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THE VALIDITY AND RELIABİLITY STUDY OF THE PRIMARY 4TH GRADE PROBLEM SOLVING ANXIETY SCALE[1]

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ABSTRACT

It was aimed to develop a valid and reliable scale to determine the mathematical problem solving anxiety of 4th grade primary school students. Relational survey model was used in the study. The sample of the study consisted of 206 primary 4th students studying in2 public schools of Afyonkarahisar centre. The sample selected by cluster sampling. It was decided that the scale should consist of six factors according to literature review. These are arising from understanding based anxiety, planning and execution of the plan based anxiety, arising from controlling the solution based anxiety, arising from self-efficiency based anxiety, arising from person based anxiety, and arising from the structure of the problem based anxiety. The content validity of Primary Problem Solving Anxiety Scale (PPSAS) was determined by the Lawshe coefficient. Confirmatory factor analysis (CFA) was performed to test the 6-factor 43-item structure for construct validity analysis. Finding show that second-order CFA, the arising from person based anxiety was extracted from the scale due to its low fit with the general anxiety structure. The theoretical structure that emerged as a result of CFA was found to be highly fit with its 5-factor 27-item form. The Croncbach α reliability coefficient for the whole PPSAS was found to be .91. For the sub-factors, .77 for anxiety arising from the understanding process, .79 for anxiety arising from the solution process, .78 for anxiety arising from the control process, .82 for anxiety arising from self-efficiency and .80 for anxiety arising from the structure of the problem. For criterion validity, the relationship between PPSAS and the problem solving test by Ulu (2017) was investigated on 337 students. A moderate negative correlation were observed between both the whole scale and its sub-dimensions with the problem solving test. As a result, PPSAS was found to be valid and reliable with its 5-factor 27-item structure.

Keywords: Primary school, problem solving anxiety, construct validity, criterion validity, reliability.

[1] This article is produced by first author's master thesis, under supervision of second author.

INTRODUCTION

Problem solving is considered the main purpose of mathematics (Cockcroft, 1982) and the main purpose of doing mathematics (NCTM, 2000). It is stated that problem solving skills positively affect the development of strategic thinking, flexible thinking, reasoning, critical thinking, creative thinking and daily life skills (Cockcroft, 1982; Dendane, 2009; Stacey, 2005; Schoen & Charles, 2003; Schoenfeld, 1992; Posamentier and Krulik, 2016; Wilson, Fernandez & Hadaway, 2011). Countries are trying to improve students' problem solving skills through mathematics curriculum reforms. [NCTM, 2000 (National Council of Mathematics Teachers); AEC (Austallian Education Council), 1990; CNMC (Chineese National Mathematics Circulum), 2005; Cockcroft, (1982); JME (Japanese Ministry of Education), 2008; SMOE (Singapore Ministry of Education), 1990; TMOE (Turkish Ministry of Education 2018]. Countries are testing the effectiveness of their reforms through international student assessments such as PISA (2018). In PISA (2018), students' mathematical literacy levels are classified into seven levels: below 1 and from 1 to 6. Higher level skills such as strategic thinking, flexible thinking, reasoning, and mathematical modeling are classified at level 3. In PISA (2018), it was determined that 46.1% of students in OECD countries were below level 3, which requires high-level mathematical skills. High rates indicate the need for further research on the factors affecting problem solving skills

Charles and Lester (1982) stated that problem solving skills are affected by attitudinal factors. Bloom (1955) stated that about a quarter of the difference between individuals in learning is due to attitudes. The literature shows that there are studies examining the effects of attitudinal factors on problem solving success. For example, some studies focused on the relationship between attitudes towards mathematics and problem solving achievement (Bakar, Mahyuddin, Elias & Ayup, 2020; Julius, 2022; Marchiş, 2013;; Sturm & Bohndick, 2021; Wakhataa, Mutarutinyaa & Balimuttajjo, 2023;). Valid and reliable scales have also been developed to determine attitudes towards problem solving (Awofala, 2014; Çanakçı & Özdemir 2011; Zakaria, Haron, & Daud, 2004). In this way, studies examining the relationship between attitudes towards problem solving and problem solving achievement have been conducted (Yew & Sean, 2015; Katrancı & Şengül, 2019; Wakhata, Mutarutinya & Balimuttajjo, 2023).

One of the affective characteristics towards mathematics is anxiety. In some studies, the relationship between math anxiety and problem solving success has been examined. In the studies, relation was found between mathematics anxiety and problem solving skills (Ashkenazi & Eisner, 2022; Erdem & Arikan, 2023; Doz, Cuder, Pellizzoni, Carretti & Passolunghi, 2023; Karasela, Aydab, Tezerc, 2010; Shimizu, 2022; Kamyl, Diaz, Rosemarievic, Belecina & Rene, 2015; Ramirez, Chang, Maloney, Levine & Beilock, 2016; Throndsen, Lindskog, Niemivirta & Mononen, 2022). In a study conducted by Karasela, et al. (2010) on 134 primary school students, a relationship of .28 was found between mathematics anxiety and problem solving skills. In the study conducted by Throndsen et al. (2022), it was observed that there was a relationship of .24 between the difficulty level of problems and mathematics anxiety. In the study conducted by Doz, Cuder, Pellizzoni, Carretti, & Passolunghi (2023), the correlation between mathematics anxiety and problem solving success was -.43.

Problem solving is expressed as a complex structure with its own unique processes. Each of these processes involves different kinds of tensions (Artzt & Thomas, 1992; Goos, Galbraith, & Renshaw, 2000; Dursun & Bindak, 2011). In the studies conducted by Karasela et al. (2010) and Throndsen et al (2022), a low negative corelation was found between maths anxiety and problem solving anxiety. Measuring problem solving anxiety, which requires different process skills, with mathematics anxiety may cause it to be lower than the actual problem solving anxiety. The situation is different in studies where the same characteristic is compared. In a meta-analysis study conducted by Hembree (1990), an average -.34 relationship was found between mathematics anxiety and mathematics achievement. In the meta-analysis study conducted by Şad, Kış, Demir & Özer (2016), -.44; in the meta-analysis study conducted by Namkung, Pend & Lin (2019), -.34; and in the meta-analysis study conducted by Bayırlı, Geçici & Erdem (2021), -.363 relationship was found. The low correlation between problem solving achievement and mathematics anxiety and the moderate correlation between mathematics achievement and mathematics anxiety make it necessary to measure problem solving anxiety within the context of problem solving skills. When the literature was examined, the measurement of problem solving anxiety was found only as a sub-dimension in the mathematics anxiety scale developed by Bessant (1995). In this context, it was decided to develop an inventory to measure the problem solving anxiety of primary school students.

Problem solving anxiety

Anxiety is defined as discomfort and worry in the face of a threatening event (Scovel, 1978; Başarır, 1990; Dursun & Bindak, 2011; Baltaş, 1995; Başarır, 1990; Ünlü, 2001; Cüceloğlu, 1996). Fennema and Sherman (1976) defined mathematics anxiety as "feelings of fear, anxiety and nervousness towards mathematics and associated physical symptoms". Dede and Dursun (2008) defined mathematics anxiety as "feelings of fear and nervousness that prevent the acquisition of mathematical skills and unwillingness to deal with numbers". Fennema and Sherman (1976) defined mathematics anxiety as "feelings of fear, anxiety and nervousness towards mathematics and associated physical symptoms". Üldaş (2005) defined mathematics anxiety as "a condition that occurs in situations that require dealing with mathematics in academic or daily life and causes distancing from mathematics". Mathematics anxiety is seen as an important reason why students' mathematics achievement decreases (Birgin, Baloğlu, Çatlıoğlu& Gürbüz (2010); Çatlıoğlu, Gürbüz &Birgin (2014) and mathematics avoiding behavior (Anton & Klisch, 1995; Richardson & Suinn, 1972; Hembree, 1990; Namkung, Peng, & Lin, 2019; Peker & Şentürk, 2012; Sarı & Ekici, 2018; Zhang, Zhao, & Kong, 2019). Some definitions of mathematics anxiety are defined as the state of anxiety and restlessness that individuals experience in the process of solving mathematical problems (Richardson & Suinn, 1972; Tobias & Weissbrod, 1980; Deniz & Üldaş, 2008; Fiore, 1999). Based on the literature, problem solving anxiety can be defined as the tension experienced against the difficulties experienced in the problem solving process. In the next stage of the research, the factor structure of the Primary Problem Solving Anxiety Scale (PPSAS) was determined based on the difficulties experienced by primary school students in the problem solving process.

Problem solving is defined as a four-step process consisting of understanding the problem, choosing a strategy, executing the chosen strategy and controlling the solution (Polya, 1990). In previous studies, it has been observed that primary school students have the most difficulty in the step of understanding the problem (Clarkson, 1991; Marinas & Clements, 1990; Clements, 1982; Clements & Ellerton, 1996; Singh et al., 2010; Fong 1995; Singhatat, 1991, Hong, 1993; Hong, 1995; Ulu, Tertemiz &Peker, 2016; Ulu, 2017). In this context, it was decided that the first factor of the PPSAS was undertanding based anxiety. In the process of problem comprehension, it was observed that successful students were able to reorganize the problem text according to themselves and visualize the plot in the problem, while low-achieving students focused on key words such as more or less, repeated reading, and word-focused solving while making sense of the problem (Panasuk & Beyranevand 2010; Moreno & Mayer, 1999; Christen & Murphy, 1991). The items written for the arising from the understanding based anxiety factor of the PPSAS were prepared according to this.

It was observed that students had the most difficulty in strategy selection and execution of the selected strategy after the comprehension process (Fong, 1995; Hong, 1993; Hong, 1995, Yeo & Har, 2009; Pantziara, Gagatsis, Elia, 2009; Ulu et al. 2016; Ulu, 2017 Baddeley & Logie 1999; Teong, 2002; Wu & King, 2011). Polya (1990) stated that the steps of strategy selection and execution of the selected strategy occur simultaneously in the solution process. This process is also the process of planning the solution and executing the plan. For this reason, the second and third steps of the problem solving process were combined and merged as anxiety arising from the planning and execution of the plan. In this step, students are expected to transform the problem into figures, tables, mathematical symbols, determine a solution path, change strategies when the solution path they choose does not lead to a solution, make use of the solution paths in previously solved problems, and develop different strategies when necessary (Griffin & Jitendra, 2008; Ainsworth, 1999; Altun, 2005; Koedinger & Tabahneck, 1994). The items written for the solution-based anxiety factor of the PPSAS were prepared according to this information.

It has been observed that not structuring the control of the solution correctly in the problem solving process causes errors (Fong, 1995; Hong, 1993; Hong, 1995; Ulu et al. 2016; Ulu, 2017). At this stage, students are expected to check each stage of the solution, to bring a different perspective if they think they have solved it incorrectly, and to question the plausibility of the result they find (Sternberg, 1988; Özsoy, 2007). The items written in the anxiety arising from the control of the solution factor of the PPSAS were prepared according to this information.

Another important factor that challenges primary school students in the solution process is the structure of the problem (Altun, 2005; Kaur & Yeap, 2009; Teong, 2002; Ulu 2008). It was observed that countries such as China, Singapore, Korea, Finland and the Netherlands, which ranked high in PISA (2018), made a radical change in their mathematics programmes, changed the structure of the problems. They reduced the weight of closed-ended problems and switched to open-ended problems, and although students had difficulty in such problems, they got used to them over time (CNMC, 2005; SMOE, 1990; JME, 1990) (CNMC, 2005; SMOE, 1990; JME, 1990). The items written in the anxiety arising from the structure of the problem factor of the PPSAS were prepared according to this information.

In addition to the fact that students cannot be at the desired level cognitively in the problem solving process, the deficiencies in their affective characteristics are also shown as the reasons for their difficulties in the problem solving process (Kayapınar, 2015). As a result of the examination, it was seen that one of the factors affecting anxiety from attitudinal characteristics is self-efficiency (Perry, 2004; Senemoğlu, 2005; Garry, 2005; Deniz & Üldaş, 2008; Alkan 2011; Ural 2015; Demir & Durmaz, 2018). It is seen as a result of the studies that another factor affecting the anxiety of the individual is caused by the people around him/her (Godbey, 1997; Baloğlu, 2001; Yushau, Bokhari, Mji, & Wessels 2004; Alkan 2011; Keskin 2017). In this context, it was decided that the theoretical structure of the PPSAS should be composed of six factors: arising from understanding based anxiety, planning and execution of the plan based anxiety, arising from controlling the solution based anxiety, arising from self-efficiency based anxiety, arising from person based anxiety, and arising from the structure of the problem based anxiety. The tested hypothesis model is given in Figure 1

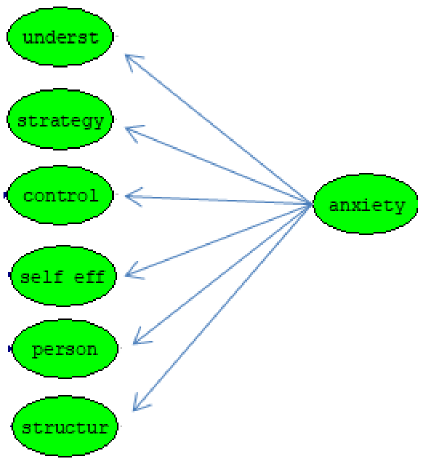


Figure 1: Hypothesis Model of the PPSAS.

METHOD

Reserah Model

The validity and reliability study of PPSAS was designed with the correlational survey model. Relational survey model is used to explain the change in the dependent variable with other variables (Karasar, 2002). In this study, the relationship between the items and factors of PPSAS, the relationship between the factors, and the relationship between the factors and the general structure were examined. The relationship between the scale and problem solving achievement was also examined within the scope of the criterion validity studies of PPSAS. The procedures required the research design to be a corelational survey model.

Study group

If the individuals in the study group are selected individually, element sampling method is used, and if they are selected in groups, cluster sampling method is used (Büyüköztürk et al., 2013). Determining the study group with the element sampling method would devised a partial structure in the distribution of students to schools. for this reason, the study group was selected with the cluster sampling method, considering that it would make the data collection process easier (Gürkan & Ulu, 20023).

When determining the study group with the cluster sampling method, the number of people in the universe is first determined. Based on the number of people in the universe, the number of samples to be reached is calculated. In the next stage, information about the clusters in the universe and the number of elements in each cluster is collected. From the list devised, a sufficient number of clusters for sampling are selected by random methods (Baştürk & Taştepe, 2013). In scale development studies, it is recommended that the sample size should be at least 200 in order to reach a reliable factor structure (Schumacker & Lomax, 1996). A different view on the sample size is that it should be 5 times the number of items (Hair, Anderson, Tatham, & Black, 1996; Gerbig & Hamilton, 1996). There are 43 items in the PPSAS. When the criterion of number of questions x 5 is used, 215 people will be sufficient. 215 people meet the minimum sample size criterion of 200 people set by Schumacker and Lomax (1996). In this context, it was decided to apply the draft scale to a total of 248 students studying in 9 classes of 3 public schools in Afyonkarahisar city center. The schools that constituted the sample of the study were decided by examining the TEOG results of the secondary schools attended by the students who graduated from the school. In this context, 2 school and 9 classes were selected from schools with moderate TEOG achievement. A total of 248 primary school 4th grade students from 2 schools are studying. 27 of the students did not come to school on the day of the application. During the implementation, it was observed that 15 students did not fill out the scale reliably. The answers given by these students were not evaluated. In this context, 206 fourth grade students formed the sample of the validity and reliability study of the PPSAS. Of the sample, 112 (54.36%) were female and 94 (45.64%) were male.

One of the most important evidence for the validity is criterion validity. For criterion validity, the relationship between the whole and sub-dimensions of the PPSAS and problem solving success was examined. The students who participated in the criterion validity applications were determined by cluster sampling method. A total of 337 fourth grade students studying in 15 branches of 4 public schools in Afyonkarahisar city center took part in the applications. The sample consisted of 185 (54.89%) female and 152 (45.11%) male students.

Scale development process.

Table 1. Procedures in development of the PPSAS

	Development Process stage	Procedures in the Scale Development Process
1	Identifying the factor structure of PPSAS	- Literature review - Analyzing the developed anxiety scales
2	Item Pool	- Identifying difficulties encountered in the problem solving process - Investigation of mathematics anxiety scales - Asking students to write an essay stating why they feel anxious while solving problems
3	Ensuring Content Validity	-Presenting the draft items for the opinions of experts and teachers in terms of linguistic, student level and content suitability -Making additions and corrections to the articles in line with the opinions and suggestions -Piloting on 44 students for the suitability of the draft articles for students and obtaining student opinions -Making revisions according to students' opinions -Calculation of content validity indices of the items
4	Implementation of the Scale	- Implementation of the PPSAS with 221 students - Canceling the answers of 15 students and reaching a final sample size of 206
5	Construct Validity Analyses	- Testing the theoretical structure of the PPSAS by confirmatory factor analysis
7	Reliability Analysis	- Cronbach's alpha reliability coefficient calculation - Determination of the power of each item to distinguish the group with high problem solving anxiety from the group with low problem solving anxiety
8	Criterion Validity Analyses	-Making a decision about criterion validity by examining the relation between the PPSAS and the problem solving test

A 5-point Likert-type item pool consisting of 62 items was formed within the theoretical structure. The 62 items were examined by two Turkish language experts in terms of lack of expression and spelling mistakes. In the next stage, the draft form was examined by two experts in the field of mathematics anxiety, two educational psychologists and a classroom teacher in terms of the appropriateness of the items for the purpose and the factor they were included in. As a result of the examination, it was determined that 7 items were not suitable for the structure of the scale, so it was decided to remove them from the draft scale. The remaining 55 items were applied to 44 primary school fourth grade students as part of the pilot application of the PPSAS. 4 items that were not understood by the students were excluded from the scale. Finally, the Lawshe (1975) content validity index was calculated for the 51-item PPSAS draft form before student implementation.

In the first phase of the implementation of the Lawshe technique, it is required to determine the expert group to assess the draft scale. In this context, a total of 18 people, including 3 mathematics field experts, 3 educational psychologists, 9 classroom teachers and 3 mathematics teachers, constituted the evaluation group. the experts were asked to evaluate each item in the draft scale. “In the assessment process, they were asked to give the item 3 points if they thought the item was related to the factor, 2 points if it was "related but unnecessary", and 1 point if it was "not related to the factor". When calculating the Lawshe content validity coefficient, first the number of experts giving the item a score of 3 is divided by half of the total number of experts. then 1 is subtracted from the result obtained.” or example, if 10 experts in a group of 18 experts say that item 1 is necessary, the average content validity of this item will be (10/9)-1 =.0.11. The sufficiency of the content validity index is compared with the minimum values corresponding to the number of experts by

Veneziano and Hooper (1997). "The minimum values for content validity averages by Veneziano and Hooper (1997) at 0.05 level of significance are given in Table 1.

Table 2: Minimum values for Content Validity Means at =0.05 significance level

Number of experts	Minimum Value	Number of experts	Minimum Value
5	0.99	13	0.54
6	0.99	14	0.51
7	0.99	15	0.49
8	0.78	20	0.42
9	0.75	25	0.37
10	0.62	30	0.33
11	0.59	35	0.31
12	0.56	40+	0.29

According to Table 2, the minimum value required for the content validity of an item evaluated by 18 experts to be sufficient is .42. The results of the Lawshe technique calculations indicated that the minimum value of 8 items was below .42, and these items were removed from the test." The content validity ratios of the factors are obtained by dividing the sum of the content validity ratios of the items in the factor by the total number of items in the factor. The Lawshe coefficient was .78 for arising from understanding based anxiety, .55 for planning and execution of the plan based anxiety, .67 for arising from controlling the solution based anxiety, .89 arising from self-efficiency based anxiety, .78 for arising from person based anxiety and .74 for arising from the structure of the problem based anxiety. Since all of these values were greater than .42, it was decided that the content validity ratios of the factors were sufficient. At the end of the Lawshe coefficient calculation process, it was decided to test the model fit of the PPSAS with 43 items and 6 factors.

Data collection process

"With the decision of Dumlupınar University commission dated 16.02.2022 and numbered 2022/02, there is no ethical problem in conducting the research. " In order to conduct the application, a permission application was made to Afyonkarahisar Directorate of National EducationSchool administrations were contacted and permission was obtained from the parents of the students. The implementations were carried out in the free curriculum activities class. The planning was made with the knowledge of the teacher of each class. Before the PPSAS was implemented, students were informed about the purpose of the study and the scale. Students were told about the points to be considered when filling in the PPSAS. It was stated that the results of the scale would only be used for scientific research and that the results would not affect their final grades. The administration of the PPSAS took 30 minutes with the information provided and the student response time.

In order to determine the criterion validity of PPSAS, its relationship with the problem solving test consisting of 10 problems developed by Ulu (2017) was examined. In this context, PPSAS and problem solving test were applied to 357 students. Firstly, the PPSAS was administered in 20 minutes and then the problem solving test was administered in 40 minutes.

Data analysis

Construct validity analysis

There are different perspectives on utilising EFA and CFA in construct validity studies (Hurley et al., 1997; Kline, 2005; Jöreskog & Sörbom, 1993; Staplaton, 1997; Schumacker & Lomax, 1996). EFA and CFA group items with different techniques. EFA releases the loadings of the items for all factors, so that each item loads on all factors in the scale (Hovardaoğlu, 2000; Thampson, 2004; Schumacker & Lomax, 1996). CFA, on the other hand, allows the item to load only on the desired factor based on the theoretical structure, and the loading value in other factors is fixed to 0 (Brannick, 1995; Kelloway, 1995; Williams, 1995). Therefore, EFA decides in which factor the items will be included and the number of important factors in the scale independently of the researcher. In CFA, the factor structure is determined based on the theoretical structure devoloped by the researcher. The disagreements about the use of EFA and CFA are based on the question "what should be the role of the scale developer in constructing factor structures?" (Hurley et al., 1997; Staplaton, 1997; Schumacker & Lomax, 1996).

In scale development studies, if there is limited information about the components that constitute the theoretical basis, EFA should be performed first to explore the factor structure (Büyüköztürk, 2002; Çokluk et al., 2012; Hair, Anderson, Tatham, & Black, 1998). There are also opinions suggesting that the factor structure obtained as a result of EFA needs to be supported by CFA (Bollen & Long, 1993; Maruyama, 1998; Hurley et al. 1997). Kline (2005) stated that the results of the analyses obtained by EFA mostly do not pass through the CFA filter, and the opinions about the validity of the scales that pass increase. It is also recommended to use CFA in the first stage of the scale development process in order to determine the relationships that are not in the mind of the researcher, to identify problematic variables in the model and to determine how much the theory in the mind of the researcher and the reality match (Gerbig & Hamilton, 1996).

A different view argues that the structure in the mind of the scale architect is much more meaningful than the structure formed by the numbers. According to them, CFA should be used in the first stage of the process (Hurley et al., 1997, Erkuş, 2003; Gerbig & Hamilton, 1996). Gerbig and Hamilton (1996) stated that CFA is actually partly EFA and partly CFA, because the obtained model is partly theory and partly model fit. Another view regarding the choice of EFA and CFA is that there is no definite truth and the decision is left to the researcher on condition that the reasons are well explained (Çokluk et al., 2012; Schumacker & Lomax, 1996). In this study, CFA was used because the model fit of the theoretical structure of PPSAS was tested. The next stage of the study provides technical information about CFA.

In CFA analysis, each item in the scale is called the observed variable and the factors are called latent variables (Bollen & Long, 1993; Schumacker & Lomax, 1996). In the next stage of the study, the factors observed in the items will be called latent variables. CFA is categorised into two as first and second order. While the first order CFA focuses on the relationship between the observed variables and latent variables and between the latent variables themselves, the second order CFA determines the fit of the latent variables with the general structure

(Şimşek, 2007). With the decision to use CFA, the 43-item version of the PPSAS implemented to 206 students was transferred to the computer environment for construct validity studies. While the data were transferred to the computer environment, they were coded as never anxious=1, rarely anxious=2, moderately anxious=3, often anxious=4, always anxious=5.

Reliability analysis

For reliability, the items should reveal the difference between students with high anxiety and students with low anxiety, and the separate items should have high correlation between themselves (Çokluk et al., 2012; Şimşek, 2007; Büyüköztürk, 2002). In this regard, 56 (27%) students with the highest anxiety scores were determined as the upper group and 56 (27%) students with the lowest anxiety scores were determined as the lower group. The t-test was performed to determine whether the scores obtained from the scores given to each item differed in the lower and upper groups. Item-total correlation (r) was analysed to determine inter-item correlation. According to Büyüköztürk (2004), a Croncbach α value of 0.70 and higher shows that the inter-item correlation and reliability of the test is high. In this context, Croncbach α reliability coefficients of the whole scale and its sub-factors were calculated.

Criterion validity analysis

Criterion validity is the determination of the relationship between a developed test and another scale (Tekin, 1997; Yılmaz, 1998). The criterion validity of PPSAS was examined by looking at its correlation with the problem solving achievement test developed by Ulu (2017). The problem solving scale developed by Ulu (2017) consists of 10 questions. It was found that the scale explained 66.32% of the change in problem solving variance and the reliability of the scale was .84. The relations between PPSAS and problem solving scale was analysed by calculating Pearson correlation coefficients. The solutions to the problem solving test were coded by giving 0 points for wrong solutions, 1 point for wrong results although the solution path was correct, and 2 points for correct answers with correct solution path and result.

FINDINGS

In this section, an unadjusted first-order factor analysis was conducted to determine whether the theoretical structure of the PPSAS fits the empirical structure. The findings are shown in Figure 2.

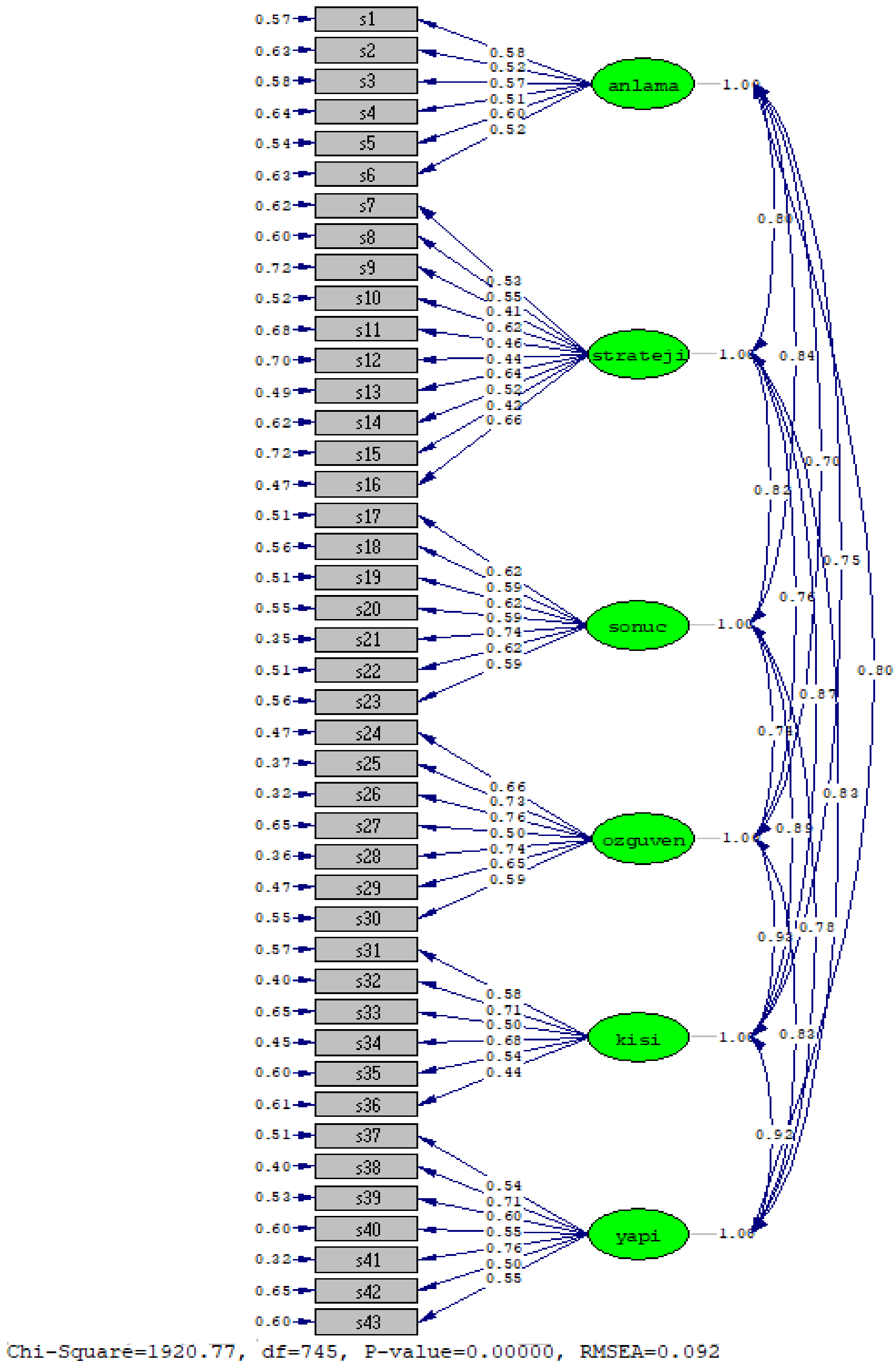


Figure 2: Unadjusted First-Order CFA Results of PPSAS

Figure 2 indicates that the factor scores of the observed variables on the latent variable of the PPSAS ranged from .41 to .76. Factor loadings of the observed variable on the latent variable below .30 indicate that the observed variable has low agreement with the latent variable. Observed variables with low fit with the latent variable are excluded from the scale if they cannot be assigned to other latent variables (Çokluk et al., 2012;

Kline, 2005; Schumacker & Lomax, 1996). The fact that the loadings of the observed variables in the PPSAS are above .30 indicates that they have good fit with the latent variable. Another reason for removing the observed variables from the scale is the error variance of the observed variable that cannot be explained by the latent variable. If this value is too high and the t-values testing the significance of the path between the observed variable and the latent variable are not significant, the observed variable is excluded from the test. The error variances of the observed variables in the scale ranged between .32 and .72. The t values expressing the paths to all observed variables and latent variables were found to be significant ($p < .05$). This indicates that the error produced by observed variables in latent variables is acceptable. (Jöreskog & Sörbom, 1993; Raykov & Marcoulides, 2008; Şimşek, 2007). As a result of the significant relationship between the observed variables and the latent variables of the PPSAS, the model-data fit of the scale was also examined. Fit criterion values (Byrne, 1994; Schermelleh Engel, Moosbrugger, & Müller, 2003; Şimşek, 2007) and the fit index values obtained as a result of the first order CFA of the PPSAS were compared. "Fit value criteria listed by Gürkan and Ulu (2007) and the values obtained from the PPSAS are given in Table 3.

Table 3. Fit Index Criterion Values and Fit Index Values for the First Order Unadjusted CFA Result of the PPSAS

Fit indices	Excellent fit	Good fit	Values obtained from Model 1
χ^2/sd	$0 \leq \chi^2/sd \leq 2$	$0 \leq \chi^2/sd \leq 5$	2.58
RMSEA	0 ≤ RMSEA ≤ .05	0 ≤ RMSEA ≤ .08	.92
NFI	.95≤ NFI≤ 1.00	.90≤ NFI≤ .94	.76
NNFI	.95≤ NNFI≤ 1.00	90≤ NNFI≤ .94	.83
CFI	.95 ≤ CFI≤ 1.00	.90 ≤ CFI≤ .94	.81
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .94	.90
GFI	.95 ≤ GFI ≤ 1.00	.90 ≤ GFI ≤ .94	.76
AGFI	.95 ≤ AGFI ≤ 1.00	.90 ≤ AGFI ≤ .94"	.73

When Table 3 is examined, it is seen that the unadjusted first order CFA results of the PPSAS show that the model-data fit is good in two indices (χ^2/df=2.58; IFI=.90), while the model-data fit is inadequate in the other six indices (RMSEA=.92; NFI=.76, NNFI =.83; CFI=.81; AGFI=.73)." Due to poor model fit, the hypothesis model of PPSAS cannot be accepted. In CFA, it is recommended to decrease the chi-square (χ^2) value to improve the model fit. Under which conditions the chi-square value will be decreased is determined by examining the modification indices produced by the model. Modification indices indicate the reductions in χ^2 when observed variables are assigned to a different latent variable (Sumer, 2000; McDonald & Moon-Ho, 2002; Schermelleh-Engel, Moosbrugger, & Müler, 2003; Thampson, 2000). Observed variables should be placed in different latent variables if they are suitable for the theoretical structure. Observed variables included in more than one latent variable must be excluded from the scale (Jöreskog & Sörbom, 1993; Raykov & Marcoulides, 2008; Şimşek, 2007; Thompson, 2008). Items p9, p11, p12, p15, p18, p19, p24, p27, p32, p35, p37, p42 were removed from the scale because of being in more than one latent variable. The corrected first order CFA results of the PPSAS obtained as a result of the exclusion of 12 items are presented in Figure 3.

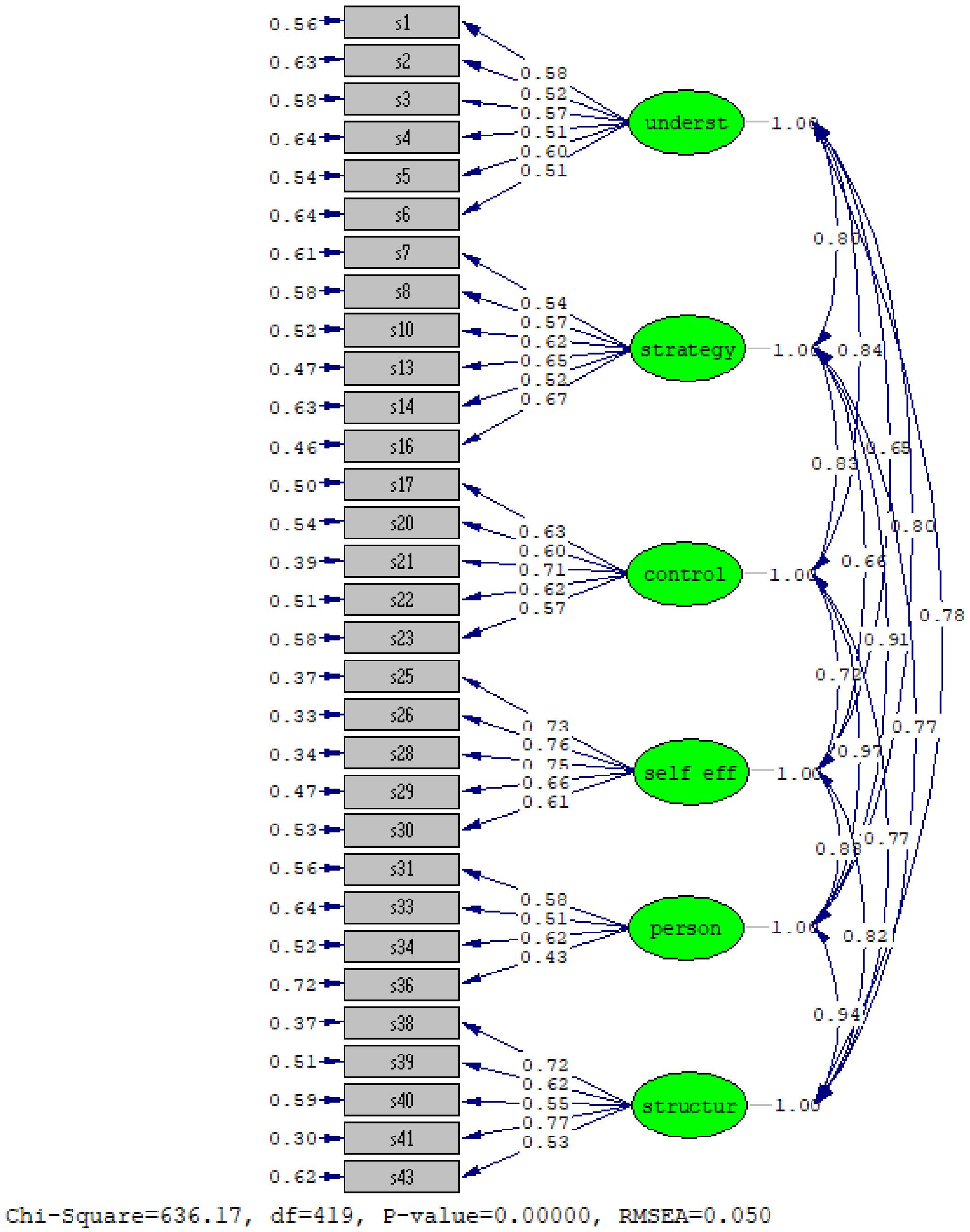


Figure 3: Adjusted First Order CFA Results of PPSAS

When the results of the adjusted first order CFA of the PPSAS presented in Figure 3 were analysed, it was seen that the factor loadings of the observed variables ranged between .51 and .77, the error variances ranged between .33 and .72, and the t values testing the paths from all observed variables to the latent variables were significant (p<.05). In the next step, the model-data fit resulting from the extruction of 12 items from the scale was re-examined. " The findings are presented in Table 4.

Tablo 4. Fit Index Criterion Values and Fit Index Values for the First Order Adjusted CFA Result of the PPSAS

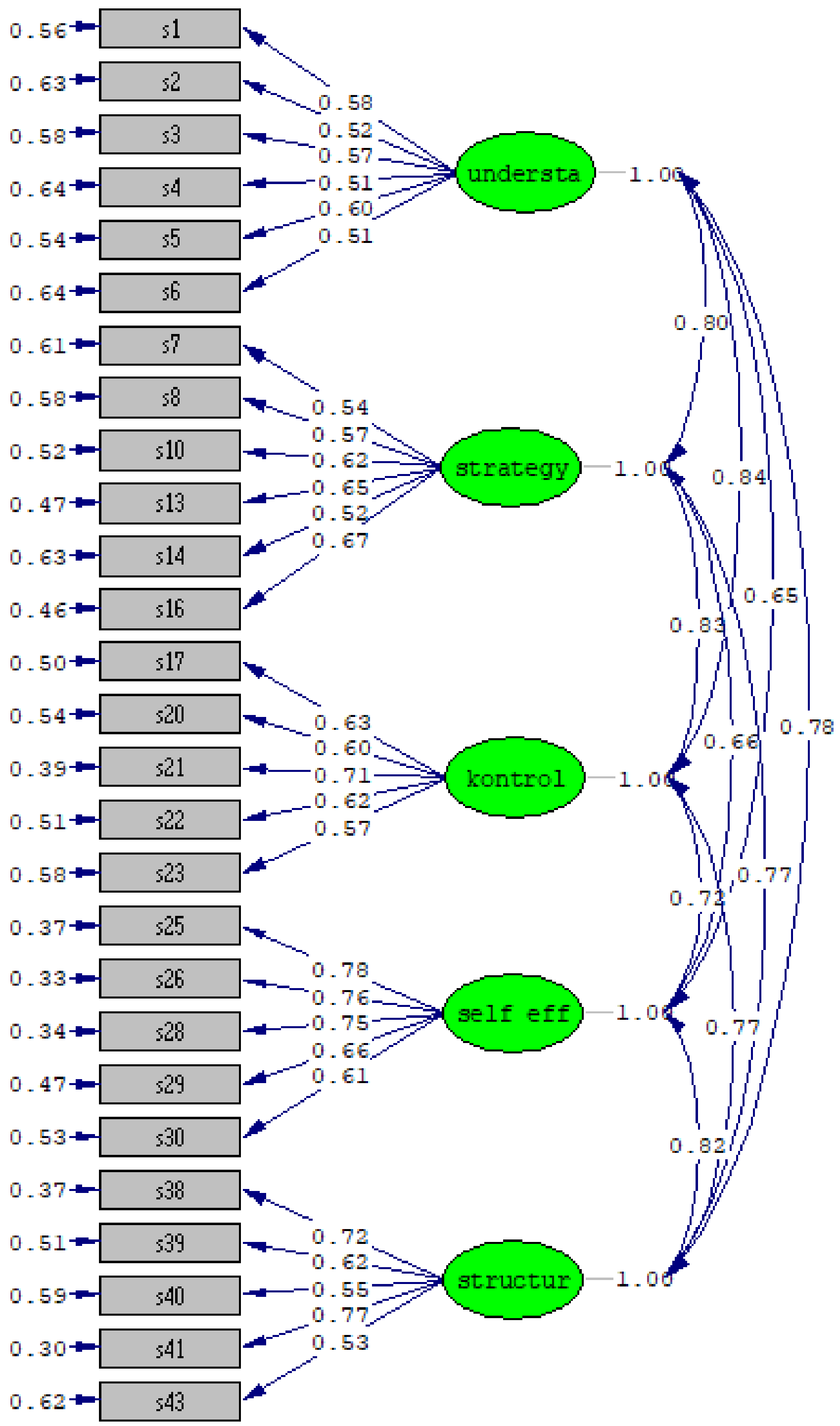
Fit indices	Excellent fit	Good fit	Values obtained from Model 1
χ²/sd	0 ≤ χ²/sd ≤ 2	0 ≤ χ²/sd ≤ 5	1.51
RMSEA	0 ≤ RMSEA ≤ .05	0 ≤ RMSEA ≤ .08	.50
NFI	.95≤ NFI≤ 1.00	.90≤ NFI≤ .94	.94
NNFI	.95≤ NNFI≤ 1.00	90≤ NNFI≤ .94	.97
CFI	.95 ≤ CFI≤ 1.00	.90 ≤ CFI≤ .94	.98
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .94	.98
GFI	.95 ≤ GFI ≤ 1.00	.90 ≤ GFI ≤ .94	.91
AGFI	.95 ≤ AGFI ≤ 1.00	.90 ≤ AGFI ≤ .94	.93

When Table 4 is examined, it was seen that the corrected first order CFA results of PPSAS indicated that the model-data fit was excellent in five indices (χ^2/df =1.51; RMSEA=.50; NNFI=.97; CFI=.98; IFI=.98) and good in three indices (NFI=.94; GFI=.91; AGFI=.93)." As it was seen that the indices showing the model-data fit of the scale were at a sufficient level, the standardised regression coefficients indicating the relationships between the latent variables in the scale were examined. Standardised regression coefficients are given in Table 5.

Tablo 5. Standardized Regression Coefficients between Latent Variables

	Undersatand	Planning	Control	Self-efficacy	Structure	Anxeity
Undersatand	1.00					
Planning	.80	1.00				
Control	.84	.83	1.00			
Self-efficacy	.65	.66	.72	1.00		
Structure	.80	.91.	.97	.88	1.00	
Anxeity	.78	.77	.77	.82	.94	1.00

In Table 5, when the standardised regression coefficients between the latent variables are examined, it is seen that arising from person based anxiety has a relationship of .91 with , arising from planning and execution of the plan based anxiety, .97 with arising from controlling the solution based anxiety, .88 with arising from self-efficacy-based anxiety and .94 with arising from structure of the problem based anxiety. According to Çokluk et al. (2012), a standardized regression coefficient of .85 and above between two latent variables indicates that the two latent variables measure very similar constructs. In this context, it was observed that the latent variable measuring anxiety about people showed a high correlation with all of the variables except for the latent variable of anxiety about understanding. According to Çokluk et al. (2012), discriminant validity decreases when the latent variables are very similar to each other. When such situations are experienced in the CFA process, it is suggested to extract the proper one from two similar latent variables. In this regard, arising from person based anxiety was extracted from the scale as it was similar to the other latent variables. The first-order model obtained by extracting arising person based anxiety from PPSAS is given Figure 4.



Chi-Square=447.99, df=314, P-value=0.00000, RMSEA=0.045

Figure 4: Corrected First Order CFA Results of PPSAS

Figure 4 shows that factor loadings, error variances and t-values testing the paths from all observed variables to the latent variables were significant (p<.05). In the next step, the model data fit obtained by excluding the arising from person based anxiety latent variable from the scale was analysed. "The results are given in Table 6.

Table 6. Fit Index Criterion Values and Fit Index Values for the First Order Adjusted CFA Result of the PPSAS

Fit indices	Excellent fit	Good fit	Values obtained from Model 1
χ^2/sd	0 ≤ χ^2/sd ≤ 2	0 ≤ χ^2/sd ≤ 5	1.43
RMSEA	0 ≤ RMSEA ≤ .05	0 ≤ RMSEA ≤ .08	.45
NFI	.95≤ NFI≤ 1.00	.90≤ NFI≤ .94	.94
NNFI	.95≤ NNFI≤ 1.00	90≤ NNFI≤ .94	.97
CFI	.95 ≤ CFI≤ 1.00	.90 ≤ CFI≤ .94	.98
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .94	.98
GFI	.95 ≤ GFI ≤ 1.00	.90 ≤ GFI ≤ .94	.91
AGFI	.95 ≤ AGFI ≤ 1.00	.90 ≤ AGFI ≤ .94”	.93

When Table 6 is examined, it is seen that the model-data fit of the corrected first-order CFA results of PPSAS is excellent on five indices (χ^2/df = 1.43; RMSEA= .0.47; NNFI =.97; CFI=.98; IFI=.98) and good on three indices (NFI=.94; GFI=.91; AGFI=.93). " The standardised regression coefficients were re-examined due to the multicollinearity problem that led to the exclusion of arising from person based anxiety from the scale. The standardised regression coefficients are given in Table 7.

Tablo 7. Standardized Regression Coefficients between Latent Variables

	Undersatand	Planning	Control	Self-efficacy	Structure
Undersatand	1.00				
Planning	.80	1.00			
Control	.84	.83	1.00		
Self-efficacy	.65	.66	.72	1.00	
Structure	.78	.77	.77	.82	1.00

Table 7 shows that the relations between the sub-dimensions varied between .65 and .84, and no variable had a relation of .85 and above with another variable. Based on these findings, it can be said that there is no multicollinearity problem among the latent variables of the scale. While first-order CFA focuses on the relationship between observed variables and latent variables and between latent variables themselves, second-order CFA is required to determine the fit of latent variables with the general structure (Çokluk et al., 2012, Şimşek, 2007; Yurdugül & Aşkar, 2008). In this context, second order CFA was conducted to determine the relations between anxiety arising from the comprehension process, anxiety arising from the solution process, anxiety arising from the control process, anxiety arising from self-efficacy and anxiety arising from the structure of the problem with general problem solving anxiety. The model obtained is given in Figure 5.

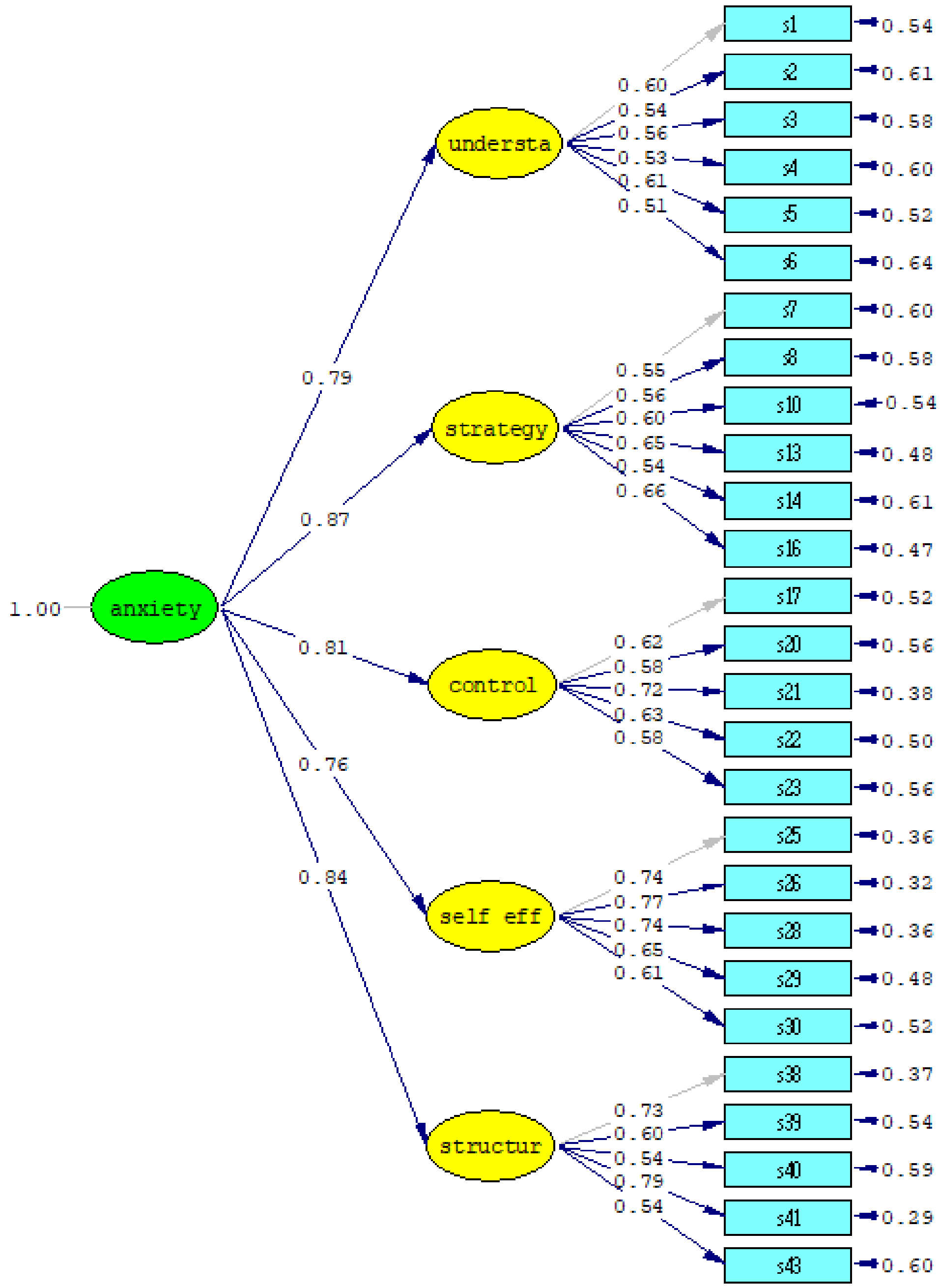


Figure 5. Second order CFA Results of the PPSAS

As a result of the second-order CFA conducted to determine the relations between the latent variables and the general structure, it was seen that all paths from the items to the latent variables and from the latent variables to the general structure were significant. In the following step, the model fit indices of the second-order CFA were examined. "The findings are given in Table 8.

Tablo 8. Fit Index Criterion Values and Fit Index Values for the Second Order Adjusted CFA Result of the PPSAS

Fit indices	Excellent fit	Good fit	Values obtained from Model 1
χ^2/df	0 ≤ χ^2/sd ≤ 2	0 ≤ χ^2/sd ≤ 5	1.62
RMSEA	0 ≤ RMSEA ≤ .05	0 ≤ RMSEA ≤ .08	.47
NFI	.95≤ NFI≤ 1.00	.90≤ NFI≤ .94	.93
NNFI	.95≤ NNFI≤ 1.00	90≤ NNFI≤ .94	.96
CFI	.95 ≤ CFI≤ 1.00	.90 ≤ CFI≤ .94	.97
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .94	.97
GFI	.95 ≤ GFI ≤ 1.00	.90 ≤ GFI ≤ .94	.90
AGFI	.95 ≤ AGFI ≤ 1.00	.90 ≤ AGFI ≤ .94"	.91

Table 8 shows that the corrected second-order CFA results of PPSAS showed that the model-data fit was excellent in five indices (χ^2/df = 1.62; RMSEA= .0.47; NNFI=.96; CFI=.97; IFI=.97) and good in three indices (NFI=.93; GFI=.90; AGFI=.91). " As second-order CFA of the scale showed that the model-data fit was sufficient, the standardised regression coefficients indicating the relations between the latent variables in the scale and the general structure of the scale were examined. Standardised regression coefficients are given in Table 9.

Tablo 9. Standardised Regression Coefficients between Latent Variables and General Structure

	Undersatand	Planning	Control	Self-efficacy	Structure	Anxeity
Undersatand	1.00					
Planning	.81	1.00				
Control	.82	.84	1.00			
Self-efficacy	.73	.75	.76	1.00		
Structure	.80	.82	.84	.74	1.00	
Anxeity	.79	.87	.81	.76	.84	1.00

Table 9 shows that the variable that explains problem solving anxiety the most is anxiety arising from the solution process, followed by anxiety arising from the structure of the problem, anxiety arising from the control process, anxiety arising from understanding and anxiety arising from self-efficacy. The second-order CFA showed that the theoretical structure of the PPSAS with its final version of 27 items with 5 factors were valid. For construct validity, the items should reveal the difference between students with high anxiety and students with low anxiety, and the items must have high correlation among themselves (Çokluk et al., 2012; Şimşek, 2007; Büyüköztürk, 2002). In this regard, firstly, 56 (27%) students with the highest anxiety scores were determined as the upper group and 56 (27%) students with the lowest anxiety scores were determined as the lower group. Then, t-test was performed to determine whether the scores obtained from the items differed in the lower and upper groups. Item-total correlation (r) was analysed to determine the inter-item agreement and the findings are shown in Table 10.

Tablo 10. *T Test Results and Total Correlation Coefficients of the Items in the PPSAS Showing the Comparison of the Items According to the Upper and Lower Groups*

Item Number	Group	*M*	*t*	*p*	*r*	Item Number	Group	*M*	*t*	*p*	*r*
S1	Upper	3.62	11.49	.00	.69	S21	Upper	3.67	9.45	.00	.75
	Lower	1.92					Lower	2.09			
S2	Upper	3.59	11.70	.00	.68	S22	Upper	3.67	11.29	.00	.78
	Lower	1.82					Lower	1.86			
S3	Upper	3.75	11.09	.00	.69	S23	Upper	3.57	11.97	.00	.73
	Lower	2.12					Lower	1.69			

S4	Upper	3.18	8.65	.00	.61	S25	Upper	3.35	12.44	.00	.67
	Lower	1.70					Lower	1.35			
S5	Upper	3.46	10.39	.00	.66	S26	Upper	3.47	13.62	.00	.75
	Lower	1.78					Lower	1.38			
S6	Upper	3.70	9.68	.00	.65	S28	Upper	3.64	16.15	.00	.78
	Lower	2.12					Lower	1.27			
S7	Upper	3.64	12.10	.00	.72	S29	Upper	3.29	14.03	.00	.73
	Lower	1.82					Lower	1.24			
S8	Upper	3.96	9.03	.00	.61	S30	Upper	3.14	10.69	.00	.67
	Lower	2.46					Lower	1.41			
S10	Upper	3.93	11.78	.00	.67	S38	Upper	3.42	10.83	.00	.67
	Lower	2.08					Lower	1.64			
S13	Upper	4.03	13.44	.00	.73	S39	Upper	3.43	13.27	.00	.73
	Lower	2.07					Lower	1.39			
S14	Upper	3.90	12.22	.00	.69	S40	Upper	3.31	13.39	.00	.73
	Lower	2.12					Lower	1.25			
S16	Upper	3.82	10.50	.00	.68	S41	Upper	3.51	11.80	.00	.71
	Lower	2.15					Lower	1.61			
S17	Upper	3.69	12.53	.00	.69	S43	Upper	3.50	10.21	.00	.60
	Lower	1.70					Lower	1.69			
S20	Upper	3.43	7.33	.00							
	Lower	2.10									

Table 10 shows that all 27 items were able to distinguish students with high and low anxiety ($t_{110)}$ = 8.65, p<.05) for the lowest item 4; ($t_{(110)}$= 16.15, p<.05) for the highest item 28. After the items were found to be distinguished, the item-total correlations (r) showing the agreement between the items in the scale were examined. Items with item total correlation below .30 are removed from the test because they are inconsistent with the whole test (Büyüköztürk, 2002). It was seen that item total correlations ranged between .60 and .78. The fact that all of the item total correlations are above .30 indicates that the inter-item agreement is high. As the discrimination of the items was high and the inter-item agreement was found to be high, the reliability of the test was finally examined. The croncbach α reliability coefficient for the entire PPSAS was found to be .91; for the sub-factors, .77 for anxiety arising from the understanding process, .79 for anxiety arising from the solution process, .78 for anxiety arising from the control process, .82 for anxiety arising from self-efficiency and .80 for anxiety arising from the structure of the problem, respectively. According to Büyüköztürk (2002), a Croncbach α value of 0.70 and above indicates that the internal consistency and therefore the reliability of the test is high. The fact that Croncbach's α values were above .70 for the overall PPSAS and for each factor allows us to see that the reliability is sufficient. Table 11 presents the findings regarding the final model of the PPSAS which was found to be valid and reliable with its 5-factor 27-item version.

Table 11. Findings on the Final Model of PPSAS

Latent variable	Item	Faktor loadings λ	Error variance ψ	Determination coefficient R^2	Regression coefficient ξ	Factor variance $\sigma 2$	Croncbach α
Understanding Based anxiety	S1	.60	.54	.46	.79	.79	.77
	S2	.54	.61	.31			
	S3	.56	.58	.41			
	S4	.53	.60	.42			
	S5	.61	.52	.36			

	S6	.51	.64	.32				
Planning and Execution of the Plan Based Anxiety	S7	.55	.60	.41		.87	.87	.79
	S8	.56	.58	.46				
	S10	.60	.54	.37				
	S13	.65	.48	.43				
	S14	.54	.61	.34				
	S16	.66	.47	.44				
Controlling the Solution Based Anxitey	S17	.62	.52	.38		.81	.81	.78
	S20	.58	.56	.34				
	S21	.72	.38	.52				
	S22	.63	.50	.40				
	S23	.58	.56	.34				
Self-efficacy Based Anxiety	S25	.74	.36	.55		.76	.76	.82
	S26	.77	.32	.59				
	S28	.74	.36	.54				
	S29	.65	.48	.42				
	S30	.61	.52	.37				
Structure of the Problem Based Anxieties	S38	.73	.37	.53		.84	.84	.80
	S39	.60	.54	.36				
	S40	.54	.59	.30				
	S41	.79	.29	.62				
	S43	.54	.60	.35				

Table 11 shows that the factor loadings of the observed variables in the final model of PPSAS were between .51 and .79, the coefficient of the observed variables explaining the variance in the latent variable was between .31 and .62, and all the paths from the observed variables to the latent variables were significant (p<.05). The latent variable explaining the variance in problem solving anxiety the most was arising from planning and execution of the plan based anxiety (σ2=.87), followed by arising from structure of the problem based anxiety (σ2=.84), arising from controlling the solution based anxiety (σ2=.81), arising from understanding based anxiety (σ2=.79) and arising from self-efficacy-based anxiety (σ2=.76). In the last stage of the development process of PPSAS the relations between it and the problem solving test was analysed within the scope of criterion validity. The findings are given in Table 12.

Table 12. The relationship between the sub-dimensions of PPSAS and total scores of PPSAS and problem solving achievement test

	Undersatand	Planning	Control	Self-efficacy	Structure	Total Anxeity Scores of PPSAS	Problem Solving Achivement Test
Undersatand	1	.70**	.61**	.54**	.56**	.82**	-.50**
Planning	.70**	1	.69**	.44**	.50**	.81**	-.47**
Control	.61**	.69**	1	.48**	.54**	.81**	-.36**
Self-efficacy	.54**	.44**	.48**	1	.71**	.78**	-.48**
Structure	.56**	.50**	.54**	.71**	1	.81**	-.42**
Total anxiety Scores of PPSAS	.82**	.81**	.81**	.78**	.81**	1	-.52**
Problem solving achivement test	-.50**	-.47**	-.36**	-.48**	-.42**	-.52**	1

Table 12 shows that there is a moderate negative correlation (r=-.52) between the total anxiety scores obtained from PPSAS and problem solving success. Among the sub-factors of PSES, there was a moderate negative correlation with arising from understanding based anxiety (r=-.50), a moderate negative correlation with arising from planning and execution of the plan based anxiety (r=-.47), a moderate negative correlation with arising from controlling based anxiety (r=-.36), a moderate negative correlation with arising from self-efficacy based anxiety (r=-.48) and moderate negative correlation with arising from structure of problem based anxiety (r=-42). "The relations between the factors of the scale developed for criterion validity and the criterion scores should not be lower than .30 (Karaca, 2006; Tekin, 1997; Yılmaz, 1998)." The fact that there was a moderate relationship between the total scores and sub-dimensions of PPSAS and problem solving achievement scores allowed us to see that the criterion validity was sufficient.

RESULTS AND DISCUSSION

As a result of the research, PPSAS was found to be valid and reliable with its 5-factor structure of 27 items. These factors are arising from understanding based anxiety, planning and execution of the plan based anxiety, arising from controlling the solution based anxiety, arising from self-efficiency based anxiety, and arising from the structure of the problem based anxiety. Students often make understanding based errors while solving problems (Clarkson, 1991; Marinas & Clements, 1990; Clements, 1982; Clements & Ellerton, 1996; Singh et al., 2010; Fong 1995; Singhatat, 1991, Hong, 1993; Hong, 1995; Ulu, Tertemiz & Peker, 2016; Ulu, 2017). As a result of the study, it was observed that understanding based anxiety was an important predictor of problem solving anxiety. It is also seen that students frequently make errors in strategy selection and execution (Fong, 1995; Hong, 1993; Hong, 1995, Yeo & Har, 2009; Pantziara, Gagatsis, Elia, 2009; Ulu et al. 2016; Ulu, 2017; Baddeley & Logie 1999; Charles & Lester, 1984; Teong, 2002; Wu & King, 2011). As a result of the research, it was seen that the anxiety arising from the planning and execution of the plan were an important predictor of problem solving anxiety. Errors arising from the control of the solution are also frequently encountered (Fong, 1995; Hong, 1993; Hong, 1995; Ulu et al. 2016; Ulu, 2017). As a result of the research, it was seen that the anxiety arising from the control of the solution were also an important predictor of problem solving anxiety. The structure of the problem can also cause errors (Altun, 2005; Baki & Kartal 2004; Kaur & Yeap, 2009; Teong, 2002; Polya, 1990; Ulu 2008). It is seen that the problem structure factor is an important predictor of problem solving anxiety. In this context, it can be said that the 4 factors that make up the structure of PPSAS are directly proportional to the cognitive difficulties experienced in problem solving. It has been determined that the self-efficiency factor also affects problem solving success (Voica, Singer, & Stan, 2020; May, 2009; Shimizu, 2022; Amri & Widada, 2019). As a result of the research, it is seen that self-efficiency factor is also an important predictor of problem solving anxiety.

As a result of the criterion validity studies examining the relationship between PPSAS and problem solving achievement, it is seen that there is a moderate negative relationship between the total scores and subscales of PPSAS and problem solving achievement scores. In the studies conducted by Karasela et al. (2010) and

Throndsen et al (2022), a low negative corelation was found between maths anxiety and problem solving anxiety. In the study conducted by Doz, Cuder, Pellizzoni, Carretti, & Passolunghi (2023), the correlation between mathematics anxiety and problem solving success was moderate negative correlation. The moderate negative correlation obtained as a result of criterion validity is inconsistent with the findings of Karasela et al. (2010) and Throndsen et al (2022) on the low negative relationship between mathematics anxiety and problem solving success. This raised suspicion about the criterion validity of the study. However, the situation is different in studies examining the relationship between the same characteristics. In these meta-analysis studies, which are a combination of many studies, a moderate relationship was found between mathematics achievement and mathematics anxiety (Bayırlı, et al. 2021; Hembree, 1990; Namkung, et al. 2019; Şad, et al. 2016). As a result of the research, the relationship between problem solving achievement and problem solving anxiety was found to be at a moderate level, just like the relationship between mathematics achievement and mathematics anxiety, eliminating the doubt about the content validity of the scale.

SUGGESTIONS

In this context, criterion validity studies can be continued by looking at the relations of the scale with problem solving attitude scales at primary school order. Individuals with low, medium and high anxiety scores from the scale can be identified and the behaviours they show in the problem solving process can be determined. The scale can be adapted to different orders. The final model of PPSAS is given in Appendix 1.

ETHICAL TEXT

In this study, all the rules set by the journal regarding ethical situations were complied with. Any ethical violation that may arise belongs to the authors of the article. It was determined that there was no ethical problem in conducting the study with the decision of Dumlupınar University commission meeting 2022/02 on 16.02.2022.

Author(s) Contribution Rate: In this study, the contribution rate of the first author is 50% and the contribution rate of the second author is 50%..

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APPENDIX

Appendix 1: Prımary School Problem Solvıng Anxıety Scale (PPSAS)

Item Number	PRIMARY SCHOOL PROBLEM SOLVING ANXIETY SCALE	I' always get anxious	I often get anxious	I get moderately anxious	I get rarely anxious	I get never anxious
1	When I had to read the problem text again and again due to my lack of understanding	(5)	(4)	(3)	(2)	(1)
2	When the problem text is too long	(5)	(4)	(3)	(2)	(1)
3	When I cannot make a connection between what is given in the problem text and what is required	(5)	(4)	(3)	(2)	(1)
4	When I cannot express the problem text in my own	(5)	(4)	(3)	(2)	(1)
5	When I can't visualise the events in the problem text in my mind	(5)	(4)	(3)	(2)	(1)
6	When I cannot find the keyword required for the solution in the problem text	(5)	(4)	(3)	(2)	(1)
7	When I don't know where to begin to solve the problem.	(5)	(4)	(3)	(2)	(1)
8	When I can't convert the information given in the problem text into mathematical expressions	(5)	(4)	(3)	(2)	(1)
9	When I do things I'm not sure about while solving	(5)	(4)	(3)	(2)	(1)
10	When I see my solution paths are inadequate for the given problem	(5)	(4)	(3)	(2)	(1)
11	When I get blocked in using the solution path I have chosen	(5)	(4)	(3)	(2)	(1)
12	When the solution path I've chosen is wasting too much time	(5)	(4)	(3)	(2)	(1)
13	While checking my result, I realised I made a mistake.	(5)	(4)	(3)	(2)	(1)
14	When I can't find my mistake in my wrong solution	(5)	(4)	(3)	(2)	(1)
15	When I realised my result was unrealistic	(5)	(4)	(3)	(2)	(1)
16	If I reach a result that is very different from the result I predicted	(5)	(4)	(3)	(2)	(1)
17	When I must re-solve the problem I solved incorrectly	(5)	(4)	(3)	(2)	(1)
18	When I think I cannot be successful in problem solving	(5)	(4)	(3)	(2)	(1)
19	When my teacher takes me to the board to solve a problem	(5)	(4)	(3)	(2)	(1)
20	When I saw that there were too many problems in the maths exam	(5)	(4)	(3)	(2)	(1)

21	I think I would be laughed at if my teacher wants me to explain my solution on the board.	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**
22	When I have to solve maths problems in my daily life	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**
23	When the information required for the solution is not clearly provided	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**
24	When I see unnecessary information in the problem I will solve	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**
25	When I see that there are figures, graphs, symbols in the problem I will solve	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**
26	When the problem to be solved requires too many operations	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**
27	When I encounter a different problem than the problems I have solved before	**(5)**	**(4)**	**(3)**	**(2)**	**(1)**

s1, s2, s3, s4, s5, s6 = understanding based anxiety

s7, s8, s9, s10, s11, s12= planning and execution of the plan based anxiety

s13, s14, 15, s16, s17 = controlling based anxiety

s18, s19, s20, s21, s22 = self efficacy based anxiety

s23, s24, s25, s26, s27 = structure of the problem based anxiety