European Journal of Alternative Education Studies
ISSN: 2501-5915
ISSN-L: 2501-5915
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.3588469 Volume 5 | Issue 1 | 2020

DEVELOPMENT OF REFLECTIVE THINKING SCALE FOR SENIOR PRIMARY EDUCATION STUDENTS

Gürbüz Ocak[1],
Hakan Yıldırım[2],
Burak Olur[1i]
[1]Afyon Kocatepe University, Turkey
[2]National Education Assembly, Turkey

Abstract:
The main purpose of this study is to develop a Reflective Thinking Scale to determine the reflective thinking levels of secondary school students. In this study, criterion sampling was employed, one of the purposeful sampling methods. The sample of the study consisted of 300 students in 6th, 7th and 8th grades in Emirdag, Afyonkarahisar. The items in the scale were graded according to 5-point Likert type. The sub-dimensions of the reflective thinking scale are reflection about action, reflection during action and reflection for action. While developing the scale, literature related to the definition of reflective thinking, reflective thinking process, characteristics of reflective thinking individuals, types of reflective thinking, ways of developing reflective thinking were examined. After examining these, a pool of items was created for the purpose of the reflective thinking scale. 52 items were selected from the pool of items and a draft scale was prepared, and 25 students in the 8th grade were pre-tested. Then, the items were presented to the expert opinion and applied to the 300 students attending 6th, 7th and 8th grades. Factor analysis was performed on the collected data. Kaiser-Meyer-Olkin (KMO) and Barlet tests were performed to determine the suitability of the data for factor analysis. Kaiser-Meyer-Olkin (KMO) value was found to be .900. Barlett's test was calculate as x2: 1859,813; sd: 231; p <.01. Confirmatory factor analysis was conducted within the framework of the validity studies of the reflective thinking scale. Confirmatory factor analysis fit indexes are as GF1 = .86; AGF1 = .83; RMR = .078; NNF1 = .94; CF1 = .95 and RMSEA = .071. After the first level confirmatory factor analysis, the second level confirmatory factor analysis was performed.

Keywords: reflective thinking, scale development

[i] Correspondence: email burakolur@gmail.com

1. Introduction

Reflective thinking is a skill that allows individuals to explain their views without being tied to anyone, by determining what their learning goals are, by taking responsibility for learning, correcting their mistakes, separating false and correct right behaviors from one another and improving their motivation skills (Unver, 2003). Ersözlü (2008) defines reflective thinking as an in-depth questioning of the individual's past-future experiences and experiences about his own learning-teaching process and thinking about the solution of the problems that arise about these inquiries and evaluations. Epstein (2003) states that reflective thinking involves problem solving, and that students have a chance to improve their self-management skills through this way of thinking. Lee (2005) deals with reflective thinking in three dimensions. These are: recall, rationalization and reflection. Individual remembers his or her experiences in recall dimensions and questions the relations and causes between his or experiences in the rationalization deminson. In the aspect of reflection, experiences are examined and incomplete and incorrect directions are developed. When the above definitions are examined, some researchers define reflective thinking as a way of thinking.

Some researchers emphasize that reflective thinking is a mental process. Korthagen (2001) describes the mental process of trying to construct or restructure an experience, problem, existing knowledge or ideas (Tican, 2013, p.16). Tok (2008) notes that reflective thinking improves mental skills such as learning through their experiences, thinking about what they do, thinking critically, and solving problems. According to Bigge and Shermis (1999), reflective thinking is a high level thinking skill hypothesis formation, studying and testing through hypotheses, collecting data through induction, and reaching results with a deductive approach (Köksal ve Demirel, 2008). Ocak, Ocak, and Saban (2013, p.163) describes reflective thinking as a mental effort, moving from the experience of the individual, involving questioning itself regularly, and reaching new knowledge and solving problems.

According to Wilson and Jan (1993), reflective thinking is often associated with past events, but this is only one dimension of reflective thinking. Reflective thinker can relate, question and evaluate himself / herself and the situation (Ersözlü, 2008). In the same way, Dewey (1952) also states that reflective thoughts lead to solutions to the problems that arise in the mind through the experience of the individual, and thus the thinking turned into behavior (Alp and Taşkın, 2008). In the process of reflection, the individuals ask themselves questions such as *"What did I do today?", "Was this behavior appropriate?", "What happens if I do that?"* (Diver, 2011). Çubukçu (2014) points out that reflective thinking is the developmental method of thinking about asking questions, asking questions, writing summaries, making comparisons for students. According to Ünver (2003), reflective activities enable students to determine their own goals, to be responsible for their own learning, and to correct their mistakes. For this, learning diary, concept maps, asking questions, self-questioning, self-assessment, agreed learning strategies can be applied.

Ünver (2007) points out the benefits of reflective thinking for the student as follows:

- Directs to determine learning objectives;
- Enable to think about the effectiveness of the learning strategies and styles;
- Enable to determine the level of learning;
- Enable to take responsibility of learning;
- Develop the skill of problem solving;
- Develop the skill of self-evaluation.

Reflective thinking helps individuals to engage in conscious behaviors by researching, solving problems, questioning the self about their correctness, shaping their subsequent actions, and improving self-regulation skills. Schön (1983-1987) deals with this thinking way in a timely manner.

The works Schön wrote (1983-1987) reveal systematic ways of reflective thinking and reflection in professional education, especially in teacher education. Schön (1983-1987) described three types of projection. These are: *"Reflection about action", "Reflection during action" and "Reflection for action"* (Tican, 2013).

Table 1: Types of Projection

Past	Present	Future
Reflection about action	Reflection during action	Reflection for action

Reflection about action: Practitioners reflect on the information in practice. Sometimes they think of a given project, an event they have lived in, and they think of ways of dealing with what they are going through (Schön, 1983, cited from Tican, 2013). We can say that reflection about action, questioning about how one behaves in the face of those who are experienced about living.

Reflection during action: In reflection during action, practitioners experience conflicts about uncertainty, imbalance and value conflicts and point out that we think about it when doing something (Schön, 1983, Akti Tican, 2013). Reflection during action involves thinking about an individual's problems while he or she is doing a job and generating solutions.

Reflection for action: Reflection during the past action shapes the future actions of the person (Schön, 1983, akt, Tican, 2013). The experiences that individuals have previously had to project for action can shape their attitudes, thoughts and attitudes towards future events.

Schön (1987) states that reflection is hidden in action, meaningful in action, and manifested in behavior by adopting Dewey's reflection concepts (Çubukçu, 2014). Dewey pioneered the development of the concept of reflective thinking and has been linked to the progressive education movement based on pragmatic philosophy (Sahan and Kalkay, 2014). A constructivist learning approach has been adopted in the educational programs that have been implemented since 2005 and this understanding is a skill that should be given to reflective thinking students because it is based on the progressive education trend. Determining the level of students' achievement of these skills is crucial in

determining the extent to which the training programs reach their goals. Different reflective thinking scales have been developed to measure this skill.

There are scale development and scale adaptation studies about reflective thinking scale in the literature. Semerci (2007) developed the "Reflective Thinking Tendency Scale (YANDE)" in order to determine reflective thinking levels of teachers and teacher candidates. "The Scale of Determining Reflective Thinking Levels of Classroom Teachers" by Dolapçıoğlu (2007), and "Reflective Thinking Scale of Teacher Candidates" by Güney (2008) were prepared for teacher and teacher candidates. "Improvement of Reflective Thinking Ability Scale for Problem Solving" by Kızılkaya ve Aşkar (2009) is composed of 14 items and applied statistically to 7th grade students. Çiğdem and Kurt (2012) and Başol and Gencel (2013) conducted a study on adaptation of "Reflective Thinking Scale" into Turkish developed by Kember et al. Both studies were applied to the students who were studying at the education faculties of the universities and validity and reliability studies were conducted. Scale development studies are generally prepared for teacher candidates and teachers in the literature. This study is distinguished from the others because it is designed to determine reflective thinking levels of senior primary school students and the sample consists of different class levels of primary school secondary education. The reflection types of Schön (1983-1987) constitute the sub-dimensions of the scale.

2. Purpose

Reflective thinking is the ability of the individual to make the right decisions by thinking about the actions that he or she can carry out or carrying out an action by his or her experiences. In this context, among objectives of renewed primary education cirriculum, these thinking skills are given to the students. The main purpose of this study is to develop the Reflective Thinking Scale to determine the reflective thinking levels of the senior primary school second students.

3. Methods

3.1 Participants

Criterion sampling, one of purposeful sampling, was chosen for the study. Criterion sampling is the study of all situations that meet a set of predetermined criteria (Yildirim and Simsek, 2006, p.112). The sample of the study is composed of 300 students studying in 6th, 7th, and 8th classes in the province of Afyonkarahisar, Emirdağ district.

The items in the scale are rated according to the 5-point likert. The pointing rate of the scale is designated according to frequency of the items done by students. The frequency of actions is organized as "Always", "Most of the time", "Sometimes", "Rarely", "Never". Students' answers were always scored as = 5 =Always, Most of the time = 4, Sometimes = 3, Rarely = 2, Never = 1.

3.2 Procedure

In developing the scale, the definitions of reflective thinking, local and foreign definitions, reflective thinking process, characteristics of reflective thinking individuals, types of reflective thinking, ways of developing reflective thinking have been examined. Theses and articles about the literature have been found and the theoretical framework of the study has been tried to be drawn by examining the previously developed or adapted scales related to reflective thinking. After they were examined, a pool of substances was created for the purpose of reflective thinking scale. The draft scale was prepared by selecting 52 items from the created substance pool. Attention has been paid to the existence of any material selected in the literature.

On the draft scale, pre-test was applied to 25 students in the 8th grade in the first semester of 2016-2017 academic year in order to determine the items that are not understood by the students and above the student level. After the trial application, it was concluded that three items couldnot be understood by the students, the items were tried to be corrected and it was decided to be removed from the scale when they could not be corrected. After the trial application, the items were evaluted by three PhD students in the department of curriculum and instruction in Afyon Kocatepe University and by a field expert, the neccessary correction was done and the scale consisting of 39 items was decided to be applied to the senior primary school students. The trial scale consisting of 39 items was applied to 300 students in 6^{th} 7^{th} 8^{th} grades, however 285 scales were evaluated.

3.3 Data Analysis

A method consisting of four steps was used in the analysis of data obtained from 285 secondary school students. First, item factor loads were examined. Maximum Likelihood Estimation (MLE) method was used for item analysis for Exploratory Factor Analysis (AFA). Exploratory Factor Analysis was used to investigate the correlation between items (Tekindal, 2015). For this purpose, variables that measure the same structure or quality have been gathered together and new factors have been identified (Büyüköztürk, 2006). In order to determine whether the items are overlapped under factors, the loads of the rotated material were examined by Varimax rotation technique, and the unsuitable items were removed from the data. Secondly, exploratory factor analysis was performed by using Maximum Likelihood Estimation on reduced model and Varimax rotation technique was employed. Thus, item-factor connection was established and named after being presented to expert opinion with the obtained dimension. Thirdly, factor loadings were established according to item-factor correlation and these models were analyzed by first-order Confirmatory Factor Analysis. The reliability of the scale was calculated for both the sub-dimensions of the scale and the total scale. Finally, Second level Confirmatory Factor Analysis was performed to determine the factorial validity of the scale.

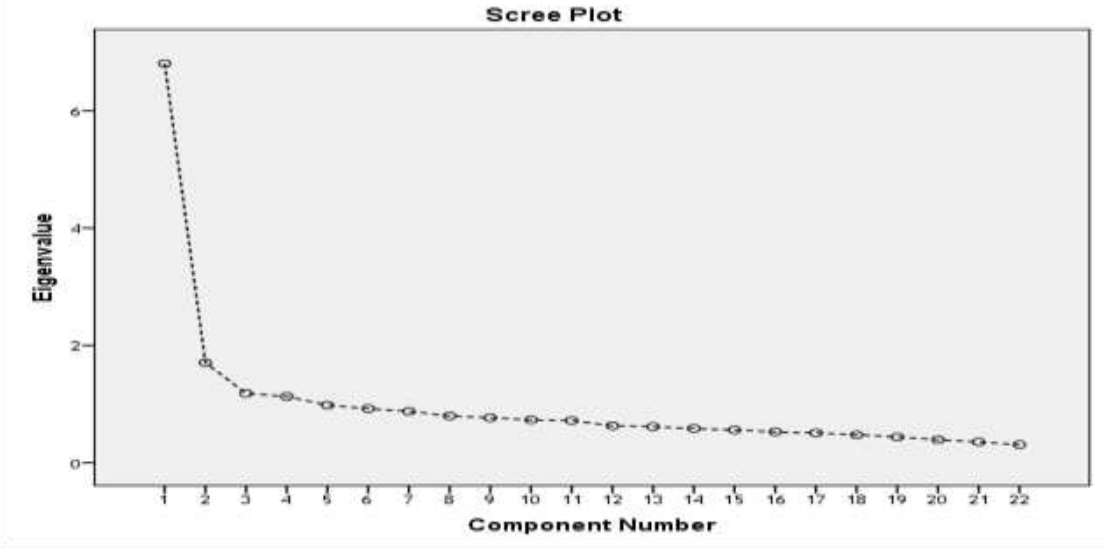
4. Findings

4.1 Explatory Factor Analysis

The scale consisting of 39 was applied to 285 senior primary school students. Barlet and KMO value are used to decide if the data ara suitable fr factor analysis, correlation examination and the size of the sample is enough to analyze (Tekindal, 2015). That KMO value is higher than .60 and Barlet test is meaningful indicate that the data are suitable for the factor analysis (Büyüköztürk, 2006). Kaiser-Meyer-Olkin (KMO) was calculated as .900 Barlett test (x^2: 1859,813; sd: 231; p<.01) is meaningful so data are normal. It was concluded that the sample size is enough as a result.

In the exploratory factor analysis, it is decided by looking at the eigenvalues and the graph of the line to decide how many dimensions are measured by the scale. Factors with an eigenvalue greater than 1 are considered significant. By making a decision based on the graph of the line, a line chart on which the vertical axis shows eigenvalues and horizontal axis shows the factors is created. This axis indicates the factor of the place where it falls with a high slope (Can, 2016).

Figure 1: Value-Factor Inclination Graph of the items



When we examine the eigen-factor graph in Figure 1, it is seen that there are three sub-dimensions of scale. The fracture begins to be linear at the third interval.
This means that if a factor has a high load value in the factor it is involved in, and if there is a cluster of substances in which a factor is associated at a high level, then this finding means that the substance measures a concept-making-factor together. The items with item load value of .30 and above can be selected (Büyüköztürk, 2002, p.124) In general, items with a load value of .40 or higher are preferred (Tekindal, 2015, p.150). Taking these explanations into consideration, items with a load value of .40 and above were taken. 17 items with lower than .40 load value were excluded from the scale

In analyzing the factor analytical model, MLE (Maximum Likelihood Estimation) and Explatory Factor Analysis were used. In this way, the item-factor relation was

reached and the eigenvalue, variance description ratios and item-factor load values of the constructed EFA are given in Table 1.

Table 1: CFA Results with Varimax Rotation Technique for Item-Factor

	Eigenvalue	**Total Variance %**	**Cumulative Variance**
	6,803	30,924	30,924
	2,377	7,753	38,677
	1,881	5,374	44,051
No	**F1**	F2	F3
10	**,574**		
12	**,524**		
37	**,628**		
1	**,638**		
29	**,489**		
30	**,449**		
38	**,665**		
36	**,658**		
9		,520	
34		,474	
16		,497	
31		,652	
6		,518	
5		,705	
32		,652	
3		,687	
21			,494
27			,557
20			,533
19			,502
39			,501
4			,555

As shown in Table 2, three eigenvalues greater than 1 were obtained in the EFA results with 22 items of the reflective thinking scale. The contribution of these eigenvalues to the total variance, respectively, was 30,924%; 7753%; It is 5.374%. These three eigenvalues account for 44.051% of the total variance. When the item factor loads given in Table 2 are examined, it is seen that the eight items are in the first factor and the item factor loads in this factor change between 449 and 665. It is seen that there are eight substances in the second factor and the substances change between 474 and 705. there are six substances in the third factor and the substance load values change between 494 and 557. These findings show that the reflective thinking scale is in a three-dimensional structure. It is desirable that the subscales of the reflective thinking scale selected according to the results of the AFA and grouped according to the results of the EFA are named by the experts, and if so, the items that disturb the integrity are indicated. All three sub-

dimensions have been named in line with expert opinions. According to this, subscales of reflective thinking scale are; Reflection on Action (Apast), Reflection During Action (Apresent), Reflection for Action (AFuture) has been named. The above subdimensions names indicate the student's reflection for the past, his reflection at the moment and his reflection for the future.

4.2 First Level Confirmatory Factor Analysis (CFA) and Reliability for the Reflective Thinking Scale

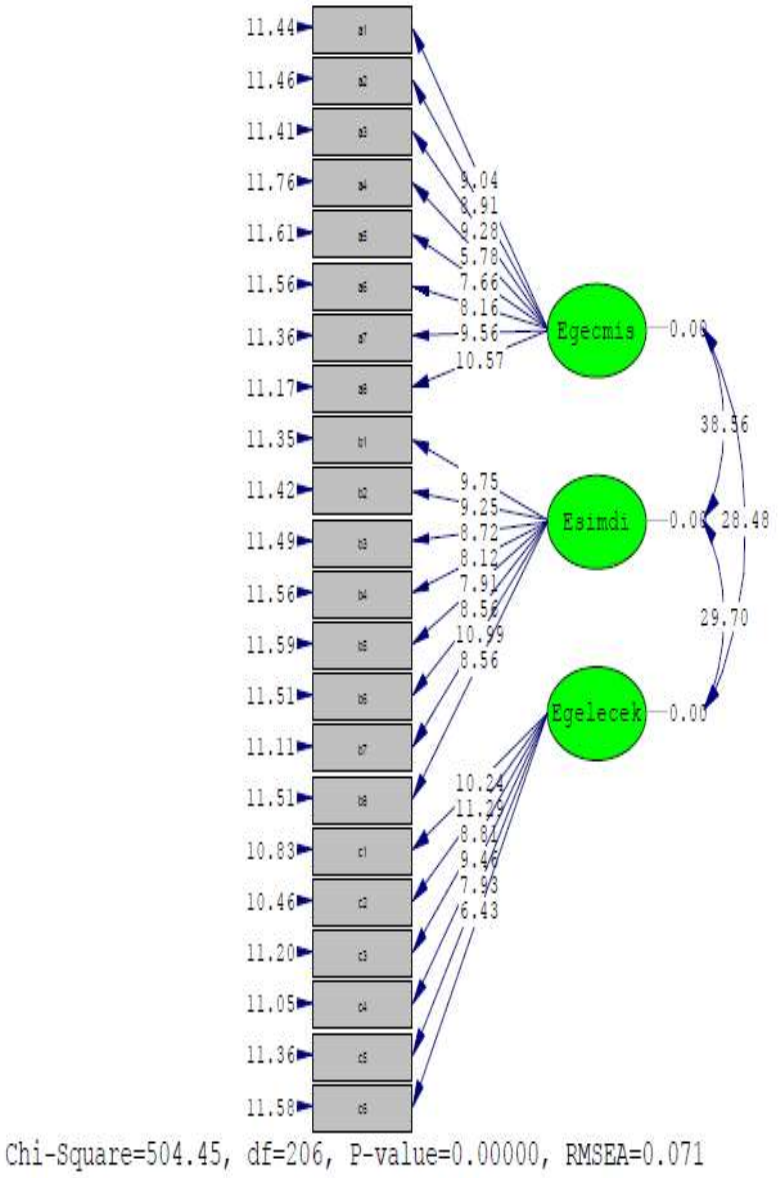
Floyd and Wideman (1995) state that the most important step in the structural equality model is to determine the model. Model identification is concerned with determining the number of hidden variables as well as which observed variable is related to which latent variable is loaded (Çokluk, Şekercioğlu, Büyüköztürk, 2016). A model has been established with the naming of the trial form of the reflective thinking scale. It was decided that the first subdimension of the scale measures reflection for action (Apast) with eight items, second subdimension measures reflection during action (Apresent) with eight items and third subdimension measures reflection for action (Afuture) with six items and it was tested with CFA. a1-a8 measure reflection about action; b1-b8 measure the reflection during action; the measures of reflection for action are shown as c1-c6. Sub-dimensions and the scale reliability coefficients of this model tested with CFA were calculated.

Table 2: Coefficient Analysis of Reflective thinking scale and its subdimensions

Subdimensions	**Cronbach Alpha**
1. Subdimension (Reflection about action)	.727
2. Subdimension (Reflection during action)	.749
3. Subdimension (Reflection for action)	.709
Total	.888

In Table 2, the subscales of the scale and the reliability scores of the combined scale are given. As seen, the subscales of the scale and the reliability of the overall scale are calculated above 70 and considered sufficient for reliability. The reliability coefficient calculated is .70 and higher indicates that the test scores are generally sufficient for reliability according to Büyüköztürk (2006). The path diagram of the Reflective Thinking Scale is given below in Figure 2.

Figure 2: The significance level of the latent variables' explanation rate on the observed variables for reflective thinking scale



T values of the latent variables for explaining the observed variables are seen on the arrows. It is indicated that if t values exceeds 2.56, they are accepted significant at level of .01 (Çokluk, Şekercioğlu ve Büyüköztürk, 2014). As seen in the figure 1, all the parameter estimations are significant at the level of .01.

As seen in Figure 3, the p value is the .01 level. Another fit index taken into consideration is $\chi 2$. According to Çokluk, Şekercioğlu, Büyüköztürk (2016), $\chi 2$ is not a statistic which can be evaluated alone. At this stage, evaluation was made by looking at the ratio of $\chi 2$ / sd. In Figure 3, it is seen that $\chi 2 = 504.45$ and sd = 206. The $\chi 2$ / sd ratio was calculated to be 2.44 (504.45 / 206 = 2.44). The table below shows the goodness of fit indexes of the Reflective Thinking Scale, the values and the acceptance values of these values.

Figure 3: The error variance of the path diagram of reflective thinking scale

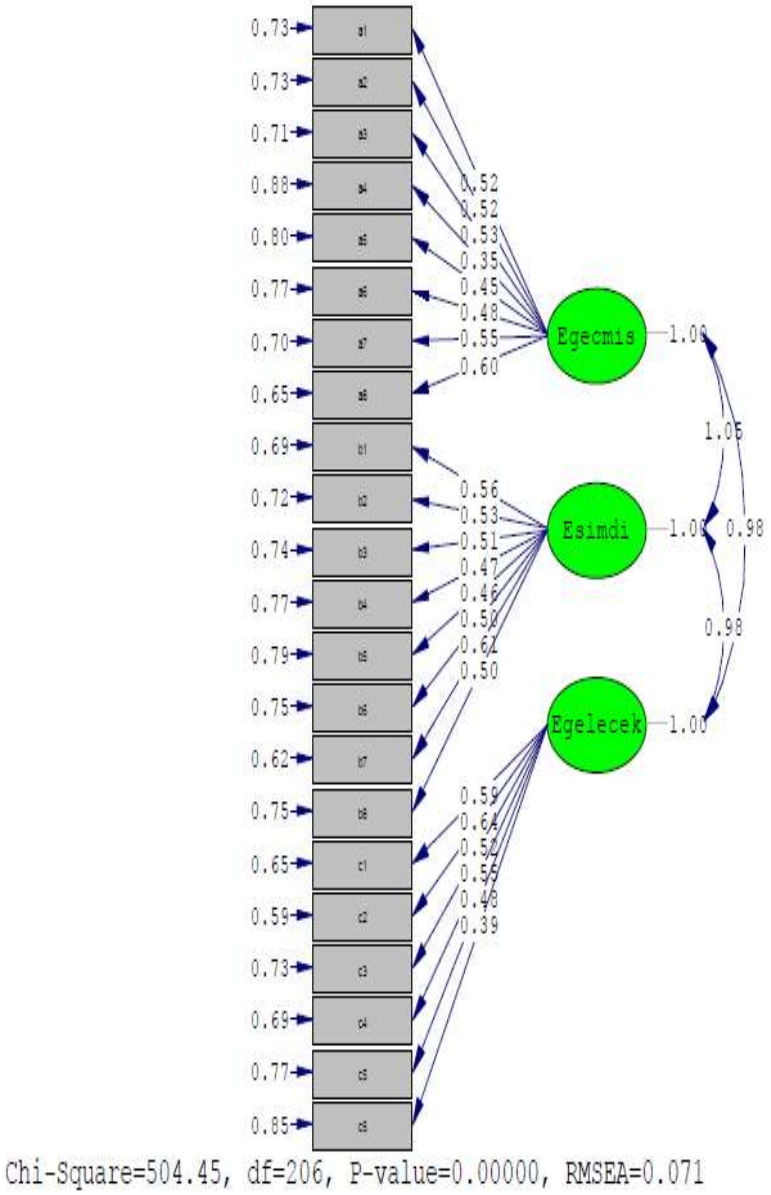


Table 3: CFA goodness of fit results of reflective thinking scale

Fitness Indexes	Proposed Fitness Value	Criteria	Acceptable Criteria
$\chi 2$ /df	2.44	$0 \leq \chi 2$ /df ≤ 2	$2 < \chi 2$ /df ≤ 3
RMSEA	.071	$0 \leq$ RMSEA $\leq .05$	$.05 <$ RMSEA $\leq .08$
Comperative Fit Index (CFİ)	.95	$.97 \leq$ CFI ≤ 1.00	$.95 \leq$ CFI $< .97$
Standartized RMR	.078	$0 \leq$ SRMR $\leq .05$	$.05 <$ SRMR $\leq .10$
Goodness of Fit İndeks (GFİ)	.86	$.95 \leq$ GFI ≤ 1.00	$.90 \leq$ GFI $< .95$
Adjusted Goodnessof Fit İndeks (AGFİ)	.83	$.90 \leq$ AGFI ≤ 1.00	$.85 \leq$ AGFI $<.90$
NNFI	.94	$.97 \leq$ NNFI ≤ 1.00	$.95 \leq$ NNFI $< .97$

Source: Engel, Moosbrugger ve Müller (2003, p. 52).

The ratio of $\chi 2$ / sd appears to be an acceptable value when looking at Table 2 for the goodness of fit of 2.44. Kline (2005) states that the $\chi 2$ / sd ratio below 3 is a perfect fit and

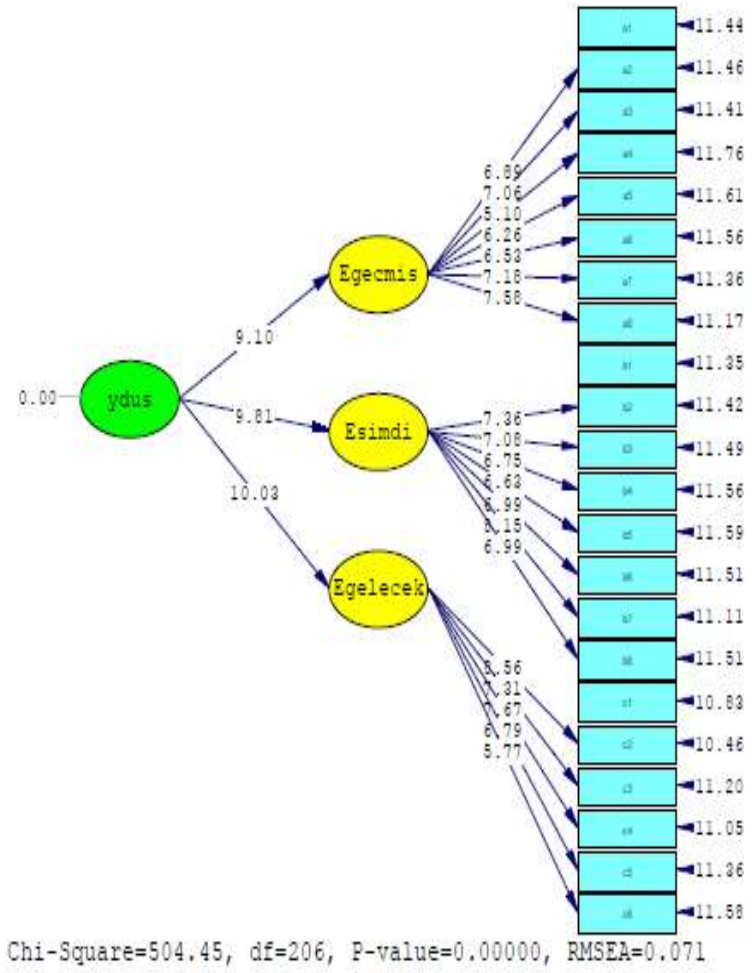
below 5 is a moderate fit (Çokluk, Şekercioğlu, Büyüköztürk, 2016). When we look at the RMSEA on the path diagram of the Reflective Thinking Scale, it appears to be .071. According to Table 2, the RMSEA value is considered to be an acceptable value less than .08. Jöreskog ve Sörbom (1993) states that RMSEA value below than .05 is perfect and below .08 value is good fit (Çokluk, Şekercioğlu, Büyüköztürk, 2016).

It is seen that GFI is .86 and AGFI is .83. When the GFI and AGFI indexes in Table 2 are examined, it is seen that both fit indexes have poor fit. index of the standardized RMR is .078. This value shows a an acceptable fit index. Finally, looking at the NNFI and CFI indexes of the scale, it is seen that NFNI is .94 and CFI is .95. NNFI shows a poor and CFI shows an acceptable fit index.

4.3 Second Level Confirmatory Factor Analysis for Reflective Thinking Scale

When the second level confirmatory factor analysis of the Reflective Thinking Scale was performed, the significance levels of the t values of the observed variables were examined.

Figure 4: T values of the second level confirmatory factor analysis of the Reflective Thinking Scale



The t values for the second level DFA of the Reflective Thinking Scale shown above in Figure 4 are shown on the arrows. The parameter estimates of the reflective thinking scale are at the .01 level. Çokluk, Şekercioğlu, Büyüköztürk (2016) indicate that if the t values exceed the 2.56, it means that it is sinificant at .01 level. In Figure 3 it is seen that $\chi 2 = 504.45$ and sd = 206. The ratio of $\chi 2$ / sd is 2.44 (504.45 / 206 = 2.44). Kline (2005) states that a ratio of $\chi 2$ / sd below 3 is a perfect fit (Çokluk, Şekercioğlu, Büyüköztürk, 2016). It can be said that the ratio of $\chi 2$ / sd is perfect. When the good fitness values in the table 2 evaluated, RMSEA= .071 and CFI= .95 show an acceptable good fitness values. SRMR, GFI, AGFI, NNFI were calculated as .062, .86,. 83, .9, respectively. Anderson and Gebing (1984); Cole (1987); Marsh, Balla and McDonald (1988) point out that the following criteria can be accepted in evaluating fitness indexes: GFI>.85, AGFI>.80, RMR ve RMSEA<.10 (Çokluk, Şekercioğlu, Büyüköztürk, 2016, p. 400).

5. Discussion and Conclusion

In this study, it was aimed to develop Reflective Thinking Scale in order to determine the reflective thinking levels of senior primary school students. Scale was developd in the form of 5 point likert scale. The scale was applied to 6th, 7th and 8th grade of elementary school and 285 students of the class. Explanatory Factor Analysis (EFA), first and second level Confirmatory Factor Analysis (CFA) were performed for the scale. The scale consists of three sub-dimensions and 22 items. These sub-dimensions are; Reflection on Action, Reflection during Action, and Reflection for Action. Items 1, 12, 37, 1, 29, 30, 38, 38 are in the first sub-dimension; 9, 34, 16, 31, 6, 5, 32, 3 are in the second dimension and 21, 27, 20, 19, 9, 34 are in the third dimension.

As a result of the exploratory factor analysis, items below .40 were excluded from the scale. It is concluded that the calculated number of samples of Kaiser-Meyer-Olkin (KMO) value of .900 is sufficient. The contribution of the eigenvalues to the total variance, respectively, was 30.924%; 7753%; It is 5.374%. These three eigenvalues account for 44.051% of the total variance. The subscales of the scale and the Cronbach Alpha reliability coefficients for the scale were calculated. Cronbach Alpha reliability coefficient for the sub-dimensions are 727; 749; 709 respectively and the Cronbach Alpha reliability coefficient for the overall scale is 888.

In the first and second level CFA results, the parameter estimates of the Reflective Thinking Scale were found to be at .01 level. The ratio of $\chi 2$ / sd is 2.44 and indicates that the goodness of fit value is a perfect fit. The RMSEA value in the pat diagram of the Reflective Thinking Scale is calculated as .071. It was calculated thatGFI of .86; .83 for AGFI; RMR .078; The fit index of .94 for NNFI and .95 for CFI.

As a result af CFA analysis that was conducted to confirm the model obtained as the result of EFA, the model is confirmed. It was concluded that the developed scale was a valid and reliable scale for measuring reflective thinking levels of students.

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