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Adaptation of the Scale of the Factors Affecting Argumentation Instruction into Turkish*

Argümantasyon Öğretimini Etkileyen Faktörler Ölçeğinin Türkçe'ye Adaptasyonu

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ABSTRACT: The aim of this study is to adapt the scale of the factors affecting argumentation instruction into Turkish. A total of 143 preservice science teachers studying in two different universities located in the east and west of Turkey participated in this study. In the process of adaptation firstly, structure, method and item biases were elimanated. After that the construct validity of the scale was determined by exploratory and confirmatory factor analysis. The results of the analysis confirmed that the 21-item scale had a three-factor-structure. Then, the cronbach's alpha value was measured for the whole scale and its sub-dimensions, and these values were found to be within satisfactory limits. It is thought that this study provides a valid and reliable measurement tool that can be used in the process of determining the factors affecting the argumentation instruciton of teachers and preservice teachers. Thus, it can be stated that the data obtained with the adapted scale will contribute to the further use of argumentation in science classes.

Keywords: adaptation, reliability, the factors affecting the argumentation instruction, validity.

ÖZ: Bu çalışmanın amacı, argümantasyon öğretimini etkileyen faktörler ölçeğinin Türkçe'ye uyarlanmasıdır. Çalışmaya Türkiye'nin doğusunda ve batısında yer alan iki farklı üniversitede öğrenimlerine devam etmekte olan toplam 143 Fen Bilimleri öğretmen adayı katılmıştır. Adaptasyon sürecinde ilk olarak yapı, yöntem ve madde yanlılıkları giderilmiştir. Daha sonra ölçeğin yapı geçerliği açımlayıcı ve doğrulayıcı faktör analizi ile ortaya konmaya çalışılmıştır. Analiz sonuçları, 21 maddelik ölçeğin 3 faktörlü bir yapıya sahip olduğunu doğrulamıştır. Ardından ölçeğin bütünü ve alt boyutları için cronbach alfa değeri hesaplanmış ve bu değerlerin, tatmin edici sınırlar içerisinde olduğu tespit edilmiştir. Mevcut çalışmanın, öğretmenlerin ve öğretmen adaylarının argümantasyon uygulamalarını etkileyen faktörlerin tespit edilmesi sürecinde kullanılabilecek geçerli ve güvenilir bir ölçme aracını literatüre kazandırdığı ifade edilebilir. Böylece uyarlanan ölçek ile elde edilen verilerin, argümantasyonun fen sınıflarında daha fazla kullanılmasına katkıda bulunacağı düşünülmektedir.

Anahtar kelimeler: argümantasyon öğretimini etkileyen faktörler, geçerlik, güvenirlik, uyarlama.

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Argumentation has recently emerged as an important educational objective (Erduran, Ozdem, & Park, 2015). It is defined as the process of combining ideas with appropriate knowledge and reasons (Toulmin, 1958), which requires reasoning (van Eemeren & Grootendorst, 1996) in order to increase the acceptability of an existing perspective. In the process of argumentation, students engage in the process of presenting claims, defending them by using evidence, and criticizing arguments presented by others (McNeill, Katsh-Singer, González-Howard, & Loper, 2016). Since these processes are the ones which scientists experience to reach a common decision (Tippett, 2009), argumentation is also expressed as the language of science (Duschl, Ellenbogan, & Erduran, 1999). This definition makes argumentation an essential application of science education (McNeill & Pimentel, 2009; Wang & Buck, 2016), and requires its use in science teaching and learning (Ruiz-Ortega, Alzate, & Bargallo, 2015).

Osborne, Erduran, and Simon (2004) argue that using argumentation as a central element of science courses has two important functions. The first function was stated as supporting students' achievement of the set of conceptual and epistemological goals, and the second as making students' scientific thinking and reasoning processes more suitable for assessment. In addition to this, many outputs provided for education by argumentation have been reported in the literature. Some of these are specified as understanding scientific processes and concepts better (Sampson & Blanchard, 2012), developing reasoning skills (Rebello & Barrow, 2013), understanding how scientific knowledge is produced and supporting decision-making processes (Pallant, Lee, & Pryputniewicz, 2013), and developing reasoning and justificaiton skills in the environment outside the classroom (McNeill & Krajcik, 2009).

When and how to incorporate reforms such as argumentation into classroom practice is affected by teachers' beliefs and perceptions (Knight-Bardsley & Mcneıll, 2016). Although the results of teaching activities depend on many factors, teachers' perceptions of their own teaching methods play an important role in this process (Hung, 2011). Therefore, in the process of argumentation instruction, teachers' opinions about the importance of argumentation in science teaching, what they understand from scientific argumentation and how they can support argumentation are important (Ruiz-Ortega et. al., 2015). However, little is known about how science teachers perceive argumentation and their views on using argumentation in science teaching (Sampson & Blanchard, 2012). The reason for that may be attributed to the fact that the factors affecting teachers' argumentation practices have not been investigated sufficiently (McNeill & Pimentel, 2009). The literature reviews made in the study have also shown that there is no scale for defining the factors affecting the argumentation instruction of teachers or preservice teachers in Turkey. However, different scales used in the field of argumentation are available in Turkey. One of them is the "Determining Argumentation Skills" scale developed by Evren-Yapıcıoğlu and Kaptan (2018). This scale was developed to determine the pre-service teachers' argumentation skills and consists of 6 unstructured open-ended questions. Daily life scenarios and case studies are presented in the scale. Pre-service teachers are asked to defend their opinions about the situations in these scenarios and case studies by using argument elements (claim, data, backing, warrant, qualifier, rebuttal). The pre-service teachers' argumentation skills were evaluated according to their usage of argument elements.

Other scales used in Turkey in the field of argumentation were adapted into Turkish by Kaya, Cetin, and Erduran (2014). These scales are the Argumentation Test developed by Sampson and Clark (2006) and the Argumentation Perceptions Test developed by Chin (2008). The Argumentation Test consists of a total of 6 open-ended questions designed to determine what students think is a good scientific argument and what is a good objection to a scientific argument. Argumentation perceptions test, on the other hand, aims to determine students' perceptions of argumentation. The test consists of two parts, the first part consists of the questions about the importance and quality of a scientific classroom environment and the classroom activities that support such a classroom environment. In the second part of the scale, there are open-ended and closed-ended questions about the importance of argumentation in science education, supporting argumentation, activities that support argumentation in science lessons and students' attitudes towards these activities.

Considering the scales used in the field of argumentation in Turkey, it is seen that there are scales to determine argumentation skills, usage of argumentation elements and the perceptions about argumentation.We can say that the present study differs from these studies in terms of adapting a scale to determine the factors affecting teachers' argumentation instruction (self-efficacy of teachers / pre-service teachers, context and policy, objectives and outcomes). Therefore, this study aims to contribute to fill this gap in the literature. The findings obtained from using this scale are thought to shed light on the process of supporting teachers' use of argumentation in science classes or overcoming the obstacles in using argumentation. Thus, many educational outcomes obtained by using argumentation more in science courses will be benefited.

Factors Affecting Argumentation Instruction

Many factors play role in the process of integration of argumentation into classes. McNeill et al. (2016) revealed that teachers 'self-efficacy, ways of determining the aim of the course, country policies and curriculum contents and teacher beliefs about students' competences affect the argumentation practices. Therefore, researching these factors identified by McNeill et al. (2016) and affecting teachers' argumentation practices is important in terms of using argumentation more in classrooms.

Teachers play a key role in integrating argumentation into science classes (McNeill & Knight, 2013). For an effective teaching of argumentation, teachers are primarily supposed to be convinced that argumentation is a fundamental part of science learning (Osborne et al., 2004) because one of the factors affecting the level of teachers' use of teaching strategies is related to what they value and how they decide to use it (Sampson & Blanchard, 2012). The ways of determining the aims of the course will affect the instructional support provided by teachers in the argumentation process (McNeill & Pimentel, 2009). If the aim of the course is regarded as teaching science concepts and contents, it may be preferable to use more traditional approaches (McNeill & Pimentel, 2009). Besides, if it is aimed to teach argumentation, it should not only be focused on explaining theories, laws, models and concepts, but also on applications that serve for producing scientific knowledge, and on argumentation activities as one of them (Sampson & Blanchard, 2012). In addition to learning objectives, teachers' self-efficacy towards science content and scientific inquiries is another factor affecting their classroom practices (Mcneill, Pimentel, & Strauss, 2013). Self-efficacy is the

confidence and belief in ourselves that we can perform a task (Bandura, 1977). Therefore, teacher beliefs are an important factor affecting when and how reforms such as argumentation are included in classroom practice (Knight-Bardsley & McNeill, 2016). As described by McNeill et al. (2016), it means that if teachers feel comfortable in supporting students' engagement with argumentation and generating arguments or modeling argumentation, this feeling will affect their practices pozitively. Therefore, a better understanding of teachers' beliefs about argumentation might provide different perspectives and support for new studies to design and implement such new strategies (Katsh-Singer, McNeill, & Loper, 2016). The first thing that should be done to improve the teaching quality of teachers is to determine their perceptions and beliefs about the teaching methods (Hung, 2011).

Teachers' beliefs related to students' ability to participate in the argumentation process also affect their instructional practices. Prime and Miranda (2006) found that teachers perceive science as a set of content that requires special skills, and define their students as lacking the qualifications required to be successful in science. Teachers with such ideas may avoid engaging all students in high-level practices such as argumentation. Teachers who believe that students can participate in argumentation can support them to participate in the argumentation process, while teachers with contradictory beliefs on all students can participate in argumentation may accept lowering their expectations as a support (Katsh-Singer et al., 2016). Such contradictory considerations may result in the fact that teachers do not use argumentation in their classes or they do not set high-level objectives for argumentation.

For example, in a study conducted by Wang and Buck (2016), a teacher stated that argumentation is only suitable for certain students, and that these students must be specialized in prerequisite knowledge or skills. Besides, the same teacher added the ideas that argumentation is only suitable for teachers, and it may cause misunderstanding and confusion among students. Teachers with such ideas cannot be expected to integrate argumentation into their classes. Therefore, firstly, teachers should accept that all students have the ability to participate in the argumentation. (Katsh-Singer et al., 2016).

Another important factor affecting the process of inclusion of argumentation in classes by teachers is contents of curriculum. Time and curriculum limitations make it difficult for teachers to integrate argumentation in their lessons (Newton, Driver, & Osborne, 1999). The practices emphasized in the curriculum are more likely to be carried out by teachers. For example, in Turkey, it is highlighted that lessons based on argumentation as one of the student-centered practices should be carried on with a change made in 2013 (Ministry of National Education [MoNE], 2013). Furthermore, in the curriculum, the statement that "In order for students to express their ideas easily, to support their ideas for different reasons, and to refute their friends' arguments, opportunities should be provided where they can discuss the profit-loss relationship for scientific phenomena to develop opposing arguments" (Ministry of National Education [MoNE], 2018, p. 11) is included.

This emphasis on argumentation in the curriculum is likely to raise awareness of teachers about the argumentation process, and to increase the possibility of this practice being integrated in lessons by teachers in their lessons. Political decisions are also important for teachers' practices. For example, Ministry of National Education

evaluates students by national exams in Turkey. Teachers can focus on learning of the content by students during this busy period of preparing students for such exams, and so might avoid allocating time to different practices. As a matter of fact, the teachers state that they see national exams as a pressure for themselves in the process of using argumentation (Katsh-Singer et al., 2016).

In the process of teaching argumentation, it is seen that teachers' opinions about the importance of argumentation, what they understand from scientific argumentation, and their opinions about the factors that affect their support in argumentation are important (Ruiz-Ortega et al., 2015). However, little is known about how science teachers understand argumentation and their views on using argumentation as a part of teaching and learning science (Sampson & Blanchard, 2012). Therefore, researches about the factors affecting the argumentation practices of teachers are important (McNeill & Pimentel, 2009). The absence of an instrument for this purpose in Turkey is the starting point of this study.

Method

In this quantitative study, it was aimed to adapt the scale of the factors affecting the teachers' argumentation instruction into Turkish.

Participants

The sample of the study consists of 143 preservice science teachers. Preservice teachers study at the two state universities located in the east and west of Turkey. 110 (77%) of the participants were female, and 33 (23%) were male. In addition, 34 (24%) students study in 1st grade, 45 (32%) in 2nd grade, 47 (33%) in 3rd grade, and 17 (12%) in 4th grade. The students' ages ranged between 17 and 25. The reason for the high number of female students is that the study is voluntary, and girls are more willing to participate in the study than boys.

Data Collection Tool

The Scale of "The Factors Affecting Teachers' Argumentation Instruction" used in the study was developed by McNeill et al. (2016) in order to investigate the factors affecting the science teachers' argumentation practices. The original version of the scale consists of four dimensions: self-efficacy, context and policy, objectives and outcomes, student background and ability. In the original scale, there are 8 items for the self-efficacy dimension, 7 items for the context, policy, objectives and outputs dimensions and 4 items for the student background and ability subdimension. The scale consisting of 26 items is a four-point likert type. The researchers who developed the scale measured the cronbach alpha coefficients of these dimensions as .90, .89 and .87, respectively.

In this study, a three-factor-structure was preserved. The student background and ability subdimension was not considered in this study. Because this subdimension had been created based on feedback that some teachers seemed to feel that some students (i.e. academically advanced) were more capable of engaging in argumentation that other students (English language learners, students with special needs). In this subdimension teachers were wanted to evaluate four different students as capable or not capable for argumentation. Teachers evaluated students according to their background

including family relationship, living conditions, academic achievement or speaking language. Since there no implementation in this study, there are no students to be evaluated. Therefore, student background and ability subdimension was eliminated in the present study. Other three factors were named with the same name as the original scale: self-efficacy, context and policy, objectives and outcomes. In the adapted version of the scale, there are 6 items for the context and policy dimensions, and the same number of items for the other dimensions as the original scale. The scale, which consists of 21 items in its adapted form, is a four-point likert type as the original scale. Cronbach's alpha values of three factors were measured in the adapted scale, and these values were presented in the findings section.

Data Collection and Ethical Process

The data of the study were collected in the spring semester of 2017-2018 academic years. Firstly, informative explanations were given to the preservice teachers studying in Science Education Department about the purpose and importance of the study. Before the scale was distributed to preservice teachers, it was stated to them that they were free to fill the scale and volunteering was important. Afterwards, volunteer preservice teachers were determined to participate in the study, and they were provided to fill the scale of the factors affecting the argumentation instruction. The preservice teachers completed the scale between 10 and 20 minutes.

Translation of the Scale into Turkish

In the process of translating the scale into Turkish, the permission was taken for the adaptation study through e-mail from the researchers who developed the scale. Afterwards, the studies were carried out considering the three main biases that may arise during the adaptation processes of the scale. These three biases can appear as construct, method and item biases.

Construct bias can occur if there are unacceptable differences between the cultural features of the original language and adaptation language of the scale (Hambleton, 1996). Construct bias can be handled with multicultural and multilingual teamwork. In the present study, there is a specialist who has lived in the United States and Turkey, and has knowledge on education systems and cultural values of two countries. Since the education specialist had knowledge on the teacher training systems of USA and Turkey, the scale could be adapted by taking two systems into consideration. In addition, an English language teacher, three specialists in science and mathematics education and a research assistant in Turkish teaching department collobarated during the adaptation process. The presence of different specialists as a working team also contributed to the elimination of item biases. Item bias appears when original and adapted scale items are not equivalent (Bayık & Gurbuz, 2016). In order to measure behaviors and concepts properly in the scale according to specialists' opinions, the changes were made in a sub-dimension since the original scale was developed for teachers unlikely to this study. In this study, it was aimed to provide a valid and reliable scale that can be used to determine the factors affecting the argumentation instruction of not only teachers but also preservice teachers. In this respect, the items under the subdimension of "context and policy" were amended to make them applicable for preservice teachers. For example, in the original scale, "Teaching scientific argumentation is a priority for my school or district" is amended as "Teaching scientific

argumentation is a priority for the schools in my district or country". In addition, the item "Teachers in my school support one another in teaching argumentation" was removed from the scale in accordance with the opinions of the specialists because it was not suitable, and could not be adapted for preservice teachers. The specialists argued that this item could be replaced by the phrase "Teachers in the school of my district or country support one another in teaching argumentation." However, it was decided to remove this article by considering that preservice teachers may not have the chance to make sufficient observations about the supportive actions performed by teachers, and in this case they cannot make an objective assessment. Hambleton and Patsula (1999) stated that additions and subtractions can be made to the items in the adaptation studies. The Turkish form of the scale was re-translated into English by an English teacher by back-translation method, and the two forms were compared and the necessary corrections were made. After the translation of the scale was completed, the pre-application was made. At the end of the pre-application with 10 preservice science teachers who were not among the participants of the study, the minor changes were made related to expression of some items.

Method bias, another bias that may arise in the scale adaptation process, is a general term used for factors threatening the validity of the measurement tool (Hambleton, 1996). The various factors that cause method bias can be listed as follows: Familiarity with stimulants, biased selection of sample, response of the participants to the measurement tool, physical conditions in which the scale was applied and communication problem between the participants (Önen, 2009). In order to eliminate method bias, scales can be applied in a non-standardized way, and respondents may be asked to interpret instructions, items, response alternatives, and motivation to respond (van de Vijer & Hambleton, 1996). For this purpose, in this study, the feedback was obtained from 10 preservice science teachers who were not among the participants in a non-standard way for the items, alternative answers and motivation for the answers. In this respect, the minor changes were made for some sentences. Preservice teachers stated that they were pleased to answer the questions; they found the questions useful because they were required to give feedback about their fields, and the items were clear.

Data Analysis

Three steps were followed during the adaptation process. These steps include adapting the scale into Turkish, ensuring the construct validity of the scale and performing reliability analyses. In the process of translating the scale into Turkish, there were 3 field specialists, two language specialists speaking English and Turkish, and one Turkish teacher. In order to ensure the construct validity of the translated scale, it was decided to perform the exploratory factor analysis. In this respect, firstly, the assumptions of the exploratory factor analysis were investigated. The assumptions of the factor analysis are listed by Can (2016) as follows:

- Data in at least minimum interval scale should be normally distributed and linear.

-The sample should be homogeneous.

- Correlated relations should be sufficient.

Before performing the analyses, the missing data were replaced with the average data. Then, the descriptive statistics based on the scores obtained from the scale are given in Table 1.

Table 1

Descriptive Statistics of Scale Items

Item no	Mean	Standart Deviation	Minimum Scores	Maximum Scores	Skewness	Kurtosis
1	2.89	.60	1	4	-.93	2.4
2	3.05	.51	1	4	.22	2.21
3	2.95	.56	1	4	.24	.93
4	2.83	.69	1	4	-.28	.12
5	2.99	.65	1	4	-.29	.30
6	2.93	.68	1	4	-.17	-.19
7	3.00	.63	1	4	-.17	.08
8	2.86	.74	1	4	-.17	-.35
9	2.67	.84	1	4	-.18	-.52
10	2.51	.82	1	4	.27	-.51
11	3.02	.73	1	4	-.48	.19
12	2.65	.77	1	4	-.03	-.41
13	2.58	.76	1	4	.01	-.35
14	2.47	.81	1	4	.05	-.45
15	3.18	.63	1	4	-.50	.89
16	3.26	.62	2	4	-.27	-.61
17	3.17	.68	1	4	-.37	-.31
18	3.16	.63	1	4	-.65	1.52
19	3.25	.66	1	4	-.62	.58
20	3.20	.70	1	4	-.67	.51
21	3.18	.80	1	4	-.84	.38

As shown in Table 1, the skewness and kurtosis values of all data were found between +3 and -3 values, which are the range required to meet normal distribution criteria (Bentler, 2006). In this respect, the first assumption of the factor analysis was accepted. The assumption that the sample is homogeneous is about collecting data from a sample with similar features (Can, 2016). In the current study, only working with preservice science teachers shows that this assumption was met. The final assumption is that correlation-based inter-relationships should be sufficient. Correlation coefficient of 0.33 and above is considered sufficient for these relationships (Can, 2016). When the correlation matrix values were examined, it was observed that the number of items with acceptable relationships (r>.30) was quite high. Therefore, it is assumed that this assumption is also met.

After the assumptions were checked, the exploratory factor analysis was realized. The confirmatory factor analysis was used to check the accuracy of the factor structure determined as a result of the exploratory factor analysis. Subsequent to controling the validity of the scale, the reliability analyses were made. For this purpose, the alpha values of all subscales and total scores obtained from the scale were calculated. The followed steps are explained in detail in the results section.

Results

This section provides information about translation of the scale into Turkish and validity and reliability analysis.

Construct Validity of the Scale

In order to ensure the construct validity of the scale, the exploratory and confirmatory factor analyses were made. These analyses are explained below.

Exploratory Factor Analysis

The exploratory factor analysis was made to determine the factor structure of the adapted scale. For this purpose, Bartlett's Test of Sphericity and Kaiser Meyer Olkin (KMO) values were measured. The statistical significance of Bartlett's Test of Sphericity value (p<.001) showed that the variance and distribution characteristics of the data were suitable for the factor analysis. KMO value was measured as greater than .5 (.80), and this finding was considered as sufficient sample size for the factor analysis (Can, 2016).

Orthogonal varimax rotation was selected for rotation in order to examine the items in the factors separately. The principal component extraction analysis revealed 3 factors, and these three factors explained 48% of the total variance.

Table 2 shows the factors under which each item is loaded, and the factor loadings.

Table 2

Factor Loadings of Items

	Factor Loadings		
Item Number	1. Factor	2. Factor	3. Factor
16	.79		
15	.76		
17	.70		
19	.69		
20	.68		
21	.68		
18	.67	.36	
3		.71	
4		.68	

8	.66	
5	.62	
6	.62	
1	.62	
2	.58	.33
7	.52	
13		.70
14		.68
12		.61
10		.56
11		.45
9		.35

According to the findings in Table 2, the first 8 items are in the second factor, the 9th, 10th, 11th, 12th, 13th and 14th items are in the third factor, 15, 16, 17, 18, 19, 20, and 21st items is included in the first factor. Among the items, it was seen that items 18 and 2 loaded in two factors. In such a case, if the difference between the correlation levels of the items in different factors is less than 0.1, there is no need to remove the items from the scale (Büyüköztürk, 2006) and the items with which a greater correleation is observed should be placed under that factor. Therefore, it was accepted that item 18 must be included in factor 1, and item 2 in factor 2. The factors were named the same as in the original scale, since the same items on the adapted and original scale were loaded under the same factors. Therefore, the first factor was named as objectives and outputs, the second factor as self-efficacy, and the third factor as context and policy. Table 2 shows that, the factor loads of the items in the self-efficacy subdimension range from .52 to .71, the items in context and policy subdimension range from .36 to .70, and the items of objectives and outputs subdimension range from .68 to .79.

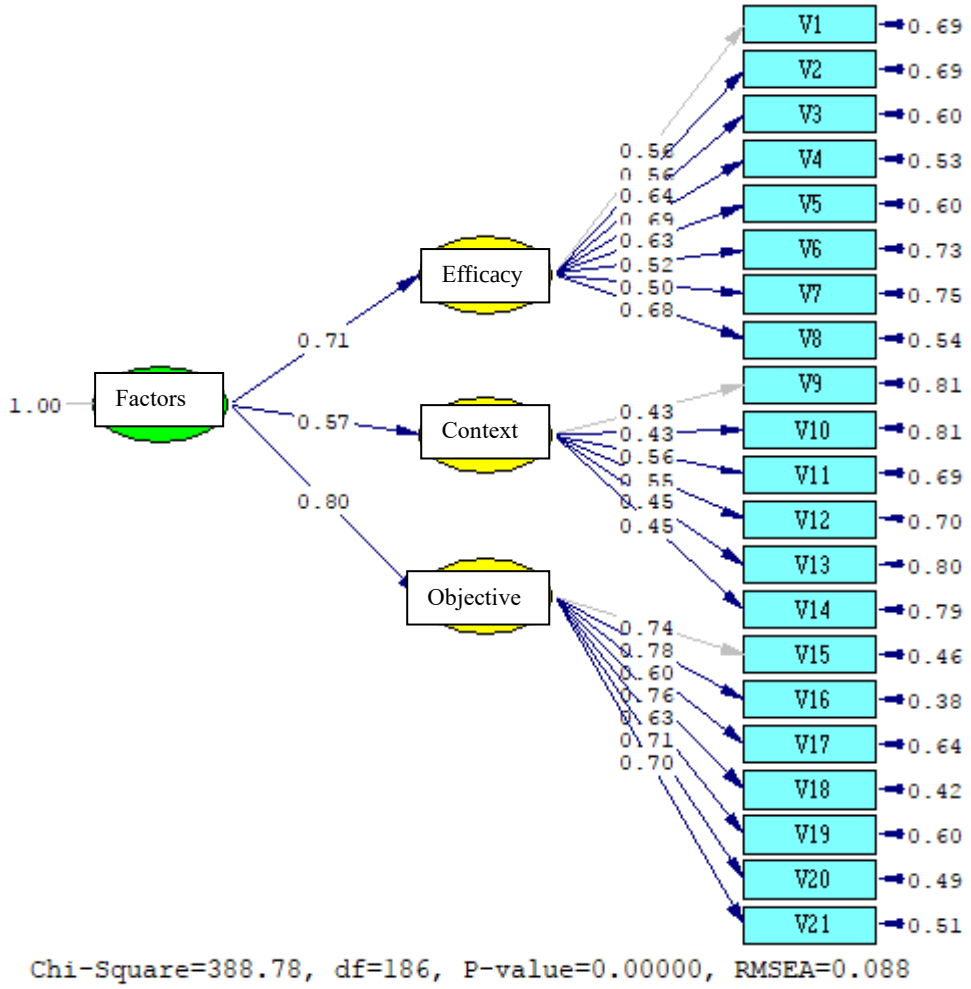
In order to check the accuracy of the structure determined in the exploratory factor analysis, the confirmatory factor analysis was also made. The findings of confirmatory factor analysis are presented below.

Confirmatory factor analysis

According to the results of confirmatory factor analysis, it can be said that the scale was 3-dimensional, including self-efficacy, context and policy, objectives and outputs. Self-efficacy subdimension consists of 8 items, context and policy subdimension consists of 6 items, and objectives and outcomes subdimension consists of 7 items. Factor loads of the items range from .36 to .79. The calculated multiple fit values were determined as follows: x^2 / sd = 2.09, RMSEA = .088, GFI = .79 CFI = .90, NFI = .82, NNFI = .88, AGFI = 0.74. A value of x^2 / sd less than 5 is considered as an acceptable value (Schermelleh-Engel, Moosbrugger, & Müller, 2003). While the RMSEA value of less than .05 represents good model fit, it is noted that there are serious problems for models with a value greater than 0.1 (Browne and Cudeck, 1993) and that these models are unacceptable (MacCallum, Browne and Sugawara, 1996). It is stated that the CFI value is between .00 and 1.00, and that approaching 1 indicates good

model fit (Brown, 2006). In the present study, considering that x^2 / sd value is less than 5, RMSEA value is less than 0.1 and CFI value is close to 1.00, it can be said that RMSEA, x^2 / sd, CFI values confirm triple factor structure. Considering that the acceptable values for NNFI, NFI and AGFI as .95 ≤ NNFI ≤ .97, .90 ≤ NFI ≤ .95 and .85 ≤ AGFI ≤ .90 (Schermelleh-Engel et. al., 2003), it can be stated that AGFI, NFI and NNFI values are of critical value. The figure of the confirmatory factor analysis is presented in Figure 1.

Figure 1. Confirmatory Factor Analysis Results



Reliability of the Scale

The reliability of the scale was determined by the internal consistency values. For internal consistency, the alpha values of each scale and the whole scale were calculated. The alpha value of the whole scale was .85. The alpha value of the items in the self-efficacy subdimension was .81, the value of the items in the context and policy subdimension .64, and the value of the items in the objectives and outputs subdimension .87, respectively. Alpha values between .60 and .80 are considered as highly reliable (Uzunsakal & Yıldız, 2018; Yıldız & Cimete, 2011) and acceptable (Gamble, 1999). Accordingly, the scale can be accepted as a reliable measurement tool. The final version of the measurement tool is presented in Appendix-1.

Conclusion and Implications

The aim of this study is to adapt "The Scale of the Factors Affecting' Argumentation Instruction" into Turkish. The results of exploratory factor analysis made after the elimination of structure, method and item biases showed that the scale had a 3-factor-structure, similar to its original form: self-efficacy, context and policy, objectives and outputs. Besides, the results of the confirmatory factor analysis showed that many model coefficients were within acceptable limits. Moreover, the Cronbach's alpha values indicated that the internal consistency of the scale was statistically acceptable. To sum up, the analyses show that the Turkish version of the scale is a three-dimensional, valid and reliable measurement tool. Therefore, it is thought that this study provides a scale, which can be used in studies carried out in Turkey and aim to identify the factors that affect the argumentation instruction of teachers and preservice teachers.

It was found that the adapted and the original scales have a similar structure. The same items were loaded under the same factors both in the original and the adapted scale. The original scale consists of 22 items, and the adapted version consists of 21 items. The item in the original scale "Teachers in my school support one another in teaching argumentation" was removed from the scale because it could not be adapted for preservice teachers. In addition, the items under the context and policy factors were adapted to be applicable for pre-service teachers. Hambleton and Patsula (1999) stated that items in scales can be changed, removed, or new items can be added when the specialists regard as necessary. It was found that there was no problem in using the 4-point Likert type (totally disagree, disagree, agree, totally agree) and scoring between 1 and 4 in the adapted scale as in the original scale.

In Turkey, despite the use of scales for evaluating the argumentation skills and perceptions of argumentation (Evren-Yapıcıoğlu & Kaptan, 2018; Kaya et al., 2014), it is thought that the lack of a scale to determine the factors affecting the argumentation instruction, the present study will contribute to the literature at this point and support the development of future argumentation instruction. The data collected by using this scale in the future studies can be supported with qualitative data, and so extensive information can be gathered on the factors affecting the argumentation instruction of teachers/preservice teachers. Thus, it can be contributed to identify the supporting reasons of the argumentation instructions of teachers/preservice teachers or the obstacles in using argumentation. The data obtained from scale can be used as a guide for support for instruction of argumentation or for measures to be taken against the factors preventing its use. Thus, argumentation can be used more in classrooms and this make possible to benefit from the many outputs of this strategy as understanding scientific processes and concepts better (Sampson & Blanchard, 2012), developing reasoning skills (Rebello & Barrow, 2013), understanding how scientific knowledge is produced and supporting decision-making processes (Pallant et al., 2013).

Statement of Responsibility

Nejla Atabey; conceptualization, methodology, validation, formal analysis, investigation, resources, writing – original draft, visualization, supervision, and project administration. Mustafa Sami Topçu; conceptualization, methodology, software,

validation, data curation, and writing- reviewing & editing. Ayşe Çiftçi; conceptualization, methodology, validation, and investigation.

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Ek1- Argümantasyon Uygulamalarını Etkileyen Faktörler Ölçeği

Ad/Soyad:

Yönerge: Bu ölçek, argümantasyon uygulamaları ile ilgili faktörleri ölçmek amacıyla hazırlanmıştır. Bu ölçekte 21 madde bulunmaktadır. Her bir ifadeyi okuduktan sonra buna ne derece katıldığınızı ya da katılmadığınızı işaretleyiniz. **Lütfen hiçbir maddeyi boş bırakmayınız ve her biri için tek yanıt veriniz. Bu çalışmaya yaptığınız katkılardan dolayı teşekkür ederim.**

Özyeterlik	**HiçKatılmıyorum**	**Katılmıyorum**	**Katılıyorum**	**Kesinlikle Katılıyorum**
1. Öğrencilere argümantasyon için önemli olan savunma ve ikna becerilerini öğretme konusunda kendime güveniyorum.				
2. Fen içeriklerini keşfetme ve anlamanın bir aracı olarak öğrencilerin argümantasyon yapmalarını destekleme konusunda kendime güveniyorum.				
3. Bireysel olarak veya küçük gruplar gibi çeşitli öğrenci ortamlarında öğrencilerin argüman oluşturmalarını kolaylaştırma konusunda kendime güveniyorum.				
4. Öğrenciler için sözlü argümantasyon etkinliklerini modelleme konusunda kendime güveniyorum.				
5. Öğrencilerin dil becerilerinin (okuma, yazma ve konuşma) gelişimini argümantasyon aracılığıyla destekleme konusunda kendime güveniyorum.				
6. Öğrencilerin argümanları eleştirmelerini kolaylaştırma konusunda kendime güveniyorum.				
7. Öğrencilere argümantasyon öğelerini (iddia, kanıt ve muhakeme) öğretme konusunda kendime güveniyorum.				
8. Okuma ve yazma için argümantasyon uygulamalarını modelleme konusunda kendime güveniyorum.				

Bağlam ve Politika	HiçKatılmıyorum	Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
1. Ülkemdeki okul veya ilçeler için bilimsel argümantasyonu öğretmek öncelik taşır.				
2. Ülkemdeki okul ve ilçe yönetimleri, bilimsel argümantasyonu uygulama konusunda öğretmenleri destekler.				
3. Argümantasyon, ülkemin fen öğretiminin önemli bir parçasıdır.				
4. Üniversitelerde ve/veya okullarda, fen eğitiminde bilimsel argümantasyonun rolü bilinir.				
5. Ülkemde, fen eğitimindeki müfredat hedefleri bilimsel argümantasyonun öğretimiyle uyumludur.				
6. Argümantasyon ülkemdeki fen sınavlarında değerlendirilir.				

Hedefler ve Çıktılar	HiçKatılmıyorum	Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
1. Argümantasyon, öğrencilerin eleştirel düşünme becerilerini geliştirmek için etkili bir yoldur.				
2. Argümantasyon, öğrencilerin muhakeme ve problem çözme becerilerini geliştirmek için etkili bir yoldur.				
3. Argümantasyon, öğrencilerin dil becerilerini (okuma, yazma ve konuşma) geliştirmek için etkili bir araçtır.				
4. Argümantasyon, öğrencilerin okur-yazarlık stratejilerini öğrenmeleri ve uygulamaları için etkili bir yoldur.				
5. Öğrencileri kanıtı açıklamak için bilimsel ilkeleri kullanmaya teşvik etmek, fen öğretiminin önemli bir parçasıdır.				
6. Argümantasyon tartışmaları esnasında öğrencilerin birbirleriyle doğrudan konuşmaları önemlidir.				
7. Öğrencileri argümantasyona teşvik etmek, feni öğrenmenin önemli bir parçasıdır.				