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INQUIRY LEARNING SKILLS IN GEOMETRY: A SCALE DEVELOPMENT*

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Inquiry learning is a powerful strategy to instill scientific thinking into the student. Therefore, it was aimed to develop a scale of inquiry learning skills towards geometry in this study. The study was designed according to a scanning model. The study group was determined according to the convenience sampling method. 514 middle school students participated in the study. The data obtained from these students were randomly divided into two groups, and exploratory and confirmatory factor analyses were performed. As a result of exploratory factor analysis, a structure consisting of 12 items and two sub-factors was revealed. This structure was tested by confirmatory factor analysis and the X^2/df ratio of the scale was obtained as 2.13. This value proved that the scale fits perfectly. By performing item analyses, it was concluded that all items in the scale are highly distinctive. Reliability analyses were performed and it was detected that the scale was highly reliable. Using this scale, researchers could reveal students' level of inquiry skills towards geometry, reveal factors affecting students' inquiry learning skills based on geometry. Teachers could determine students' inquiry skills to learn geometry topics, and could decide what measures they can take in case of deficiency.

Key words: Geometry, inquiry learning skills, scale development, validity, reliability

1. Introduction

As science and technology develop as a result of our age, living conditions change and provide individuals with the opportunity to access information anywhere, anytime. In this environment where information is highly accessible, the need for individuals who inquiring and thinking about cause and effect relationship is increasing (Katrancı & Şengül, 2020). Accordingly, the main purpose of education should be to provide students with the ability to access information and scientific literacy rather than providing existing information (Balım & Taşkoyan, 2007). Today, it is aimed to raise individuals who can produce information, use it functionally in daily life, solve problems, think critically, and have entrepreneurial qualifications (Ministry of National Education [MoNE], 2018). Based on this, school curricula should be arranged to direct students to use their metacognitive skills, provide meaningful and permanent learning, associate them with previous learning and create an educational environment integrated with other disciplines (Smolleck & Yoder, 2008). In accordance with the constructivist approach that our education system is based on, it is aimed that students use their high level skills such as research, inquiry, critical and creative thinking (MoNE, 2018). As a result, objectives were adopted that will enable students to grow up to investigate, question, think critically, produce different solutions to the problems they encounter and access information using different ways (Öner & Özdem-Yılmaz, 2019). In this context, Inquiry Based Learning (IBL) is one of the strategies that conform to the principles of the constructivist approach (Balım & Taşkoyan, 2007). In recent years, IBL has gained importance in the education process, especially as technology has developed and its usage has become widespread (Keselman, 2003; Kuhn, Black, Keselman, & Kaplan, 2011). IBL was explained below in detail. It can be said that IBL, which provides students with access to scientific knowledge by its nature, has become a frequently preferred strategy in enriched learning environments.

1.1. Inquiry-Based Learning (IBL)

Inquiry learning takes into account students' interpretation using different knowledge and skills. The dynamics of inquiry learning is based on students' use of their imagination, and the ability to interpret the

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information they acquire and the questions they ask (Kitot, Ahmad, & Seman, 2010). This model is based on the assumption that people have an innate urge to find information themselves (Andrini, 2016). Inquiry learning is a powerful strategy to instill the foundations of scientific thinking into the essence of the student (Wulandari & Wulandari, 2013). In IBL, students themselves have more responsibility in terms of accessing information as independent learners (Karamustafaoğlu & Celep-Havuz, 2016; Keselman, 2003; Sriarunrasmee, Suwannatthachote, & Dachakup, 2015; Şimşek & Kabapınar, 2010; Wulandari & Wulandari, 2013; Zerafa & Gatt, 2014). For this, IBL process is highly important.

In IBL process, it is aimed that students establish hypotheses on the situations they encounter, test their hypotheses, construct theories, and experiment (Steurer, 2018), and act like scientists in this process, as well as acquire high-level thinking skills (Balım, İnel, & Evrekli, 2008; Smolleck & Yoder, 2008). IBL is a student-centered process (Sukariasih, Edi-Saputra, Ikhsan, Sejati, & Nisa, 2019) that guides students to ask questions, think critically and solve problems, and helps students develop certain skills they will need throughout their entire lives (Işık & Yenice, 2012). The observation, classification, inference, prediction, modeling, interpretation, conclusion, and presentation skills that students use in the inquiry learning environment are also frequently used in inquiry skills (Aslan, 2017; Yaşar & Duban, 2009). In line with this information, it can be said that it is important to enrich the teaching environments structured with IBL in terms of situations where students will actively apply to some inquiry skills.

Studies on IBL emphasize the effectiveness of IBL in the teaching process and that some skills develop in students. For example, the results of Wu and Hsieh’s (2006) study show that students who undergo a series of inquiry-based activities develop significant inquiry skills to make scientific explanations. İnel (2009) concluded that the individuals questioning were also individuals who tried to establish relationships between the information about the events in their environment and their own mental structures and that inquiry learning skills perceptions of such students had a positive effect on their level of constructing concepts. In their study, Wulandari and Wulandari (2013) concluded that IBL created a significant change for students in the classroom environment, therefore improving their scientific attitude and performance. It is thought that when students who question the information in their minds and their surroundings construct new information in line with their prior knowledge, the aforementioned result may occur.

In addition, there are studies stating that IBL has a positive effect on students' mathematical skills. Kandil and Işıksal-Bostan (2018) stated that in the inquiry-based learning process, students are active in processes such as problem solving, interpretation, seeing relationships and deciding related mathematical information, supporting their solutions with mathematical proofs, planning and defense. Thus, they stated that students developed a higher level of understanding (Kitot et al., 2010) and increased their level of success while creating their own knowledge. In the studies of Mensah-Wonkyi and Adu (2016), it was concluded that students taking part in inquiry and research-based lessons perform better out of context mathematical problems, retention, and problem solving ability than their peers studying in traditional style. In this context, it can be said that the inquiry learning process will improve students' mathematical understanding and thus make it necessary and functional to use mathematical knowledge in different contexts as well as school responsibilities (Katrancı & Şengül, 2020). On the other hand, Masilo (2018) stated that another important factor of inquiry learning is the guidance of students to discover, and concluded that most students cannot learn by memorizing the theorems in Euclidean geometry but can easily discover them.

The assessment of inquiry as an instructional output is important for the framework of Program for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) that are held internationally. Students' mathematical literacy is important and measured in TIMSS and PISA exams (Mullis & Martin, 2017; Organization for Economic Co-operation and Development [OECD], 2003). Hung (2009) stated that questioning is effective in reaching students' mathematical literacy. In addition, studies on inquiry were conducted with the help of the data obtained from these exams (Anderson, Lin, Treagust, Ross, & Yole, 2007; Teig, Scherer, & Kjærnsli, 2020). Anderson et al. (2007) concluded that the increase in students' perception of using inquiry is related to the increase in their PISA performance. Considering that one of the learning areas studied in mathematics in TIMSS and PISA is geometry (Mullis & Martin, 2017), it can be said that inquiry in mathematics and therefore in geometry is significant for international students.

Therefore, it is considered that inquiry learning in geometry is significant as well as inquiry learning in mathematics. It is anticipated that researching it is important because this situation can be easily reduced to our daily life as we face the geometry at any moment. Many geometric concepts such as translation, reflection, area and volume, which are frequently encountered in everyday life, require teaching geometry (Jones, 2002). It can be said that it is worthwhile to carry out inquiring learning in this teaching. It is thought that various measurement tools will be needed to reveal the inquiry in the teaching.

In this context, some of the studies conducted on the basis of IBL show that measurement tools were developed to measure the students' inquiry skills. For instance, Balım and Taşkoyan (2007) developed an inquiry learning skills scale for the science and technology course. This scale is used to examine the inquiry learning skills of middle school students towards science lesson. The five-point Likert-type scale consists of 22 perception items and three sub-dimensions. There are nine items in the positive perceptions dimension, seven items in the negative perceptions dimension, and seven items in the perceptions of questioning the accuracy. The Cronbach's Alpha coefficients for the sub-dimensions of the scale were calculated as 0.67 for positive perceptions, 0.73 for negative perceptions and 0.71 for perceptions of questioning the accuracy, respectively. The Cronbach-Alpha value of the whole scale is 0.84. In this context, it is a valid and reliable measurement tool that can be used to determine the inquiry learning skills perceptions of middle school students towards science course.

In another study, a questionnaire was developed. In this study, Akben (2011) developed a questionnaire form to evaluate laboratory activities based on scientific inquiry developed by prospective teachers. The questionnaire form consists of 26 items. The form, which offers triple rating, has been grouped under three sections: preliminary-planning, application and finalization. The first chapter involves nine items, the second involves ten and the third involves seven. The developed questionnaire form was submitted for expert opinion to test the content validity. Its reliability has been tested using the scorer reliability. With this questionnaire, to what extent the laboratory activities developed by the candidates themselves reflect the scientific inquiry approach can be measured. Aldan-Karademir and Saracaloğlu (2013) developed a scale that can be used to measure the inquiry skills of prospective teachers. The scale consists of six items in the "acquisition of knowledge" sub-dimension, five items in the "controlling knowledge" sub-dimension, and three items in the "self-confidence" sub-dimension, in total of fourteen items and three sub-dimensions. The Cronbach Alpha reliability coefficients of the sub-dimensions are 0.76 for "acquisition of knowledge", 0.66 for "controlling knowledge", and 0.82 for "self-confidence", respectively. This coefficient for the whole scale was calculated as 0.82. In this context, the lowest score that can be obtained from the scale that is considered reliable is 14 and the highest score is 70.

Apart from the scales mentioned, there is a scale that allows to measure students' inquiry skills towards mathematics. Katrancı and Şengül (2020) developed a scale consisting of two sub-dimensions and twenty five items, fifteen in the positive perceptions dimension and ten in the negative perceptions dimension. Cronbach's Alpha coefficient of positive perceptions sub-dimension is 0.843, coefficient of negative perceptions sub-dimension is 0.825. The Cronbach-Alpha coefficient for the whole scale is 0.880. Kaplan-Parsa (2016), on the other hand, prepared a rubric in order to evaluate students' inquiry skills, unlike the aforementioned measurement tools. With the rubric that was developed by Kaplan-Parsa (2016), inquiry skills of students, such as guessing, deciding how much evidence should be collected in the research, planning the research with a scientific approach can be evaluated.

In addition, inquiry skills, such as determining how to make observations and comparisons, using tools and equipment, making accurate measurements, presenting the results achieved, expressing the findings in an appropriate language, and revealing the data can also be evaluated. Katrancı and Şengül (2020), on the other hand, developed a scale in order to determine the students' perceptions of mathematical inquiry skills. In this context, it was observed in the literature that measurement tools developed on inquiry learning skills are mostly in the scope of science. A measurement tool for examining the inquiry learning skills of middle school students towards geometry was not encountered. Considering that the "inquiry" skill is at the core and that "learning" takes place afterwards, it is seen that the level of inquiry skills that individuals have should be determined (Aldan-Karademir, Çaylı, & Deveci, 2019).

As a matter of fact, it was aimed to develop the inquiry learning skills scale towards geometry in this study. It is thought that the development of this scale towards geometry will contribute to the scientific research to be carried out from now on and fill a gap in this field. The scale developed could be used in studies that examine the effectiveness of the IBL process on teaching geometry, and variables that affect students' perception of inquiry learning skills could be investigated with the help of the scale. For the aim of the study, the following research questions were examined.

1. What are the exploratory factor analyses' results of the scale of inquiry learning skills towards geometry (SILSG)?
2. What are the item-total correlations and item-remained correlations of the SILSG?
3. What are the confirmatory factor analyses' results of the SILSG?
4. What are the reliability analyses of the SILSG?

2. Method

2. 1. Research Design

The research was designed according to the general scanning model, which is one of the quantitative research methods. In this model, it is aimed to collect data to determine certain characteristics of a group (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz, & Demirel, 2011). In this study, the data for determining the inquiry learning skills of the selected group towards geometry were collected.

2. 2. Participants

While determining the study group, convenience sampling, one of the purposeful sampling methods, was used. In convenience sampling, the researcher takes the sampling elements that are easily accessible (Özen & Gül, 2007). In this context, the participants consisted of 514 middle school students (5th, 6th, 7th, and 8th grades) who study at a middle school in Turkey. Detailed information about these students is given in Table 1 below.

Table 1. *The Information about the Participants*

	5th-Grade (5thG)	6th-Grade (6thG)	7th-Grade (7thG)	8th-Grade (8thG)	Total (T)
Female (F)	54	58	49	62	223 (%43.38)
Male (M)	74	72	66	79	291 (%56.62)
Total (T)	128 (%24.90)	130 (%25.29)	115 (%22.37)	141 (%27.43)	514

Since it was aimed that the data obtained from different groups was used in exploratory and confirmatory factor analyses, the data obtained from 514 students were randomly divided into two. After this separation, the groups were named as the first group and the second group. Information about the first group is presented in Table 2 below.

Table 2. *The Information about the First Group*

	5thG	6thG	7thG	8thG	T
F	13	26	30	56	125 (%42.66)
M	30	28	36	74	168 (%57.34)
T	43 (%14.68)	54 (%18.43)	66 (%22.52)	130 (%44.37)	293

In Table 2, there were 293 students in the first group. Explanatory factor analysis (EFA), item analyses, and reliability analyses were carried out with the data obtained from this group. Sample size should be checked for EFA first. It is stated that a sample of 200 individuals is sufficient to reveal reliable factors. In addition, it is stated that the sample size should be ten times the items in the scale (Kline, 1994). Bryman and Kramer (2001) accept five times the number of items as sufficient. In this study, since the EFA was performed with the data obtained from 293 students, this sample size was considered sufficient. Information about the second group is presented in Table 3 below.

Table 3. *The Information about the Second Group*

	5thG	6thG	7thG	8thG	T
F	41	32	19	6	98 (%44.34)
M	44	44	30	5	123 (%55.66)
T	85 (%38.46)	76 (%34.39)	49 (%22.17)	11 (%4.98)	221

According to Table 3, there were 221 students in the second group. 98 (%44.34) of them were female and 123 (%55.66) of them were male. 85 (%38.46) of them were 5th graders, 76 (%34.39) of them were 6th graders, 49 (%22.17) of them were 7th graders, and 11 (%4.98) of them were 8th graders. CFA and reliability analyses were carried out with the data obtained from these students.

2.3. Data Collection Tool

2.3.1. The Scale of Inquiry Learning Skills towards Geometry (SILSG): A draft of the scale. In order to do the first application of the scale to be developed, it was deemed appropriate to create a draft scale and it was decided to create an item pool. For this purpose, firstly, the literature related to inquiry learning was reviewed within the scope of inquiry learning (Balım, İnel, & Evrekli, 2008; Balım & Taşkoyan, 2007; İnel-Ekici, 2016; Kaplan-Parsa, 2016; Katrancı & Şengül, 2020; Kula, 2009; Mensah-Wonkyi & Adu, 2016; Özkanbas, 2018). Later on, the objectives of the mathematics curriculum were taken into consideration. Learning outcomes in the geometry sub-learning field, mathematics textbooks and resource books were examined in the program. Considering the meanings of geometry and inquiry learning, a pool of 41 items was created in the light of the information obtained. The items in this pool were reexamined by the researchers and some items were found to have similar meanings. For this reason, it was decided to exclude 11 items from the study. An expert opinion form was prepared for the remaining 30 items. Expert opinion form was prepared in three grades. These grades are "not suitable", "partially suitable" and "suitable". Experts are expected to choose one of these options and provide their opinions in the explanation section if they deem necessary. The expert opinion form was presented to the opinion of three different experts with a PhD degree in mathematics education. After the expert opinions had been collected, the forms were brought together. Arrangements were made for the items that are thought by the experts to measure similar expressions and items that are not sufficient to measure inquiry learning skills. In this context, while the fifth item of the scale had been "I look for other solutions even if I solve a geometry problem", it was arranged as "I look for alternative solutions after I solve a geometry problem". The expression given as "Geometry topics" in item 17 was changed to "Geometry concepts". The expression given as "Geometric information" in article 26 was changed to "Information about Geometry". As a result, the draft of the 30-item scale was made five-point Likert type. The 5-point Likert type was determined as strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. The data of the research were collected using the draft version of the scale, in a class hour (40'), by applying the determined participants.

2. 3. Data Analysis

The data obtained in the first application were analysed at this stage of the research. There is a consensus that factor analysis is appropriate for revealing the validity of a measurement tool (Atılgan, Kan, & Doğan, 2006; Bowden, 2004; Dancey & Reidy, 2004; Reio & Wiswell, 2006; Rosenthal & Rosnow, 2008; Urbina, 2004). Therefore, exploratory factor analysis (EFA) and then confirmatory factor analysis (CFA) were performed to determine the validity of the scale to be developed in this study. Item analyses were carried out to determine the discrimination of the items in the scale.

Internal consistency is the criterion of how homogeneous the items expected to measure a certain area are among themselves. It is also the criterion whether the items measure only the desired concept (Karakoç & Dönmez, 2014). In order to reveal the internal consistency of the scale, Cronbach-Alpha reliability analyses were performed using both the first group data and the second group data. The validity and reliability of the scale was tested by executing these analyses.

3. Findings

The first research question of the study was determined as *"What are the exploratory factor analyses' results of the scale of inquiry learning skills towards geometry (SILSG)?"*. For this question, exploratory factor analyses were executed and the following results were gained. First, the convenience of the data obtained from the sample discussed in the study for factor analysis should be tested. This compatibility is demonstrated by Kaiser-Meyer-Olkin (KMO). Achieving the KMO test at 0.90 and above indicates perfect suitability and allows for further analysis (Leech, Barret, & Morgan, 2005). The KMO value obtained in this study was 0.90 and it was found to be perfectly suitable. However, if Bartlett's Sphericity test results are greater than 0.05, it is seen that the data are not suitable for factor analysis (Şencan, 2005). This value obtained in this study ($X^2 = 3002.898$; $p = .000$) revealed that EFA can be conducted.

After controlling the necessary counts for EFA, the relevant processes were carried out. The findings were examined in order to determine the number of factors. Firstly, eigenvalue statistics were considered and it was seen that there were eight factors whose eigenvalue was calculated over one. However, it is not sufficient just to consider the eigenvalues. For this reason, the scree plot of EFA was also examined. This chart is given in Figure 1 below. The number of factors was decided to be “two” according to the eigenvalue statistics and scree plot.

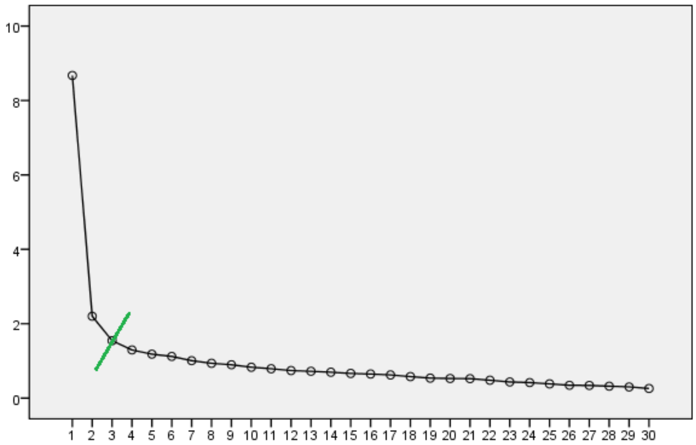

Figure 1. *The scree plot of the SILSG-EFA*

According to Figure 1, it can be seen that there are two sub-factors. Factor load value is the coefficient that explains the relationship of an item with the related factor (Kline, 1994). It is generally stated that 0.32 is sufficient for factor load value (Tabachnick & Fidell, 2001). However, the load value of 0.55 is considered to be “good”, 0.63 is considered to be “very good” and 0.71 is considered to be “perfect” (Comrey & Lee, 1992). In this context, it was decided that 0.55 is sufficient for factor load values. In this context, items with factor load values below 0.55 and overlapping items were excluded from the scale. As part of this process, 18 items were removed from the scale. As a result, a scale consisting of 12 items and two sub-factors remained. The items of the scale were reviewed and the factors were named. According to this review, the first factor was named as “positive perceptions towards inquiry” and the second factor as “negative perception towards inquiry”. EFA results are given in Table 4 below.

Table 4. *EFA Findings of the SILSG*

Items (I)	F1	F2	h^2
I3	.785		.65
I1	.762		.58
I2	.703		.49
I18	.678		.52
I11	.672		.49
I24	.643		.45
I5	.610		.37
I13*		.724	.53
I12*		.711	.53
I22*		.663	.44
I15*		.642	.42
I10*		.617	.49
Explained variance	%34.456	%15.222	
Explained total variance	%49.677		

According to Table 4, it was seen that the load values of the items under the first factor ranged between 0.785 and 0.610. The variance rate explained by this factor is 34.456%. The load values of the items under the second factor ranged between 0.724 and 0.617. The variance rate explained by this factor was calculated as 15.222%. The total variance rate explained by the scale was found to be 49.677%.

The second research question of the study was determined as *“What are the item-total correlations and item-remained correlations of the SILSG?”*. Within in the scope of this question, item-total correlations (ITC) and item-remainder correlations (IRC) were calculated. Findings related to these analyses are presented in Table 5 below.

Table 5. *The Item Analysis Findings of the SILSG*

Items	ITC	IRC
I1	.542	.642
I2	.459	.569
I3	.645	.726
I5	.383	.500
I10	.513	.619
I11	.548	.644
I12	.442	.556
I13	.369	.493
I15	.327	.447
I18	.586	.675
I22	.317	.444
I24	.515	.613

When Table 5 is examined, it can be seen that the total correlations of the items ranged between 0.317 and 0.645. The item-remainder correlations were determined to vary between 0.444 and 0.726. Then, the relationship between the sub-factors of the scale and the sub-factors with the entire scale were examined. The findings are given in Table 6 below.

Table 6. *Relationships between SILSG and Its Sub-factors*

	F1	F2	SILSG
F1: Positive perceptions towards inquiry	1	.350	.884
F2: Negative perceptions towards inquiry		1	.747
SILSG			1

According to Table 6, the correlation coefficient of the first factor with the second factor is 0.350, and the correlation coefficient with SILSG is 0.884. The correlation coefficient of the second factor with SILSG is seen as 0.747.

The third research question was determined as *"What are the confirmatory factor analyses' results of the SILSG?"*. Within in the scope of this question, CFA operations of the scale were performed. The X^2/df ratio of the scale is 2.13 and the RMSEA value is 0.07. NFI value was calculated as 0.91 and NNFI value was calculated as 0.93. CFI value is 0.95, RMR value is 0.09 and SRMR value equals to 0.06. Finally, GFI value was calculated as 0.92. The graph of SILSG obtained as a result of CFA is shown in the following Figure 2.

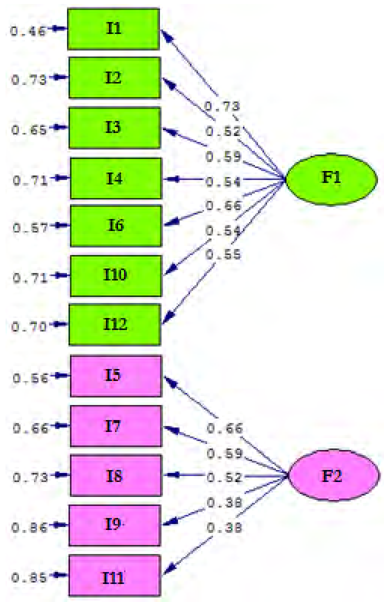

Figure 2. *The CFA graph of the SILSG*

The last research question was determined as *"What are the reliability analyses of the SILSG?"*. For this question's answer, Cronbach-Alpha calculations were made to determine the reliability of SILSG. In this context, firstly, calculations related to the first version of the 30-item scale were made with EFA data and the reliability coefficient was calculated as 0.910. Later on, CFA data were used to analyses the reliability of the scale with 30 items and the Cronbach-Alpha coefficient was calculated as 0.903. Then, reliability analysis of the final version of the 12-item scale was performed with both EFA and CFA data. The findings obtained are given in Table 7 below.

Table 7. *Reliability Analysis Findings of the SILSG*

SILSG and sub-factors	Cronbach Alpha-EFA data	Cronbach Alpha-CFA data
F1	.833	.785
F2	.720	.635
SILSG	.819	.818

In Table 7, when the findings obtained from EFA data are analyzed, the reliability factor of the first factor is seen as 0.833, the reliability factor of the second factor is 0.720 and the reliability factor of the whole scale is 0.819. When the findings obtained from the CFA data are examined, the reliability factor of the first factor is revealed as 0.785, the reliability factor of the second factor is 0.635 and the reliability coefficient of the whole scale is 0.818.

4. Discussion, Conclusion, and Implications

This study was carried out with the aim of developing a scale that would help reveal the inquiry learning skills about geometry. For this purpose, a draft scale consisting of 30 items was applied to the study group. After the EFA, it was observed that 18 items did not meet the necessary conditions and they were removed from the scale. As a result of EFA, a structure consisting of 12 items and two sub-factors was revealed. The "Measurement of Inquiry Learning Skills Perception in Science" developed by Balım and Taşkoyan (2007) consists of 22 items and three sub-factors. The "Inquiry Skills Scale" developed by Aldan-Karademir and Saracaloğlu (2013) consists of 14 items and three sub-factors. The scale developed in this study differs from the above two scales in terms of the number of items and sub-factors. However, it is similar to the "Inquiry Learning Skills Scale towards Math", which consists of 25 items and two sub-factors, positive and negative, developed by Katrancı and Şengül (2020) in terms of sub-factors. SILSG consists of fewer items compared other scales. It can be said that the reason for this is that item load values are kept as high as possible while performing factor analysis.

The first factor of SILSG included seven items. It was determined that the load values of these factors ranged between 0.785 and 0.610. The variance rate explained by this factor was 34.456%. The second factor included five items. The load values of the items in this factor ranged from 0.725 to 0.617. The variance rate explained by this factor was calculated as 15.222%. The total variance rate explained by the factors was 49.677%. It is considered sufficient that the total variance rate explained in multiple factor scales is between 40% and 60% (Büyüköztürk, 2012). For this reason, the 49.677% rate was considered sufficient for this study.

According to the item analysis findings, it was seen that the item-total correlations of the scale ranged between 0.317 and 0.645. These correlation values are used to interpret how discriminative the items are, and it is known that 0.30 and higher values show that the items are well discriminative (Büyüköztürk, 2012). Therefore, all item-total correlations obtained are well discriminative. In this context, it has been concluded that the scale has highly discriminative items.

When the relationship between the sub-factors, and the sub-factors and the scale was examined, it was found that the correlation coefficient between the sub-factors was 0.350. The correlation coefficient between 0.70 and 0.30 indicates a middle-level relationship (Büyüköztürk, 2012). In this context, the relationship between the sub-factors is at the middle-level. Engs (1996) states that the relationship between the sub-factors should also be below 0.60 because if the relationship is below this level, the factors can be considered as separate factors. In this framework, the factors in this study should be moderately related among themselves and were accepted as evidence that the factors are separate factors. The correlation coefficient between the first factor and SILSG is 0.884, and the correlation coefficient between the second factor and SILSG is 0.747. These results indicate that the sub-factors are highly related to the scale, which is also preferred since these results show that the sub-factors are related to the whole scale. CFA results of SILSG are given in Table 8 below.

Table 8. *CFA Results of the SILSG*

Indexes	Results	Interpretation
X^2/df	2.13	≤ 2.5: Perfect fit (Kline, 2005)
RMSEA	0.07	≤ 0.07: Good fit (Steiger, 2007)
NFI	0.91	≥ 0.90: Good fit (Thompson, 2004)
NNFI	0.93	≥ 0.90: Good fit (Thompson, 2004)
CFI	0.95	≥ 0.95: Perfect fit (Sümer, 2000)
RMR	0.09	≤ 0.10: Weak fit (Kline, 2005)
SRMR	0.06	≤ 0.08: Good fit (Brown, 2006)
GFI	0.92	≥ 0.90: Good fit (Hooper, Coughlan, & Mullen, 2008)

In Table 8, it is determined that SILSG has a perfect fit according to X^2/df=2.13 ratio. Besides, there are seven different indexes to prove the fitness of the scale in Table 8. Therefore, it is shown that it shows a good fit on average compared to other fit indexes of the scale. When the internal consistency values of SILSG were examined, the reliability coefficient of the 30-item scale was obtained as 0.91 according to the EFA data. The reliability coefficient for the remaining 12 items was calculated as 0.819. The reliability coefficients for the sub-factors were 0.833 and 0.720, respectively. The reliability coefficient between 0.70 and 1.00 is a high reliability indicator (Büyüköztürk, 2012). For this reason, all the results obtained according to EFA data were evaluated as highly reliable. According to CFA data, the reliability coefficient for the 30-item version of the scale was obtained as 0.903. The reliability coefficient of the remaining 12 items was calculated as 0.818. The reliability coefficients of the sub-factors were 0.785 and 0.635, respectively. When these results are evaluated, it is concluded that the reliability of the whole factor and the first factor is high and the reliability of the second factor is at the middle-level because the calculated reliability coefficients between 0.61 and 0.80 are considered as middle-level reliability (Özdamar, 1999; quoted from Yaşar, 2014). When all reliability values are considered, it is concluded that the scale is highly reliable.

As a result, a valid and reliable measurement tool has been developed that measures inquiry learning skills for geometry. However, the research seems limited in terms of determining the study group according to the convenience sampling. In this context, researchers could repeat working with groups determined by different sampling methods. In addition, the study was carried out with students studying at middle school level in Turkey. This means that the research was conducted with students between the ages of 10 and 14. In this case, it also shows that the developed scale is aimed at determining the inquiry learning skills of the students between the ages of 10 and 14. The items of the scale are likely to be meaningless for younger or older students because changes in cognitive development of students also occur depending on age. For this reason, it is thought that repeating validity and reliability studies is important for younger or older age groups.

Using the scale developed, researchers could reveal students' level of inquiry skills related to geometry, as well as reveal factors affecting their inquiry learning skills based on geometry. Within the framework of the obtained results, what could be done to increase the geometry success can be determined. Teachers, on the other hand, could determine their students' inquiry skills by using the scale to learn geometry topics, and could decide what measures they could take in case of deficiency.

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Appendix 1: The Scale of Inquiry Learning Skills towards Geometry (SILSG)**

Items
I3: I would like to find solutions to the geometry problems that are stuck in my head.
I1: I do research on geometry topics that I cannot learn.
I2: After solving a geometry problem, I discuss it with my friends to decide the accuracy of the solution.
I18: I would like to do more detailed research on geometry topics I learned in the class.
I11: I do research from different sources to solve a geometry problem.
I24: I create rational solutions to solve a geometry problem.
I5: I look for alternative solutions after I solve a geometry problem.
I13*: After I solve a geometry problem, I don't need to prove its accuracy.
I12*: When I cannot solve a geometry problem, I give up trying.
I22*: I accept all the information I learned in geometry class, I do not check for its accuracy.
I15*: I do not use prior geometry knowledge when I learn new geometry topics.
I10*: I do not want to do research on the geometry topics I learnt in the class.

** Opposite items*

*** The English version of the scale should be tested by doing validity and reliability analyses. It is thought that the scale is going to be a good reference for the future studies.*