated the industrial period and before is declining and is being replaced by a more flexible, agile, individual/organization centered approach that can adapt to new conditions and environments with a personalized education vision.

Considering the impact of advances in information and technology on organizations, organizations in the field of education need to prepare their stakeholders for the future in accordance with this change. This adaptive situation requires schools to have agile qualities (Gençcelep, 2020). In this context, in the literature on the position of schools in the face of change; school reform (Reeves, 2009), turnaround schools (Fullan, 2006), effective schooling (Hallinger & Murphy, 1986), school capacity (Cosner, 2009), systemic improvement (Duffy, 2003) and learning schools (Senge, 2000). It has been examined with various concepts such as. Although these studies in the literature reveal the need for change in schools, they do not adequately address the skills that schools need to acquire today with change. Because change fuels the search for harmony/stability and balance in organizations. Therefore, agile organizations that can predict change, are competent, flexible and respond quickly can provide competitive advantage in today's world (Llamosa-Villalba et al., 2014; Sharifi & Zhang, 2001). In this context, although the concept of agility has been researched in business fields from the perspective of organizational agility in the literature, it has been determined that the concept of "Agile School" has not gained widespread use. However, there are very important parameters that distinguish schools from organizations in different disciplines. Examples of these parameters are that schools provide public services without profit, aiming to provide information and value for students instead of products with economic value, their outputs are not clear as in for-profit organizations, and schools have a complex and multi-dimensional process. Therefore, the concept of agility should be addressed specifically within the school system. In this context, agile school can be defined as the capacity to adapt to constantly changing situations and turn unpredictable situations into advantages. In addition, the agile school focuses not only on today's challenges but also on educating the individuals required by tomorrow in environments dominated by chaos and uncertainty. As a result, agile school is the new paradigm of pedagogy that integrates traditional schools with technology to meet the needs that will occur in the future of education but are also relevant today.

18,231 scientific studies on the concept of agility have been published in the Web of Science database in the last decade (2013–2023). As a result of the literature review, it was seen that these scientific studies were mostly carried out in the field of business administration. By analyzing the agility implementation processes of business organizations and adapting these features to schools, it is assumed that schools can respond to change by being flexible in innovative processes, more competitive and collaborating with all their stakeholders. Hearing this need, Gül and Çetin (2022) conducted research developing the Organizational Agility Scale in Higher Education, Gravett and Cadwell (2016) the Learning Agility Self-Assessment Scale, Yazıcı and Özgenel (2020) the Marmara Agile Leadership Scale, and Sherehiy (2008) the Workforce Scale. In these studies, the agility level and characteristics of the school were indirectly addressed. In Kaya and Özdemir's (2022) studies on measuring school agility, the relationship with external stakeholders, which is an important dimension in the agility of schools in the organization, was not taken into account. As a result, as a result of the literature review, it was determined that there are various scales measuring agile features in the field of business. These scales have also been used in the field of education. However, the specific values of education differ from the business field. Therefore, a scale suitable for the field of education is needed to measure the agile characteristics of schools in the field of education. To meet this need, this study aims to develop a valid and reliable scale to measure agile characteristics in the field of education.

2. Method

2.1. Research Model

The aim of this study is to develop a scale to measure schools' agile feature levels in a valid and reliable way. The scale development process was designed and carried out according to the screening model. The screening model is used in studies where data is collected to determine certain characteristics of a group (Büyüköztürk et al., 2017).

2.2. Study Group

In the study, data was collected from three different study groups. Three working groups consist of school administrators and teachers working in public and private schools affiliated with the Provincial Directorates of National Education on the Anatolian side of Istanbul in the 2021-2022 academic year . While Creswell (2017) states that an average of 300 participants are required for factor analysis, Comrey and Lee (1992) state that the number of participants in the sample should be 50 very poor, 100 weak, 200 suitable, 300 good, 500 Very good means 1000 or more means excellent. For this reason, forms were distributed to 520 school administrators and teachers for Exploratory Factor Analysis (AFA), which was the first study group for the trial scale. Of these, 472 forms were taken back and 35 forms were not included in the analysis because they did not meet the necessary conditions, and factor analysis was started with 437 forms. The next stage in the scale development process was Confirmatory Factor Analysis (CFA) to test the validity of the scale. For Confirmatory Factor Analysis, scale forms were distributed to 750 school administrators and teachers by the researcher. 692 of the scale forms were taken back, 9 forms were not included in the analysis because they did not meet the necessary conditions, and analysis was carried out with 683 forms. In addition, data was collected from 78 school administrators and teachers for the third study group, Test-retest and criterion validity studies.

2.2.1. Scale Development Process

Scale development is a process that determines the methodology to be followed by classifying and grading the features that are subject to measurement (Büyüköztürk, 2005). For this reason, the process was planned by following the stages used by DeVellis (2017) in scale development. These:

Stage 1: Determining the parameters you want to measure

Stage 2: Creating the item pool

Stage 3: Determining the measurement method

Stage 4: Review of the initial item pool by experts

Stage 5: Considering the inclusion of validity items

Stage 6: Application of the items to the scale development sample

Stage 7: Evaluation of the items

Stage 8: Optimizing the scale length

In the first stage of the development of the scale, after the structure to be measured was clearly determined and defined, national and international literature was examined and an item pool was created and 98 items were collected. For the fourth stage, expert evaluation, expert evaluation was carried out in three successive steps.

- It was revised as 78 items by taking the opinions of 5 school administrators and 6 teachers.
- Two focus groups consisting of school administrators and teachers were formed. (One of these focus groups is a group of 6 people consisting of private school administrators and teachers, the other is a group of 5 people consisting of public school administrators and teachers). As a result of these focus group discussions, the final version of the scale's pre-application form was revised to 53 items.
- As a last step, the final version of the pre-application form of the scale was revised to 55 items by taking the opinions of 10 expert researchers who had done a postgraduate thesis on the concept of agility in the field of education (With the expert opinion form, experts were asked to evaluate the articles

according to the expressions 'Appropriate, Should be Corrected, Should Be Removed'. A section was reserved in the form for experts to write their opinions about the article).

Within the scope of validity and reliability studies, which is the fifth stage in the development of the scale, exploratory factor analysis (AFA) was performed on the 55-item trial scale with the SPSS 22 (Statistical Package for the Social Sciences) program . After the AFA data obtained, it was decided that the final version of the trial scale would be 4 factors and 33 items.

2.3. Analysis of Data

Within the scope of AFA, descriptive statistical values were found and the scale's suitability for normal distribution was examined and visually analyzed on the screeplot chart. Kaiser-Meyer-Olkin (KMO) and Bartlett's results, which are important for validity, were examined. The total variance ratio and factor eigenvalues of the scale were examined in this context. After AFA, a CFA study was conducted on the scale, which has 4 factors and 33 items. SSPS AMOS program was used for CFA. Fit indices [Chi-square goodness of fit (χ 2); Comparative fit (CFI); Goodness of fit index (GFI) Adjusted goodness of fit index (AGFI); Root mean square error of approximation (RMSEA); Root square error of approximation (RMR); Standardized root mean square error (SRMR)] was analyzed.

Within the scope of reliability of the Agile School Scale, Cronbach's Alpha values and reliability coefficients of the scale and its sub-dimensions were discussed. In addition, the scale's content validity rate (CVR), criterion validity, test-retest, item total score and item remaining score correlation values, and item discrimination index values with the upper and lower 27% group were analyzed.

3. Findings

3.1. Validity Findings

The validity findings of the Agile School Scale are discussed under three headings: content validity, AFA and CFA validity.

Content Validity

Content validity is related to the extent to which the scale items represent the set of behaviors they are intended to measure (Büyüköztürk et al., 2017). This representation situation was developed by Lawshe (1975) and given as stages: Stage 1: Establishing a group of field experts. Stage 2: Preparation of scale forms. Stage 3: Getting expert opinions. Stage 4: Determination of content validity rates for the items. Stage 5: Obtaining content validity indexes for the scale. Stage 6: Finalizing the scale

Within the scope of the determined first stage, an invitation was made to 11 researchers working in the field of education on the concept of agility. A field expert group was formed with the agreement of 10 researchers. After this, the experts' opinions on each item were collected and content validity rates were obtained. Lawshe (1975), in his opinion of 10 experts, stated that the content validity ratio (CVR) should be at least 0.62. The item pool of 98 items created as a result of literature readings; As a result of the opinions of experts in the field (KGO), it was transformed into a scale form with 55 items. Additionally, the content validity index of the developed agile school scale was calculated (KGI=0.86). Since this value is greater than the value determined for the minimum Content Validity Rate (CVR=0.62), the content validity of the scale was found to be statistically significant (CGI > CVR). As a result, it can be said that the CSA provides content validity with expert opinions.

AFA Validity Values

In this study, Exploratory Factor Analysis (AFA) method was used to determine the factor structure of the Agile School scale and to test the structural validity of the scale. Normality test was applied to determine whether the data conformed to normal distribution. Compliance of the data with normal distribution is important for the validity and reliability of statistical analyses (Tabachnick & Fidell, 2015; Özdamar, 2017). Statistical values of the normal distribution of trial scale data are given in Table 1.

Table 1. *Scale Draft Form Descriptive Statistics Values*

Descriptive Values	Values
Frequency	437
Arithmetic mean	3.76
Hydrangea	3.78
Standard deviation	.446
smallest score	1.72
biggest score	4.80
Range	3.08
Distortion	.-418
kurtosis	.602

As indicated in Table 1, the trial scale is normally distributed. Because it is widely used that kurtosis and skewness values are the two most important elements in evaluating normality and that their values are normal distribution when they remain within ±1 (George & Mallery, 2016; Gravetter et al., 2018; Tabachnick & Fidell, 2015). The suitability of the trial scale to normal distribution was examined on the Normality Distribution Plot. QQ plot is a method used to visually evaluate the conformity of data to normal distribution. In this graph, the quantiles of the data are compared with the quantiles of the normal distribution. If the data conforms to normal distribution, the points in the QQ graph are located on a line of approximately 45 degrees (Büyüköztürk, 2018). This shows that the data conforms to the expectations of normal distribution. As a result of the examinations in Figure 1, it was concluded that the normality of the distribution was suitable for factor analysis.

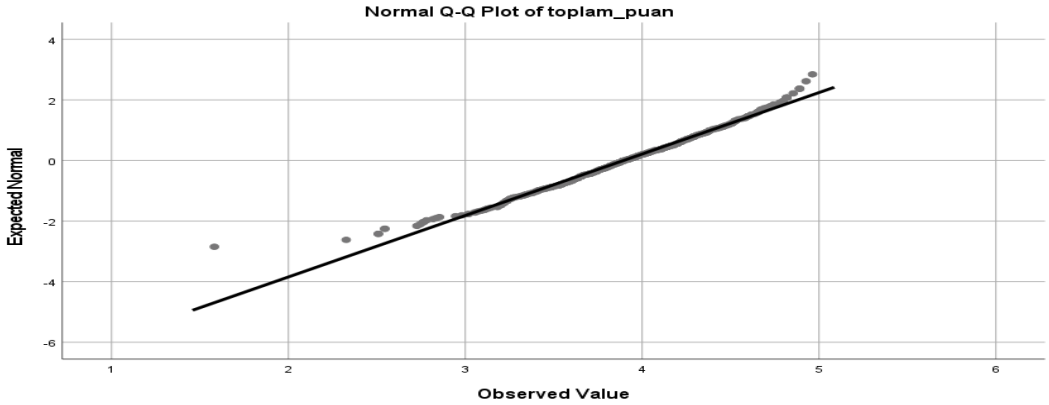

Figure 1. *Normality Distribution Plot*

KMO (Kaiser /Meyer /Olkin) and Bartlett's Test were performed to check the sample size and to determine the suitability of the data structure for Exploratory Factor Analysis (AFA). KMO and Bartlett's Test data of the Agile School Scale are shown in Table 2.

Table 2. *Agile School Scale KMO and Bartlett's Test Data*

Kaiser-Meyer-Olkin (KMO)	.943	
Bartlett's Test	*Chi-Square*	12953,442
	df	1485
	p	,000

In Table 2, the Kaiser-Meyer Olkin (KMO) value (.953) and the Bartlett sphericity test chi-square value (x^2 = 14867.52 ; sd= 1485 ; p= 000) was found. The fact that the KMO value is over .60 and the Bartlett test of sphericity is statistically significant (p<.05) indicates that the data is suitable for AFA (Dimitrov, 2012; Huck, 2012; Tabachnick & Fidell, 2013). In addition, although a KMO value above .60 is considered sufficient, it is also stated in the literature that a KMO value between 0.90 and 1.00 is perfect (Field, 2009). When these results were evaluated in line with the recommendations in the literature, it was concluded that the data set was suitable for AFA. After the data were suitable for AFA, Principal Components Analysis was performed. After the analysis, it is necessary to take into account the size of the items in the scale and some criteria to prevent the dimensions from showing items that are close to each other and causing accumulation. One of these criteria is the first analysis values of the scale. Table 3 shows the total variance and first analysis results of the 55-item trial scale.

Table 3. *Total Variance and First Analysis Results of the Agile School Scale*

Factor	Eigenvalue	Variance	cumulative
1	17,564	31,935	31,935
2	3,648	6,633	38,568
3	2,700.	4.91	43,477
4	2,251	4,093	47.57
5	1,468	2.67	50.24
6	1,352	2,458	52,698
7	1.27	2.31	55,007
8	1,215	2,208	57,216
9	1,082	1,968	59,184
10	1,066	1,939	61,122
11	1,103	1,873	52,995

In the first analysis table shown in Table 3, 11 dimensions with values greater than 1 and 1 and above 5% were identified. 11 dimensions represent 52.995% of the total variance. When performing factor analysis, it was stated that it would be better if it was above .45. For this reason, within the scope of AFA, a lower limit of .45 was determined for the item factor loading. In order to prevent overlap that may arise due to the assumption that the items will load on more than one factor, the difference between the load values on the factors was taken into consideration at least .10 level (Büyüköztürk, 2018). Items with item loadings lower than .45 or differing from each other by less than .10 were gradually eliminated from the scale. With this method, a total of 1, 7, 8, 9, 11, 12, 15, 16, 18, 20, 25, 26, 29, 31, 33, 34, 35, 42, 48, 49, 50, 51 were obtained from the scale, respectively. It was decided to remove 22 items and keep 33 items in the scale. In the final analysis, the dimension values and variance values of the scale are given in Table 4.

Table 3. *Variance and Final Analysis Eigenvalue Results of Agile School Scale*

Dimension	Eigenvalue	Variance	Cumulative
1	12,403	37,586	37,586
2	2,325	7,047	44,633
3	2,028	6,144	50,777
4	1,316	3,988	54,765

When Table 4 is examined, 12.403 of the factor loading of the first dimension was determined to be stronger compared to the other dimensions. In the table, 37.58% of the 54.76% variance is explained as the first dimension, 7.04% as the second dimension, 6.14% as the third dimension and 3.98% as the fourth dimension.

Since it was thought that an analysis based only on the eigenvalue criterion would not be sufficient to determine the factor, the Scree Plot test was also applied. This test is used to determine how much the observed values deviate from the "a priori" theory (Erkuş, 2014). Accordingly, factors with eigenvalues of 1 and above and sudden decreases in the line graph were accepted as criteria for how many factors should be (Worthington & Whittaker, 2006). The Agile School Scale Slope Plot obtained from the last rotation of the AFA application is presented in Figure 2.

Figure 2. *Plot of Agile School Scale AFA Application*

When Figure 2 is examined, it is seen that the factor eigenvalues drop below 1 after the fourth factor. This situation can also be seen in the table showing the total variance explained. Accordingly, after the fourth component, the eigenvalues of the factors drop below 1 and their contribution to the total variance becomes statistically insignificant.

After applying the variance amount, Varimax orthogonal rotation analysis was applied to determine the distribution of the items in dimensions. Varimax rotation is a method that aims to maximize the variance of factor loadings for each factor (Tabachnick & Fidell, 2015). As a result of rotation, high factor loadings increase further, while low factor loadings decrease further. Thus, the meaningfulness and interpretability of the factors increases. In Table 5, dimensions, size items and item load values as a result of Varimax orthogonal rotation analysis are given.

Table 4. *Agile School Scale Dimension Item Loadings*

Items	Factor 1	Items	Factor 2	Items	Factor 3	Items	Factor 4
38	.701	5	.806	22	.761	52	.711
40	.699	4	.790	23	.748	53	.693
46	.668	3	.716	24	.711	54	.619
37	.633	2	.706	21	.690	55	.570
45	.531	6	.536	28	.633	30	.546
41	.613	10	.597	19	.608	Total Variance	1,316
39	.609	17	.577	32	.562		
36	.550	13	.562	27	.545		
43	.548	14	.465	Total Variance	2,028		
44	.525	Total Variance	2,325				
47	.523						
Total Variance	37,586						

As a result of the analysis, it was determined that 33 items remained in the scale. The varimax rotation technique was used to determine the direction and strength of the relationship between factors in cases where variable factor correlations approached +1 or -1. This technique attempts to make the factors independent of each other in order to facilitate the interpretation of the factor loading matrix. (Hair et al., 2014). When the table was examined, it was determined that no factor was below 0.45. The item load amount of the first dimension is between .70 and .52; second dimension .80 to .46; third dimension .76 to .54; The fourth dimension was found to be between .71 and .54.

Since there were no overlapping items in the factor load value of the items, it was decided that the Agile School Scale would be 4-dimensional. Based on the theoretical structure, each item of the scale was examined and defined in the resulting sub-dimensions. Table 6 shows the factor names and item numbers.

Table 6. *Factor Names and Number of Items After AFA*

Factor	Number of Items	Old order of items	New order of items
Agile Leader	9 Article	5,4,3,2,6,10,17,13,14	1,2,3,4,5,6,7,8,9
Agile Teacher	8 Article	22,23,24,21,28,19,32,27	10,11,12,13,14,15,16,17,18
Agile School Environment	11 Article	38,40,46,37,45,41,39,36,43,44,47	19,20,21,22,23,24,25,26,27,28
Agility in External Stakeholder Relations	5 Article	52,53,54,55,30	29,30,31,32,33

As seen in Table 6, the first factor, *"Agile Leader", contains* 9 items (items 5, 4, 3, 2, 6, 10, 17, 13, 14), and the second factor, *"Agile Teacher" , contains* 8 items (items 22, 23, items 24, 21, 28, 19, 32, 27), the third factor, *"Agile School Environment" , consists of* 11 items (items 38, 40, 46, 37, 45, 41, 39, 36, 43, 44, 47), the fourth factor The factor *"Agility in External Stakeholder Relations" consists* of 5 items (items 52, 53, 54, 55, 30).

Item-total correlation values were examined to provide evidence whether the Agile School Scale items were necessary for the total of the scale. Table 7 shows the total score and inter-factor correlation values of the Agile School Scale.

Table 7. *Agile School Scale Correlation Values*

Sub-Dimensions	Agile Leader	Agile Teacher	Agile School Environment	Agility in external stakeholder relations
1-Agile Leader	-	.545 **	.620 **	.417 **
2-Agile Teacher		-	.706 **	.554 **
3-Agile School Environment			-	.696 **
4-Agility in External Stakeholder Relations				-
5-Total Score	.792 **	.838 **	.922 **	.769 **

When Table 7 was examined, it was determined that the correlation coefficients of the Agile School Scale's total score and sub-themes were between .922 and .792. It is seen that the correlation coefficient between the sub-themes is between .706 and .417. According to the results in the table, all factors and the total score of the scale are positive and significant. Correlation is applied to detect and express the level of relationship between two parameters (Gravetter et al., 2018). The values of the correlation vary between ±1. A correlation result close to 1 indicates a strong relationship, while a correlation result close to 0 indicates a weak relationship. When the correlation coefficient is "1", it is considered as a perfect positive correlation; When it is "0", it means that there is no relationship between the two variables, and when it is "-1", it can be expressed as a perfect negative correlation.

DFA Validity Values

CFA was used to understand whether the construct validity of the study, which consists of 4 sub-dimensions and 33 items, was changed by changing the sample characteristics (Brown, 2006). In other words, CFA is an analysis that tests a theory put forward by AFA (Worthington & Whittaker, 2006). The model resulting from the first level confirmatory factor analysis of the Agile School Scale is presented in Figure 3.

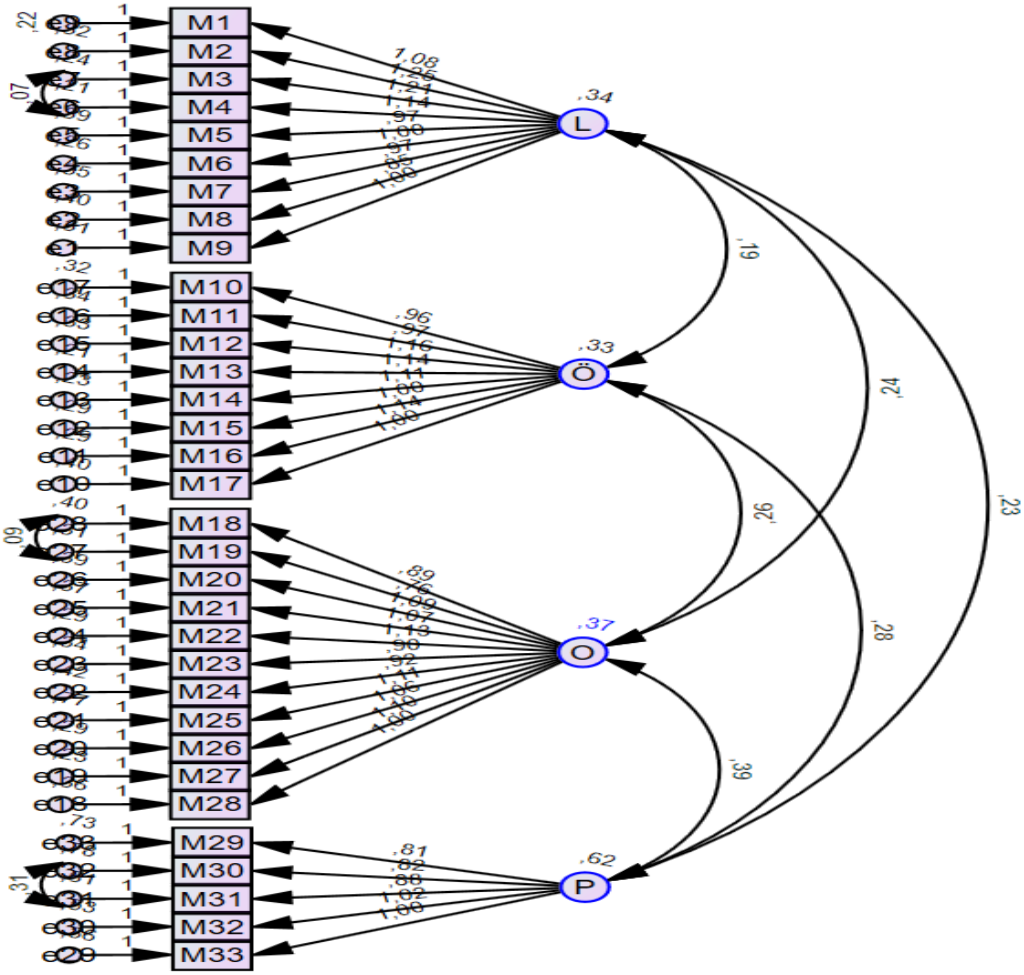

Figure 3. *Agile School Scale Level I Confirmatory Factor Analysis (CFA)*

The model obtained as a result of the first level CFA applied for the Agile School Scale is shown in Figure 3. When the standardized values in the model are examined, it is seen that these values are sufficient to explain the latent variables.

In CFA, the criteria of fit indices were used to evaluate the Agile School Scale. For this reason, the fit index values are good fit limits, acceptable values recommended in the literature (Hair et al., 2014; Schumacker & Lomax, 2010; Kline, 2011; Tabachnick & Fidell, 2013) and the values extracted from the first level CFA application of the Agile School Scale are shown in Table 8. is also given.

Table 8. *Agile School Scale Adaptation Index Values Acceptable Values*

	x^2	$x2/df$	GFI	IFI	TLI	CFI	RMSEA	RMR
First result	1,665,017	3,405	.864	.913	.906	.913	.059	.042
1.Modification(m31-m32)	1,545,816	3,168	.874	.922	.915	.922	.056	.039
2.Modification (m6-m7)	1,496,463	3,073	.878	.925	.919	.925	.055	.038
3.Modification(m27-m28)	1,455.29	2,994	.881	.928	.922	.928	.054	.038
Acceptable Values		<5	>0.85	>0.90	>0.90	>0.90	<0.08	<0.08
Good Fit Values		<3	>0.90	>0.95	>0.95	>0.95	<0.05	<0.05

As seen in Table 8, goodness-of-fit values were analyzed using appropriate statistical methods and various modification strategies were evaluated to optimize the values. A value of x2/df below 3 indicates a good fit (Hair et al. 2014). Obtaining the x2/df value of the scale as 2.994 is a good fit indicator. For the RMSEA value, it is stated in the literature that the fit value increases as it approaches 0 (Tabachnick & Fidell, 2013). The RMSEA value of the scale is quite high at .054. Again, it is stated in the literature that CFI, TLI, GFI, IFI values take values between 0 and 1, and as they approach 1, the fit value increases (Kline, 2011; Worthington & Whittaker, 2006; Schumacker & Lomax, 2010). . It is seen that the CGI, GFI, TLI, IFI values of the Agile School Scale are above the acceptable values stated in the literature. As a result, a high goodness of fit was observed between the AFA and CFA results of the Agile School Scale. This shows that the construct validity of the scale is ensured and the factor structure of the scale is compatible with the data set.

3.2. Reliability Findings

For the reliability analysis of the Agile School Scale, Cronbach Alpha, item-total correlation, item-remaining correlation, bottom-top 27% group comparison, test were used to evaluate the internal consistency of the scale, item discrimination, stability over time, and the relationships between the sub-dimensions of the scale. -retest methods were used. Reliability coefficients of the Agile School Scale are given in Table 9.

Table 9. *Reliability Coefficients for the Overall Scale and Each Sub-Dimension*

Factor	Crohnbach's Alpha Value
Agile Leader	.909
Agile Teacher	.889
Agile School Environment	.866
Agility in External Stakeholder Relations	.914
Total	.954

According to general acceptance, Cronbach's Alpha value being greater than 0.70 or close to 1 is an indication that the scale is reliable (Büyüköztürk, 2018; Şeker & Gençdoğan, 2014). When Table 9 is examined, the internal consistency coefficient of the scale was calculated as Cronbach's α=.954, and the internal consistency values of the sub-dimensions vary between αmax=.914 (External Stakeholder) and αmin=.866 (Agile School Environment). Cronbach Alpha reliability coefficients show that the internal consistency of the Agile School Scale is statistically significant and sufficient.

As another reliability test, item analysis based on item-total correlation was conducted to determine the relationship of each item to the entire scale. The general acceptance for item-total correlation is that items of .30 and above measure well; It was stated that items with a score of .20 or less should be removed from the scale (Büyüköztürk, 2018). Table 10 shows the Agile School Scale item total/remaining score correlation.

Another reliability test was carried out item analysis based on item-total correlation to determine the relationship of each item to the entire scale. The general acceptance for item-total correlation is that items of

.30 and above measure well; It was stated that items with values of .20 or lower should be removed from the scale (Büyüköztürk, 2018). Table 10 shows the Agile School Scale item total/remaining score correlation.

Table 10. *Agile School Scale Item Total and Item Residual Score Correlation Values*

Factor		Item Total Correlation	Item Residual Correlation
	Agile Leader		
1.	Our school principal encourages the professional development of teachers.	.665	.640
2.	Our school principal includes relevant people in the decision-making process.	.629	.597
3.	Our school principal has a solution-oriented approach to negative situations.	.612	.582
4.	Our school principal questions the current situation and offers new suggestions.	.647	.620
5.	Our school principal makes quick decisions.	.583	.553
6.	Our school principal follows the innovations in education and training.	.639	.613
7.	Our school principal takes the initiative in risky situations or in times of crisis.	.602	.573
8.	Our school principal cooperates with stakeholders outside the school (Public, NGOs and private organizations, etc.).	.573	.542
9.	Our school principal encourages cooperation among staff.	.613	.585
	Agile Teacher		
10.	Teachers in our school anticipate the changes in education and do what is necessary.	.672	.647
11.	The teachers at our school are skilled in using information technologies.	.609	.580
12.	Teachers at our school perceive uncertain and difficult situations as a learning opportunity.	.635	.605
13.	Teachers in our school demonstrate high performance by learning from their experiences.	.677	.652
14.	Teachers at our school are quick to adapt to innovations and developments.	.664	.639
15.	Teachers in our school work collaboratively in educational activities.	.637	.610
16.	Teachers in our school constantly improve themselves professionally.	.679	.653
17.	Teachers at our school create environments for students to learn on their own.	.646	.618
	Agile School Environment		
18.	Educational activities in our school are carried out according to the needs of the student.	.660	.633
19.	The values of the school are taken into account in the educational activities at our school.	.642	.618
20.	Motivation enhancing activities are carried out in our school.	.690	.663
21.	It is believed that student ideas improve educational activities at our school.	.698	.672
22.	Our school resources are used effectively and efficiently.	.736	.713
23.	Our school has an environment where students can trust.	.645	.619
24.	In our school, students are guided in line with their career planning.	.640	.612
25.	Physical equipment is sufficient for a qualified education in our school.	.579	.537
26.	Feedback is given importance in educational activities in our school.	.728	.705
27.	Activities are held in our school "for better education".	.759	.739
28.	In our school, all employees act together to solve an unexpected problem.	.711	.687
	Agility in External Stakeholder Relations		
29.	Teachers in our school are given training to increase their technological skills.	.585	.546
30.	Our parents are responsible for fulfilling what is expected of them.	.526	.481
31.	In our school, parents' experiences are used to improve the quality of education.	.563	.522
32.	Experts are invited to social events (culture, art and sports, etc.) in our school.	.616	.577
33.	Our school cooperates with other schools.	.669	.638

When Table 10 is examined, it is seen that the item-total correlation values of the Agile School Scale are between r = .21 and r = .45. It can be interpreted that all items in the scale are greater than .20 and significant at the .001 level.

Following this process, the item discrimination index of the Agile School Scale was conducted as another reliability analysis. Item discrimination index is a statistical measure that shows how well the items of the scale

distinguish the general concept of the scale. (Cohen and Swerdlik, 2018). The purpose of this analysis is to determine whether there is a differentiation between the groups that gave low and high scores in response to the item and to reveal the discrimination power of the scale (Büyüköztürk, 2018). Item discrimination index is an important criterion to increase the validity and reliability of the scale. In this context, item discrimination analysis was carried out by comparing the values given by the people in the lower and upper quarters of the test (27%) according to the total score using the "independent sample t test". Data scores obtained from 437 participants were sorted from smallest to largest and determined as the lower 27% and upper 27% groups (118 people). Table 11 shows the independent groups t test data, comparing the scores of the lower and upper 27% groups.

Table 11. *Independent t-Test Data for the Difference between the Lower and Upper 27% Groups*

	Items	Group	N	Mean	sd	t	df	p
Agile Leader	M1	Lower 27%	118	3.84	0.679	-13,859	236	.000
		Upper 27%	118	4.84	0.392	-13,859	236	
	M2	Lower 27%	118	3.6	0.849	-13,409	236	.000
		Upper 27%	118	4.78	0.436	-13,409	236	
	M3	Lower 27%	118	3.85	0.735	-13,287	236	.000
		Upper 27%	118	4.88	0.417	-13,287	236	
	M4	Lower 27%	118	3.72	0.727	-14,549	236	.000
		Upper 27%	118	4.83	0.399	-14,549	236	
	M5	Lower 27%	118	3.57	0.722	-12,764	236	.000
		Upper 27%	118	4.65	0.576	-12,764	236	
	M6	Lower 27%	118	3.81	0.584	-14,787	236	.000
		Upper 27%	118	4.8	0.425	-14,787	236	
	M7	Lower 27%	118	3.56	0.768	-12,175	236	.000
		Upper 27%	118	4.59	0.51	-12,175	236	
	M8	Lower 27%	118	3.73	0.7	-10,603	236	.000
		Upper 27%	118	4.58	0.528	-10,603	236	
	M9	Lower 27%	118	3.79	0.705	-12,689	236	.000
		Upper 27%	118	4.8	0.499	-12,671	236	
Agile Teacher	M10	Lower 27%	118	3.67	0.68	-11,383	236	.000
		Upper 27%	118	4.64	0.622	-11,383	236	
	M11	Lower 27%	118	3.47	0.688	-13,671	236	.000
		Upper 27%	118	4.59	0.573	-13,671	236	
	M12	Lower 27%	118	3.14	0.777	-14,047	236	.000
		Upper 27%	118	4.44	0.634	-14,047	236	
	M13	Lower 27%	118	3.57	0.66	-13,647	236	.000
		Upper 27%	118	4.6	0.492	-13,647	236	
	M14	Lower 27%	118	3.47	0.65	-15,181	236	.000
		Upper 27%	118	4.67	0.556	-15,181	236	
	M15	Lower 27%	118	3.64	0.722	-13,547	236	.000
		Upper 27%	118	4.74	0.497	-13,547	236	
	M16	Lower 27%	118	3.24	0.649	-15,932	236	.000
		Upper 27%	118	4.54	0.608	-15,932	236	
	M17	Lower 27%	118	2.81	0.987	-11,785	236	.000
		Upper 27%	118	4.27	0.912	-11,785	236	
Agile School Environment	M18	Lower 27%	118	3.31	0.734	-13,604	236	.000
		Upper 27%	118	4.5	0.61	-13,604	236	
	M19	Lower 27%	118	3.36	0.746	-13,783	236	.000
		Upper 27%	118	4.51	0.519	-13,783	236	
	M20	Lower 27%	118	3.66	0.754	-12,183	236	.000
		Upper 27%	118	4.68	0.504	-12,183	236	
	M21	Lower 27%	118	3.31	0.781	-14,504	236	.000
		Upper 27%	118	4.58	0.544	-14,504	236	
	M22	Lower 27%	118	3.29	0.775	-14,662	236	.000
		Upper 27%	118	4.57	0.547	-14,662	236	
	M23	Lower 27%	118	3.49	0.793	-14,119	236	.000
		Upper 27%	118	4.69	0.466	-14,119	236	

	M24	Lower 27%	118	3.71	0.693	-12,492	236	.000
		Upper 27%	118	4.72	0.537	-12,492	236	
	M25	Lower 27%	118	3.3	0.755	-15,381	236	.000
		Upper 27%	118	4.61	0.54	-15,381	236	
	M26	Lower 27%	118	2.71	0.979	-11,997	236	.000
		Upper 27%	118	4.14	0.85	-11,997	236	
	M27	Lower 27%	118	3.27	0.636	-17,362	236	.000
		Upper 27%	118	4.62	0.553	-17,362	236	
	M28	Lower 27%	118	3.38	0.626	-18,168	236	.000
		Upper 27%	118	4.71	0.491	-18,168	236	
Agility in External Stakeholder Relations	M29	Lower 27%	118	3.31	0.803	-15,758	236	.000
		Upper 27%	118	4.69	0.501	-15,758	236	
	M30	Lower 27%	118	2.26	0.821	-10,868	236	.000
		Upper 27%	118	3.58	1,025	-10,868	236	
	M31	Lower 27%	118	2.53	0.824	-11,232	236	.000
		Upper 27%	118	3.8	0.902	-11,232	236	
	M32	Lower 27%	118	3.03	0.991	-11,916	236	.000
		Upper 27%	118	4.39	0.751	-11,916	236	
	M33	Lower 27%	118	3.09	0.837	-13.97	236	.000
		Upper 27%	118	4.47	0.663	-13.97	236	

When Table 11 is examined, it is seen that the scale items are statistically significant in the lower and upper groups of 27% (at the p <.001 level), the reliability level of the items is high and the items are discriminated at the expected level.

Another criterion for determining the reliability of the scales is the test-retest method. In this method, the high correlation score obtained by applying the scale to the same people again after a certain interval indicates that reliability and stability are strong. (DeVellis, 2017: 51-52; Özdamar, 2016: 85). The test-retest method was conducted four weeks apart on 78 school administrators and teachers working in the Sancaktepe district of Istanbul. Table 12 shows the coefficient values obtained from the test-retest study.

Table 12. *Test-Retest Correlation Coefficients*

	N	r	p		N	r	p
M1-M1	78	.507	.000	M18-M18	78	.527	.000
M2-M2	78	.487	.000	M19-M19	78	.475	.000
M3-M3	78	.601	.000	M20-M20	78	.576	.000
M4-M4	78	.587	.000	M21-M21	78	.487	.000
M5-M5	78	.576	.000	M22-M22	78	.398	.000
M6-M6	78	.617	.003	M23-M23	78	.620	.000
M7-M7	78	.532	.000	M24-M24	78	.401	.000
M8-M8	78	.384	.000	M25-M25	78	.505	.001
M9-M9	78	.548	.000	M26-M26	78	.293	.000
M10-M10	78	.560	.000	M27-M27	78	.314	.000
M11-M11	78	.409	.000	M28-M28	78	.231	.000
M12-M12	78	.513	.001	M29-M29	78	.466	.000
M13-M13	78	.484	.043	M30-M30	78	.311	.000
M14-M14	78	.491	.000	M31-M31	78	.426	.004
M15-M15	78	.409	.000	M32-M32	78	.345	.000
M16-M16	78	.503	.000	M33-M33	78	.489	.000
M17-M17	78	.399	.000				

Table 12 shows that the Pearson Correlation Coefficient scores of the values reached in the test-retest study vary between r = .23 and r = 62. It is seen that the test-retest application is positive and significant (p <.05). It has been observed that the construct validity of the Agile School Scale does not change over time. Table 13 shows the dependent group t-test data of the test-retest values of the Agile School Scale.

Table 13. *Arithmetic Means, Mean Scores, Standard Deviation Scores and Dependent t-test Results of the Items in the Agile School Scale Test-Retest Study*

First-Last Application	N	Mean	sd	t	df	p
M1-M1	78	.-063	.773	.-402	78	.689
M2-M2	78	.050	.741	1,358	78	.171
M3-M3	78	.037	.823	.357	78	.456
M4-M4	78	.050	.749	.670	78	.325
M5-M5	78	.-012	.650	.-555	78	.125
M6-M6	78	.075	.608	.191	78	.741
M7-M7	78	.088	.706	.524	78	.852
M8-M8	78	.063	.670	.658	78	.963
M9-M9	78	.-021	.821	-1.056	78	.321
M10-M10	78	.-037	.735	.-956	78	.369
M11-M11	78	.113	.741	.636	78	.258
M12-M12	78	.-112	.675	.-847	78	.147
M13-M13	78	.012	.589	.231	78	.069
M14-M14	78	.-164	.691	.-587	78	.187
M15-M15	78	.025	.598	.522	78	.789
M16-M16	78	.036	.742	.452	78	.507
M17-M17	78	.037	.763	.489	78	.469
M18-M18	78	.045	.638	.587	78	.401
M19-M19	78	.102	.602	1,101	78	.308
M20-M20	78	.087	.703	.898	78	.603
M21-M21	78	.045	.688	.555	78	.437
M22-M22	78	.089	.677	.686	78	.101
M23-M23	78	.-014	.748	.-201	78	.503
M24-M24	78	.-026	.759	.-363	78	.171
M25-M25	78	.038	.659	.451	78	.179
M26-M26	78	.082	.668	.856	78	.601
M27-M27	78	.071	.739	.785	78	.773
M28-M28	78	.-010	.721	.-656	78	.683
M29-M29	78	.021	.599	.653	78	.603
M30-M30	78	.068	.601	.854	78	.511
M31-M31	78	.042	.605	.591	78	.221
M32-M32	78	.031	.598	.482	78	.333
M33-M33	78	.-063	.731	.-727	78	.550

When Table 13 is examined, it is seen that the dependent t test result in the test-retest application of the Agile School Scale is significant at the $p < .05$ level. The dependent t test is a parametric statistical method used to test whether the mean difference between two dependent samples is different from zero. If the p value is more than 0.05, it can be interpreted that the difference between two dependent samples is not statistically significant (Patton, 2017). As a result, the total data obtained shows that the scale is stable and meaningful and is high enough for the field of social sciences.

4. Conclusion, Discussion and Recommendations

In this research, it is aimed to develop a scale that can measure validly and reliably to determine the agile feature levels of schools. In line with this goal, the Agile School Scale was designed as a 5-point Likert type. To measure the structure, KMO and Bartlett's tests were applied before factor analysis. The KMO value was found to be (.953), and the Bartlett test was found to be (14867.521). Kaiser (1974) classifies these value ranges as perfect. These data show that the sample size and distribution are normally distributed and are suitable for factor analysis. In the next stage, AFA was conducted with 437 participants to test the construct validity of the scale. Exploratory Factor Analysis determines how many sub-factors the items to be used in measurement are divided into (Seçer, 2017). As a result of AFA, a 4-dimensional 33-item scale structure was obtained. After the literature review on agility, the first dimension was named "Agile Leader", the second dimension was "Agile

Teacher", the third dimension was "Agile School Environment", and the fourth dimension was named "Agility in External Stakeholder Relations".

After AFA, CFA (Confirmatory Factor Analysis) was performed. CFA is an analysis that tests a theory formed by AFA (Worthington & Whittaker, 2006). CFA data was collected from 683 participants to test the relevant structure. As a result of the analysis, it was determined that Chi-square, RMR, GFI, CFI, IFI, TLI and RMSEA scores were above accepted values. As a result, it can be stated that the findings after CFA support the factor structure of the scale and the model is compatible with this structure.

Within the scope of reliability of the Agile School Scale, Cronbach's Alpha value was found to be .954. According to general acceptance, a score greater than 0.70 or close to 1 indicates that the scale is reliable (Büyüköztürk, 2018; Şeker & Gençdoğan, 2014). Additionally, the internal consistency values of the sub-dimensions vary between αmax=.914 (External Stakeholder) and αmin=.866 (Environment). Cronbach Alpha values obtained as a result of statistical measurement show that the Agile School Scale has a high degree of internal consistency.

Another finding that supports the reliability of the scale is the item discrimination index of the Agile School Scale. Item discrimination index is a statistical measure that shows how well the items of the scale distinguish the general concept of the scale (Cohen & Swerdlik, 2018). The purpose of this analysis is to determine whether there is a difference between the groups that gave low and high scores in response to the item and to show the discriminatory power of the scale (Büyüköztürk, 2018). In this context, item discrimination analysis was carried out by comparing the values given by the people in the lower and upper quarters of the test (27%) according to the total score, using the "independent sample t test". It was determined that the answers given to the scale items by the lower and upper 27% groups showed a statistically significant difference. This result shows that the items of the scale are reliable and discriminative.

Another criterion used to determine the reliability of the Agile School Scale is the test-retest method. In this method, the high correlation score achieved by applying the scale to the same people again after a certain interval indicates strong reliability and stability (DeVellis, 2017). In this context, in the application made to 78 school administrators and teachers three weeks apart, it was found that there was a positive, strong and significant relationship ($r = .49$, $p < .001$) between the first and second application scores. Finally, the criterion validity of the Agile School Scale was determined. The aim of criterion validity is to estimate the performance power of the scale by comparing it with a scale with similar features whose validity and reliability have been proven (Seçer, 2015). To determine the criterion validity of the scale, the organizational agility scale developed by Sharif and Zhang (1999) and adapted to Turkish was used (Akkaya & Tabak, 2018). In this context, the correlation coefficient showing the relationship between the Agile School Scale and the Organizational Agility Scale was calculated as r=.62. It was determined that the Agile School Scale had a positive and significant relationship with the scale with similar features.

When the development process and analysis of the Agile School Scale were evaluated, it was determined that it was a valid and reliable measurement tool. Finally, the factors and item orders of the scale are given below:

***Agile Leader** : 1-9*

***Agile Teacher** : 10-18*

***Agile School Environment** : 19-28*

***Agility in External Stakeholder Relations** : 29-33*

The scale was developed with data collected from school administrators and teachers working at primary, secondary and high school levels. Branch differences of the participants were not taken into consideration when creating the scale items. For this reason, the Agile School Scale (ASA) can be applied by all branches. However, it may be recommended to perform confirmatory factor analysis in studies with different study groups. It can also be used as a supporting document to equip schools with agile features against the chaos created by the VUCA era and to increase both internal and external stakeholder performance and the quality of the school environment.

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