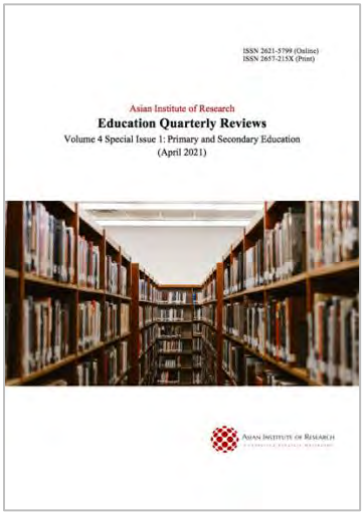

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The Science Course-Focused Responsibility Scale Towards Primary School Students': Study of the Validity and Reliability

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Abstract
The research is a scale development research that aimed to develop a valid and reliable measurement tool that may determine the science course-focused student responsibility levels of primary school students. The research was carried out in three central districts in Kayseri province in the 2018-2019 academic year. The research' sample was made up of three different study groups and research was carried out with the participation of 870 students. The data of the first study group were used for the pilot application phase, the data of the second study group for the exploratory factor analysis (EFA), the data of the third study group for the confirmatory factor analysis (CFA). As a result of the validity-reliability analysis of the study by adopting a Likert-type scale development model, a 17-item scale structure with Cronbach Alpha internal consistency coefficient .87, consisting of 4 factors, was collected, which explains 50.83% of the total variance

Keywords: Science Course, Scale Development, Responsibility

1.Introduction

1.1 Introduce the Problem

Responsibility is an individual's choice-making for his personal or social life and undertaking the possible consequences of these choices (Douglass, 2001; Glasser, 2005). It directs individuals to undertake various duties

to protect the social life, peace, and security environment in which individuals live. This orientation stems from the sense of responsibility that individuals have.

The concept of responsibility, which is so effective in human life, is mainly examined under two headings as individual responsibility and social responsibility. While the aspect that looks at the personal life of the individual is considered as individual responsibility, the aspect facing his social life is considered as social responsibility (Berkowitz & Lutterman, 1968; Burke et al., 2001; Eraslan, 2011; Glasser, 2005; Özen, 2015).

The sense of responsibility, in the process of transforming the choices into action, contributes to the individual's self-knowledge, increase in self-control, and at the same time reach the awareness of being "We" in the society he/she lives in (Cüceloğlu, 2017; Glasser, 2005; Wubbolding, 2015). Individuals with a sense of responsibility are people with developed self-esteem, strong empathy skills, and compliance with social rules. Therefore, they cannot remain indifferent to environmental and social problems. They always feel ready to act to prevent and solve these problems (Ergül & Kurtulmuş, 2014; Karagöz, 2013; Messina, 2004).

The awareness of individual and social responsibility is an indispensable element for maintaining order in every aspect of social life, including family life, friendship relations, educational activities, and the hierarchical order in management systems. It can be said that many militaries, political, social, economic, and ecological problems encountered in daily life stem from the failure to fulfil the responsibilities undertaken at the right place and time. For this reason, it is necessary to raise awareness of responsibility in making individuals sensitive to environmental and social problems (Aladağ, 2009; Hayta Önal, 2005; Tillman, 2000).

Responsibility is an awareness that individuals should gain by assigning tasks appropriate to their ages, developmental levels, and gender, starting from early childhood. Firstly family, then school life and social relations are crucial in the development of an awareness of responsibility (Cüceloğlu, 2017; Glasser, 2016; Luckner, 1994; Yavuzer, 1996).

Educational institutions are among the institutions that have direct responsibility and instill responsibility in terms of their functions (Demirci Güler & Açıkgöz, 2019). They contribute to individuals' learning the basic knowledge, skills, and values that they need to gain physical and mental well-being and to raise them as individuals who will carry society forward. In this respect, the school is important in the individual's self-realization and integration with society by meeting the academic and psychological needs of the individual during the development of various skills and attitudes (Maslow, 1954; Rothstein, 2000).

1.2 The Relationship Between Science Education and Responsibility

There is a parallel relationship between the development level of countries and the quality of education. According to the result of TIMSS (2019) and PISA (2018), it is seen that countries with the highest success rate are located among the high-level welfare countries. The education programs of these countries have a comprehensive and effectively planned science education process, and their goals are to raise science-literate individuals (Finnish National Agency for Education, 2020, Ontario Ministry of Education, 2007; Hong Kong/Education Bureau, 2017; Republic of Estonia/Ministry of Education and Research, 2014).

"A science literate person is one who can read and understand common media reports about science and technology, critically evaluate the information presented, and confidently engage in discussions and decision-making activities that involve science and technology" (Science Teachers' Association of Ontario, 2006: 1). With this purpose, science education aims to raise students as responsible citizens who respect the ecosystem and act with the awareness of sustainability. So special attention should be given to science education in raising responsible individuals who can produce information and technology (Ayas, 1995; Çepni et al., 2003; Matthews, 2017). In the study carried out for this purpose, the studies on responsibility scale (Altunok Çal & Yeşil (2019a; 2019b), Coles & Schofield (2008), Doğan (2014), Eraslan (2011), Filiz & Demirhan (2015), Golzar (2006), Gough, McClosky & Meehl (1952), Kaya & Doğan (2014), Özen & Gülaçtı (2011), Şahan (2011), Yeşil (2014; 2015) in the literature were examined, accepting that responsibility awareness is soo important in the process of

raising science-literate individuals. When the researches were investigated, no study was found about developing a responsibility scale intended for the science course. Therefore, the research is expected to contribute to the literature.

1.3 The Aim of the Research

This research aimed to develop a data collection tool that may determine the science course focused student responsibility levels of primary school third and fourth-grade students.

2. Method

This research is a scale development study that aimed to develop the science course-focused student responsibility scale.

2.1 The Population and Sample

The population of the study has been determined as third and fourth-grade students in primary school which is in Kayseri in the 2018-2019 academic year. The research samples consisted of 870 students attending third, fourth grade levels, and 4th grade graduate in 3 central districts of Kayseri in 2018-2019 academic year. In determining the sample, the typical case sampling method and convenience sampling method was preferred. “The typical case sampling method is to collect information from this sample by determining a situation that is typical in many situations in the universe, related to the research situation” (Büyüköztürk et al., 2018:94). “Convenient sampling method, the sample is chosen from easily accessible and practicable units due to the limitations in terms of time, money and labor" (Büyüköztürk et al., 2018: 95).

The data collection tool of the research was developed in the fall semester of the 2018-2019 academic year. Therefore, as regards the reliability of the data, the research was carried out with 4th grade graduate students who have mastered the 3rd, and 4th-grade acquisitions and continue their education in three central districts in Kayseri. In this context, the data collected from 3rd, 4th-grade levels, and 4th-grade graduate students in the pilot application phase of the study were examined, and the data collected from 4th grade graduate students during the exploratory and confirmatory factor analysis process were used.

In the research sample of this study, which is made up of three different study groups, consists of 870 students in total. The first study group, which provided data for the pilot implementation phase of the study, consists of 32 third grade, 35 fourth grade, and 32 fourth grade graduate students and a total of 99 students. The second study group, which provides data for the exploratory factor analysis of the research, consists of 371 students. The third study group providing data for confirmatory factor analysis (CFA), consists of 400 fourth grade graduate students.

2.2 The First Study Group (Pilot Implementation Group)

The data collected from the first study group were used in the pilot implementation phase of the research. Class-gender distributions of the students who formed the first study group are examined. The first study group comprises 99. When the information gave is analyzed based on gender; The first study group consisted of 49 female and 50 male students. When the data are analyzed based on classes; 32.3% of the first study group comprised third grade (f=32), 35.4% was fourth grade (f=35) and 32.3% was fourth-grade graduate (f=32) students.

Table 1: Distribution of the First Study Group by Grade and Gender

Grade	Gender				Total	
	Female		Male			
	f	%	f	%	f	%
3rd Grade	15	46.9	17	53.1	32	32.3
4th Grade	18	51.4	17	48.6	35	35.4
5th Grade	16	50	16	50	32	32.3
Total	49	49.5	50	50.5	99	100

When Table 1 is investigated, it indicates that a total of 99 students participated in the first study group. When the information given is analysed based on gender; It is seen that 49.5% of the first study group is female (f = 49) and 50.5% is male (f = 50) students. When the data are analysed based on classes; It is seen that 32.3% of the first study group was third year (f = 32), 35.4% was fourth grade (f = 35) and 32.3% was fifth grade (f = 32) students.

2.3 The Second Study Group (EFA)

In the study, the data collected from the second study group consisting of fourth grade graduate students were used for Explanatory Factor Analysis (EFA). The distribution of the students in the second study group by gender was given in Table 2 below.

Table 2: Distribution of the Second Study Group by Gender

Gender	f	%
Female	184	49.6
Male	187	50.4
Total	371	100

Table 2 indicates that a total of 371 students participated in the second study group. The data indicates that 49.6% of the second study group is female (f = 184) and 50.4% are male (f=184) students. Nine students that four of them did not mark the majority of the items in the scale, and five of them answered an item by ticking more than one option, were not included in the study group. According to Field (2005), the percentage of samples required for exploratory factor analysis should be 10 times the number of items, and according to Tabachnick and Fidel (2015), it should consist of at least 300 participants. In this study, the sample size can be considered to be at a good level, since data were collected from 371 people for exploratory factor analysis.

2.4 The Third Study Group (CFA)

The data collected for the confirmatory factor analysis of the study were collected from a different study group. Table 3 indicates the gender distribution of the students in the third study group.

Table 3: Distribution of the Third Study Group by Gender

Gender	f	%
Female	209	52.3
Male	191	47.8
Total	400	100

Table 3 indicates that the third study group consists of 400 students in total. Regarding gender, this table indicates that the third study group consisted of 209 female (52.3%) and 191 male (47.8%) students. Ten students, who eight of them did not mark most of the items in the scale, and two of them answered more than one option to an item were not included in the study group.

2.5 Development of the Data Collection Tool

Scale development studies are phased studies that contain discipline (Karasar, 2016; Tezbaşaran, 2008). After studying the literature, it was determined that there were many scale developments approaches, and it was decided to conduct the research by adopting the Likert Type Scale Development Approach.

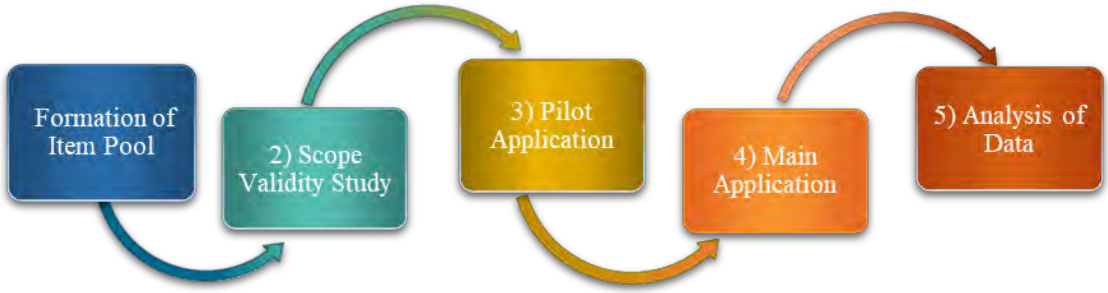

Figure 1: Likert type scale development basic approach (as cited in Tezbaşaran, 2008)

In the study, it was decided to prepare the item pool by considering the study of Demirci Güler & Açıkgöz (2019) titled " Examination of the Science Course Curriculum of the Year 2018 in Terms of Including Course Outcomes Regarding Responsibility ". The study was investigated the acquisitions of the 2018 Science Course (3rd and 8th grade) Curriculum in detail, considering the concept of responsibility. The outcomes were categorized under tiles of "individual responsibility" and "social responsibility," "conscious resource consumption," "environmental awareness," "health awareness" and " Security awareness."

The reliability of the categories was calculated using the Miles & Huberman (1994) model ("reliability = consensus/consensus + disagreement"), and it was determined that Consensus-Disagreement coefficient was .95. In this context, the mentioned research was decided to use for the formation of the item pool of the scale.

Considering the class levels of the population and the sample of the research, it was decided to limit the item pool to the responsibility gains at the 3rd and 4th grade. In this context, an item pool of 35 items in total was formatted, 27 of which were positive and 8 of which were negative was created under titles of "Conscious Resource Consumption," "Health Awareness," "Environmental Consciousness" and " Security Awareness." It was decided that the scale aimed to be developed in the study should be prepared in Likert type rating scale developed by Likert (1932), which is used more frequently and more widely than other scales in measuring many personality traits in social sciences (Oppenheim, 1979; Judd, Eliot & Kidder, 1991; Sommer & Sommer, 2002; Fraenkel & Wallen, 2003: as cited in Tezbaşaran, 2004). Likert scale was prepared in 3-Likert type to be appropriate for the age of the study group (Bourke & Frampton, 1992; Adelson & McCoach, 2009: as cited in Adelson & McCoach, 2010: 797). Likert grades were graded from positive to negative (3 = Always, 2 = Sometimes, and 1 = Never) (Tezbaşaran, 2008).

2.6 Scope Validity

For the content validity study of the research, a total of 11 expert opinions were taken from one expert in each field of Turkish language and literature, 3 experts in each field of psychological counselling and guidance, education programs and primary school education, and 2 experts in each primary school classroom teachers who were experts in classroom education and science education. The items were presented to the experts by preparing an expert opinion form and each item was asked to be evaluated under the criteria of "Suitable," "Not Suitable" and "Developable". While taking expert opinions, Lawshe (1975) technique was adopted, and the content validity ratios of each item were calculated. Content validity ratio is the rate of agreement of experts on an item during the scale development process, or in other words, the rate of considering the item as "essential" (Lawshe, 1975).

Content validity ratio determination formula (Lawshe, 1975:567):

$$CVR=\frac{N_e-N/2}{N/2}$$

(Equation 1)
*N = Total number of experts
*Ne= Number of experts who find the item "essential"

2.7 Pilot Application

After taking expert opinions in the research, pilot application of the draft scale was performed. The pilot application is an application which to tests the functionality of the scale by applying the scale to be developed on a small group and to eliminate possible problems (Borg & Gall, 1971: as cited in Karasar 2017). The pilot implementation of the study was conducted with the voluntary participation of 99 students. The required corrections were made to the items, as a result of the feedback received from the students. Thus, the draft scale consisting of 27 items was made ready for construct validity analysis.

2.8 Construct Validity

The construct validity of the draft scale was examined. "Construct validity indicates the degree to which the test can accurately measure an abstract concept (factor) in the context of the behaviour to be measured. For examining the construct validity factor analysis, cluster analysis, internal consistency analysis, and hypothesis testing techniques are used" (Büyüköztürk, 2018: 180). The exploratory and confirmatory factor analysis of the data was performed in the construct validity study.

2.9 Exploratory Factor Analysis

In scale development studies, data must normal distribution to be suitable for exploratory factor analysis (Özdamar, 2016). Otherwise, correlation-based relationships that allow factor analysis will not emerge (Can, 2017). In this context, the normality test of the data set was performed. Then exploratory factor analysis was performed. "Exploratory factor analysis is a type of statistical analysis that aims to combine variables of similar nature and explain this measurement with fewer factors to determine the theoretical constructs in which the variables in the data set are constructed, to what extent these theoretical structures represent variables" (Büyüköztürk, 2018; Henson & Roberts, 2006).

In the study, the exploratory factor analysis performed on the data collected from 371 fourth grade graduate students. During the analysis, if an item is distributed to more than one factor, it has been paid attention that the factor values are at least .40 and the difference between the two factor load values is at least .10. (Büyüköztürk, 2018; Tabachnik & Fidell, 2015). Principal Component Analysis was performed during the analysis. Within the framework of the concept of responsibility, the Oblimin rotation method was used because the sub-factors are interrelated (Can, 2017; Çokluk et al., 2018).

2.10 Confirmatory Factor Analysis

The confirmatory factor analysis was carried out to measure if the data collected as a result of the exploratory factor analysis is compatible with pre-determined factor levels (Meydan & Şeşen, 2011). The confirmatory factor analysis was carried out with the data collected from 400 fourth-grade graduate students. During the analysis, the results were evaluated by considering the CFA fit index values of Hu & Bentler (1999).

2.11 Security

As a result of the use of a data collection tool by different researchers, similar outcomes of the data collection

tool are desired. This situation shows that the data collection tool is consistent and authentic (Karasar, 2016). In the reliability analysis of the research, it was examined Cronbach Alpha internal consistency coefficient which shows the fit levels of the items in the scale.

2.12 Analysis of Implementation Phase Data

In the study, the data were carefully analysed and transferred to the computer. The data was removed that impede the validity and reliability of the research, and the data set was made ready for analysis. Then the validity and reliability studies of the "Science Course Focused Student Responsibility Scale" were carried out. It was determined that the scale is a valid and reliable scale.

The score ranges of the data collection tool are calculated using the n-1/n (n= Likert number) formula to determine the level of responsibility of students focused on the science course. Since the scale has got 3 items and 2 even intervals, the score range is calculated as .66 (2/3 = .66). Likert levels calculated according to the score ranges are as such: never = 1 point (1.00 -1.66), sometimes = 2 points (1.67-2.33), always = 3 points (2.34-3.00) (Büyüköztürk, 2018).

The structure validity-reliability analyses of the data collection tool were carried out using IBM SPSS Statistics 25 and LISREL 8.8 package programs.

3. Results

During the content validity study, 11 expert opinions were received. While taking expert opinions, Lawshe (1975) technique was adopted, and the content validity ratios of each item were calculated. The CVR values show that the value of 8 items (I9, I13, I15, I16, I17, I20, I22, I23) is lower than the minimum CVR value (.59) valid for 11 experts. As a result, it was decided that 8 items exclude from the scale (Lawshe, 1975). In the research, it was conducted the test of normality to find out whether the data set was suitable for analysis, and the Skewness and Kurtosis values of the data were checked. It was determined that the Skewness value was -1,041 and the Kurtosis value was 749. When Skewness and Kurtosis values are between -1 and +1 values, it is accepted that the data set is normally distributed. In this context, it can be said that the data set is distributed normally (Hair et al., 2013: 34; Morgan et al., 2011: 51).

3.1 Science-Course-Focused Student Responsibility Scale Explanatory Factor Analysis Findings

Before performing exploratory factor analysis, the Bartlett Sphericity test and the Kaiser Mayer Olkin (KMO) coefficient values were examined (Büyüköztürk, 2018: 136). Since the KMO coefficient is greater than .80, it can be said that the sample size is at an acceptable level. (KMO = 0.86) (Hutcheson & Sofroniou: as cited in Seçer, 2017). According to the result of the Bartlett Sphericity test (x^2 = 2603.002; df = 351; $p<.05$), it can be said that the data are suitable for factor analysis (Büyüköztürk, 2002; Tabachnick & Fidell, 2015). After checking the KMO and Bartlett Sphericity tests, the exploratory factor analysis was performed.

Table 4: Factor Loadings of the Science Course Focused Student Responsibility Scale

Item	Factors			
	Conscious Resources Consumption	Security Awareness	Health Awareness	Environment Awareness
I-8	**.791**	-.004	.062	-.048
I-14	**.752**	-.046	-.013	.104
I-2	**.741**	.051	-.038	-.047
I-27	**.679**	-.005	.071	.144
I-19	**.650**	.005	.076	.112
I-17	-.012	**.789**	.086	-.139
I-22	-.106	**.631**	.085	.194
I-10	.102	**.618**	-.179	.048
I-23	.300	**.547**	.100	-.273
I-4	.071	.071	**.740**	-.104
I-1	.113	-.192	**.685**	-.010
I-9	-.152	.337	**.505**	.173
I-13	.162	.077	**.436**	.227
I-7	-.005	-.138	.071	**.667**
I-18	.067	.009	-.018	**.663**
I-15	.184	.247	-.198	**.609**
I-11	.154	.370	.007	**.480**
I-3	.125	-.069	.204	**.475**

During the analysis, it was seen that the 6th, 12th, 16th, 20th, 24th, 26th items were not placed under certain factors. Contents of the 5th, 21st, and 25th items were found to be irrelevant in terms of the factors in which they were placed. These items were not included in the analysis. When table 4 examined, it is seen that reveals that the factor loadings of the "Conscious Resource Consumption" sub-dimension items are between .65 and .79, the " Security Awareness" sub-dimension items are between .54 and .78, the "Health Awareness" sub-dimension items are between .43 and .74 in, "Environmental Consciousness" sub-dimension items are between .47 and .66. When the variance values of the factors are examined, it is seen that the self-value of the "Conscious Resource Consumption" sub-factor comprising five items is 4.848 and its variance is 26.931%. It is seen that the self-value of the "Security Awareness" sub-factor comprising four items is 1.681, and its variance is 9.340%. It is seen that the self-value of the "Health Awareness" sub-dimension comprising four items is 1.324, and the variance is 7.353%. It is seen that the self-value of the "Environmental Consciousness" sub-dimension comprising five items is 1.298 and its variance is 7.210. As a result of the factor analysis, it is detected that the scale comprised 18 items and 4 factors, and the total self-value of the scale is 9.151 and its total variance is 50.834%. After performing exploratory factor analysis, item discrimination levels of the scale items were examined. To determine the internal consistency of the scale items, it was performed the t-test to the lower 27% and upper 27% groups of the second study group. According to the results, it was determined that there was a significant difference between the lower 27% and upper 27% groups ($p<0.05$), and the item discrimination levels of the scale items can be accepted level.

3.2 Confirmatory Factor Analysis Findings of the Science Course Focused Student Responsibility Scale

After the exploratory factor analysis is done, confirmatory factor analysis is done. The model resulted from the analysis, is shown in Figure 2.

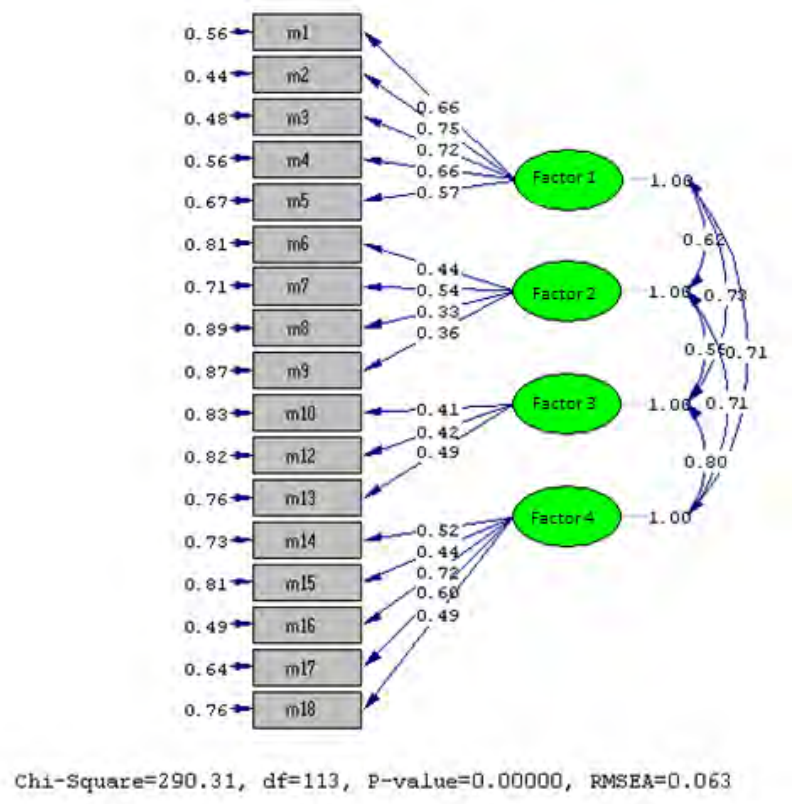

Figure 2: Standardized Factor Loadings of Confirmatory Factor Analysis

Standardized factor loadings for the analysis in Figure 2 indicates that the factor loadings for all items are higher than 30. The factor load (.13) of M11 was decided to be excluded from the analysis since it was below 30 (Seçer, 2017).

When the confirmatory factor analysis fit indices are examined, it can be said that the Chi-Square value (x^2 = 290.31, sd = 113, p<0.001) is significant. As a result of the analysis, the "x^2 /sd" ratio was calculated as 2.56. It can be stated that the value collected is within the acceptable range. When the other collected fit indices are examined, the "Normed Fit Index" (NFI=0.92), "Non-Normed Fit Index" (NNFI=.94), "Relative Fit Index" (RFI=.90), "Comparative Fit Index" (CFI=.95), "Adjusted Goodness of Fit Index" (AGFI=.92) and "Root Mean Square Error" (RMSEA=.063) values are found to be acceptable. "Increasing Fit Index" (IFI)=.95, "Goodness of Fit Index" (GFI)=.92, "Root Mean Square Residuals" (RMR)=.018 values are seen to be at the perfect fit level (Hu & Bentler, 1999; Schermelleh-Engel & Moosbrugger, 2003).

3.3 Reliability Analysis Findings of the Science-Course-Focused Student Responsibility Scale

As a result of the confirmatory factor analysis, it is detected that the scale comprised 17 items and 4 sub-factors. Then, the Cronbach Alpha internal consistency coefficient was examined for the reliability analysis of the scale, and this value was found to be .87. In this context, the reliability of the scale is high (Büyüköztürk et al., 2018).

Then the reliability coefficients for each sub-factor of the scale were examined. It was seen that the internal consistency coefficient of the "Conscious Resource Consumption" factor is .81; the internal consistency coefficient of the "Environmental Consciousness" factor is .71; the internal consistency coefficient of the " Security Awareness" factor .60, and the internal consistency coefficient of the "Health Awareness" factor is .55. In this context, it can be said that the internal consistency coefficients of the "Conscious Resource Consumption" and "Environmental Awareness" sub-factor are high. It can be said that the internal consistency coefficients of the "Security Awareness" factor and of the "Health Awareness" factor are acceptable because they are higher than .40 (Tavşancıl, 2006).

4. Discussion, Conclusion and Suggestions

This research was performed with the intention of prepare a valid and reliable scale that can be used to determine the responsibility levels of primary school 3rd and 4th-grade students focused on the science course. Discussions, results, and recommendations regarding the research are presented below.

4.1 Science Course Focused Student Responsibility Scale

This research was performed intending to prepare a valid and reliable scale that can determine the Science Course Focused Responsibility levels of primary school 3rd and 4th-grade students. Discussions, results, and recommendations regarding the research are given below.

Considering the age level of the students, the scale was decided to be prepared in a 3-point Likert type (Adelson & McCoach, 2010). After the literature was reviewed, an item pool comprising 35 items was prepared. Then, 11 field experts were consulted for the content validity study. Based on the feedback received from experts, the Content Validity Ratio (CVR) of each item was calculated (Lawshe, 1975). When the CVR values of the scale items were examined, it seen that the value of 8 items was lower than the minimum CVR value (0.59) which is valid for 11 experts at a 95% confidence interval. Therefore, these items were excluded from the draft scale (Lawshe, 1975).

For the construct validity analysis of the research, exploratory factor analysis and confirmatory factor analysis were performed. The data was collected from 371 students for exploratory factor analysis, and 400 students for confirmatory factor analysis. With the intention of obtain healthy results in the exploratory factor analysis, the sample size should be at least 300 according to Tabachnick & Fidel (2015), and 10 times the number of items in the scale according to Field (2005). In this context, the sample size of the research is at a fair level.
With the intention of check whether the data set belonging to the exploratory factor analysis is suitable for analysis, Skewness and Kurtosis values were checked and the normality distribution was examined (Can, 2017). It was observed that the Skewness value was -1.041 and the Kurtosis value was 749. When Skewness and Kurtosis values are between -1 and +1 values, it is supposed that the data set is distributed normally. In this context, it can be said that the data set is normally distributed and is suitable for factor analysis (Hair et al., 2013: 34; Morgan et al., 2011: 51). After the normality test, with the intention of check whether the sample size is suitable for factor analysis, “the Bartlett Sphericity Test” values were examined to determine whether there was a relationship between the “Kaiser Mayer Olkin” (KMO) coefficient and the variables (Büyüköztürk, 2018: 136). Since “the Kaiser Mayer Olkin” coefficient (KMO = .86) is greater than .80, the sample size is very good (Hutcheson & Sofroniou: as cited in Seçer, 2017). As the values of the “Bartlett Sphericity test” (x^2=2603.002; df = 351; p<.05) are significant, the data are also suitable for factor analysis (Büyüköztürk, 2002; Tabachnick & Fidell, 2015).

After the preliminary examinations for the construct validity, the exploratory factor analysis of the data set was performed. During the analysis, principal components were subjected in the analysis, and” the Direct Oblimin” rotation method was used as it was thought to be related to one of the sub-factors (Can, 2017). As a result of the exploratory factor analysis, a scale construct consisting of 18 items and 4 sub-factors was collected. Each factor was analysed in terms of content and named as "Conscious Resource Consumption," "Environmental Consciousness," "Safety Awareness" and "Health Awareness." It can be stated that the collected value meets the recommended 50% total variance value (Hair et al., 2009).

Confirmatory factor analysis was carried out to determine whether the data collected after the exploratory factor analysis in the research were compatible with predetermined factor levels (Meydan & Şeşen, 2011). Since after the analysis, the factor load of an item was less than 30, it was decided to be excluded (Seçer, 2017). Collected fit indices as a result of confirmatory factor analysis. As a result of the analysis, the values of x^2/df=2.56, “NFI”=.92, “NNFI”=.94, “RFI”=.90, “CFI”=.95, “AGFI”=.92, “RMSEA”=.063 were found to be at acceptable levels; “IFI”=.95, “GFI”=.92, “RMR”=.018 values are seen to be at the perfect fit level (Hu & Bentler, 1999; Schermelleh-Engel & Moosbrugger, 2003).

Cronbach Alpha coefficient was examined for the reliability analysis of the scale, and it was found to be .87. In this context, the reliability of the scale is high. The results indicated that the reliability of the scale is high. Then the reliability coefficients for each sub-factor were examined. They were determined that the "Conscious Resource Consumption" factor was .81, the "Environmental Consciousness" factor was .71, the "Safety Awareness" factor was .60, and the "Health Awareness" factor was .55. In this context, it is understood that the internal consistency coefficient of the “Conscious Resource Consumption” sub-factor is high, and the internal consistency coefficients of “Environmental Awareness,” “Safety Awareness,” and “Health Awareness” factors are higher than .40 (Tavşancıl, 2006). The high number of items in the scale's reliability affects the reliability coefficient of the measurement tool positively. In this research, since the health and reliability factors were items removed from the scale structure after CFA, the number of items for both factors was lower than other factors. That's why it can be indicated that the Cronbach Alpha reliability coefficient of health and safety awareness factors is lower than the expected level.

5. Suggestions

According to the results obtained from the research, various suggestions for the development process of the "Science-Course Focused Student Responsibility Scale" and determining student responsibility levels are given below.

“Science Course Focused Student Responsibility Scale”:

1- Determining science courses-focused responsibility number of students in different cities, different countries or Turkey can be used in the studies that aim to examine them according to different variables.
2- It can be used as a data collection tool in researches about the relationship between science and responsibility.
3- It can be used as a data collection tool in various studies to examine the relationships between students' academic achievement, science class attitude level, science class interest and curiosity level.
4- It can be revised and used for different grades in future studies.
5- Different scale development studies can be done for each sub factor of the data collection tool.

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