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## Turkish Adaptation of Preschool Children's Science Motivation Scale: A Validity and Reliability Study\*

**Melek Merve Yilmaz\*\***  
Cukurova University, TURKEY

**Ayperli Dikici Sigirtmac**  
Cukurova University, TURKEY

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**Abstract:** The aim of the study is to adapt Preschool Children's Science Motivation Scale (PCSMS) developed by Oppermann et al. into Turkish and conduct the validity and reliability analyses. This scale is considered important in terms of evaluating the science motivation of preschool children through the science concepts they are familiar with, based on their daily life experiences. The research data were obtained from 303 children attending preschool education in central districts of Adana. The findings of exploratory factor analysis, a two-factor structure named self-confidence and enjoyment consist of 28 items was determined in accordance with the original structure of the scale. Confirmatory factor analysis showed that this two-factor structure showed good fit. Subsequently, the study proceeded to reliability analyses and Cronbach's  $\alpha$  and Composite Reliability values were calculated. In consequence of the study, it was seen that the original form of the scale and the goodness of fit and internal consistency values obtained within the scope of the adaptation form coincided. The findings of the study indicate that the Turkish version of the PCSMS is valid and reliable for Turkish preschoolers.

**Keywords:** *Early childhood, science education, science motivation, preschool, scale adaptation.*

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### Introduction

Children are born with a natural curiosity and an inner motivation to explore the environment in which they live (Jirout & Klahr, 2012). Young children, who are interested in science because of its existential features, wonder about the world around them, the underlying causes, processes and mechanisms of biological and physical phenomena (Brown, 1997; Gelman, 1999). Therefore, preschool science education is a very suitable discipline for children who tend to explore the natural environment and enjoy observation (French, 2004; Patrick et al., 2009).

Science education is becoming increasingly important in today's societies where a science and technology-based life is adopted. Among the behaviors that are important for science education; it is known that there are components such as enjoying learning science, showing interest in science-related activities, self-confidence in science, and motivation towards science (Osborne et al., 2003). However, studies show that students experience a decrease in the success of science education in schools (Galton, 2009; Osborne et al., 2003), have low self-efficacy perceptions about science education (Aschbacher et al., 2010), and that their motivation for science education has decreased (Vedder-Weiss & Fortus, 2011; 2012). In the study conducted by Andre et al. (1999), it was revealed that the science competencies perceived by primary school-age children were lower than their proficiency in reading and mathematics classes and they gave less importance to science. These findings obtained as a result of different studies are alarming. Because early motivational beliefs are accepted as an important predictor of current and future science achievements, determining a career towards science, advanced academic skills and attitudes towards school (Jacobs et al., 1998; Leibham et al., 2013; Valeski & Stipek, 2001). Related to this, Simpkins et al. (2006) state that the negative beliefs and motivation developed towards science in the early period are likely to continue in the following years of education. Therefore, it is

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**\*\* Corresponding author:**

Melek Merve Yilmaz, Cukurova University, Faculty of Education, Department of Early Childhood Education, Turkey.

✉ [melekmerveyilmaz@gmail.com](mailto:melekmerveyilmaz@gmail.com)



important to carry out motivation studies for science starting from preschool period in order to identify possible negative beliefs at an early age and to take necessary measures.

When the existing measurement tools for evaluating motivational beliefs for preschool children are examined, it is seen that pictures (Baroody & Diamond, 2013) or puppets (Edens & Potter, 2013; Mantzicopoulos et al., 2008) are used in data collection processes with these tools. However, these measuring tools developed to assess children's motivational beliefs mostly focus on mathematics and reading (Baroody & Diamond, 2013; Edens & Potter, 2013; Tirosh et al., 2013). Three different facial expressions, smiling, neutral and sad, were used in the measurement tool developed by Andre et al. (1999) to evaluate motivational beliefs about science. Children are asked to indicate which facial expression they are closer to in terms of self-confidence and enjoyment in physical sciences and life sciences. However, there is no validity or reliability analysis data regarding the standardization of this measurement tool. Another measurement tool used to examine young children's motivational beliefs about science was developed by Mantzicopoulos et al. (2008). In the measurement tool in which two puppets expressing positive and negative judgments about science are used, children receive 1 or 0 points by showing the puppet using the expression closest to them. At the same time, this measurement tool was adapted to Turkish and used within a science education program applied to preschool children. In the adaptation form of the scale, items in the scale were illustrated and used instead of puppets. Measuring tool; it consists of three sub-factors: Scientific Knowledge, Scientific Competence and Scientific Interest (Alabay et al., 2020). The scale in question is a measurement tool that measures the motivational beliefs of children towards science in a valid and reliable manner. However, the point to be taken into consideration regarding this measurement tool is that the results obtained in the development of the original form of the scale were obtained from children who attended a ten-week science workshop. Similarly, the content of the items in the measurement tool is parallel to the activities children experience in the science workshop (Mantzicopoulos et al., 2008). Therefore, it can be said that the knowledge and experience of children who answered this measurement tool are related to their participation in science workshops to a large extent. However, it is known that the opportunities for children to receive preschool science education are quite limited (Aysu & Aral, 2016; Buyuktaskapu Soydan, 2019; Sackes et al., 2011). Therefore, in the process of evaluating motivational beliefs about science, it can be associated with daily experiences involving science concepts rather than directly relating to science terms, taking into account that children have a limited understanding of science terms and concepts. Considering that many preschool classrooms are not labeled as a type of activity even if science activities are carried out, it is considered important to use a measurement strategy based on children's beliefs about science based on their daily life experiences (Oppermann et al., 2018).

Preschool Children's Science Motivation Scale (PCSMS), based on the view of evaluating children's motivation for science through familiar science concepts based on their daily life experiences. The theoretical foundations of this scale are based on the expectation-value model of success motivation. The expectation element of the model is defined as the beliefs of the individual about how successful he / she can be in these tasks (Wigfield & Tonks, 2002). Value, the second element of the expectation-value model, is associated with the attractiveness of the task in question, its perceived importance, and the belief that the individual will participate in this task (Schunk, 2012; Wigfield & Tonks, 2002). Perception of value; it consists of four subcomponents: intrinsic value, extrinsic-utility value, significance value and cost (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000; Wigfield & Tonks, 2002). Intrinsic value, which is also used as an intrinsic motivation, is related to the pleasure that a person gets while performing a task, and performing a task with an intrinsic value perception can also result in positive psychological gains (Schunk, 2012; Wigfield & Eccles, 2000; Wigfield & Tonks, 2002). Extrinsic value, in another sense, is about the extent to which a task fits with future plans. Accordingly, the fulfillment of the task depends on the achievement of a desired final goal, that is, external reasons. Therefore, extrinsic value is mostly associated with extrinsic motivation (Battle & Wigfield, 2003; Schunk, 2012; Wigfield & Eccles, 2000; Wigfield & Tonks, 2002). Importance value is defined as the importance of the task to be done well by the individual. The task is important in terms of carrying important information for the individual, providing the individual with the opportunity to provide success or meet their social needs (Schunk, 2012; Wigfield & Eccles, 2000). Cost, which is the last component of the perception of value, refers to the extent to which the decision to participate in an activity limits other activities, how much effort will be made to achieve the activity, and emotional cost (Wigfield & Eccles, 2000). In the PCSMS, which was based on the expectation-value model in the development process, the intrinsic value dimension was focused. Because children's interest in science; it was assumed that science stems from children's enjoyment of learning science rather than its perceived importance in terms of future careers, personality structures or costs (Oppermann et al., 2018).

The purpose of this study, Turkish Adaptation of the PCSMS and realize the reliability and validity analysis. The scale is considered important in terms of evaluating the motivation of preschool children towards science through the science concepts they are familiar with, based on their daily life experiences. It is thought that this scale can be used by researchers in different studies as it can be used for children who do not have a specific science education program due to its items based on daily life experiences.

## Methodology

### Study Group

The study group of this research consisted of 303 children of 60-72 months of preschool education in twelve independent kindergartens in the central districts of Adana in the second period of the 2018-2019 academic year. In the selection of the study group, it is recommended to use a heterogeneous sample group, as homogeneous groups will reduce variance and factor loads (Kline, 1994). Based on the relevant literature, proportional stratified sampling method was used to increase the diversity of subgroups in the sample (Gay et al., 2012). Accordingly, 303 out of 17551 children attending preschool education in Seyhan, Çukurova, Sarıçam and Yüreğir districts of Adana province were included in the sample in accordance with the rate of attending preschool education according to gender on district basis. The study group; 51.8% of them are girls (n = 157) and 48.2% are boys (n = 146). These children; 40.3% is 60-66 months old (n = 122), 59.7% is 67-72 months old (n = 181). In factor analysis studies, it is stated that a sample size of five or ten times the number of items will be sufficient (Bryman & Cramer, 2002). In addition, Comrey and Lee (1992, p.216) evaluate the adequacy of the sample size as follows: 50-very poor, 100-poor, 200-suitable, 300-good, 500-very good 1000 and more excellent. Kline (1994) stated that it is important to reach a sufficient sample size in order to produce reliable factors and emphasizes that a sample of 100 people may be sufficient in cases where there is a clear factor structure. The number of variables can also be considered as a criterion in determining the sufficient sample size. Accordingly, Kline (1994) states that the sample size can be varied at least twice to ten times the number of items. Considering the body of literature recommendations, it is thought that the sample of 303 people discussed in this study is sufficient.

### Instrument

Preschool Children's Science Motivation Scale (PCSMS) is the data collection tool of this study. The scale focuses on intrinsic values by associating children's self-confidence in science-related activities with an aspect of their outcome expectation beliefs. On the basis of this idea, children's interest in science; It is based on the assumption that it stems from an innate curiosity to learn science rather than future career, identity or other possible benefits. The scale consists of items covering the life sciences and physical science content areas. During the process of creating scale items, the relevant literature was examined, and it was concluded that children may have interests in different fields, but for science, these areas are mostly physics and life sciences. Therefore, scale items focus on children's motivations for these two content areas (Oppermann et al., 2018).

The validity-reliability studies of the original scale were carried out in Germany with a sample of 277 children in the 5-6 age group. The scale consists of two sub-dimensions (Self-Confidence & Enjoyment). Cronbach's  $\alpha$  values of these sub-dimensions were determined as .87 and .86, respectively. Scale items consisting of 28 items; Self-confidence in life sciences is divided into eight items, self-confidence in physical sciences seven items, enjoyment in life sciences seven items, and enjoyment in physical sciences six items. An example item on the scale is as follows:

*"Have you ever looked at plants in detail? For example, at a leaf, a blossom or a root? Kora/Momo already knows a lot about plants. Kiki/Bodo does not yet know much about plants. How about you? Please show me how much you already know about plants. Do you know very much, quite a lot, not that much or very little?"*

The scale's response options, which are calculated over four points for each item, vary between 1 and 4 as "very little / no" and "very / very good". The response process is accompanied by children's verbal responses, as well as a diagram divided into sections 1 to 4 (Oppermann et al., 2018). The diagram example used is shown in Figure 1.

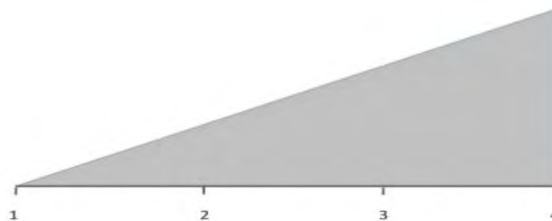


Figure 1. The diagram of the PCSMS

While the scale items are verbally directed to the children, puppets are used. In order to prevent children from feeling sympathy / antipathy, puppets identified with the gender of the child guide the children throughout the interview. If the child is a girl, two puppets named Kiki and Kora were used, and if the child was a boy, puppets named Bodo and Momo were used. The procedure for applying the scale; the researcher is getting to know the child, providing basic information about the process (briefly the purpose of study, introducing puppets), the implementation of the exercise items and the scale items, respectively.

*Data Collection Process*

During the implementation of the PCSMS, a place that is as quiet as possible and outside of the environment where other children are was preferred in the preschool education institution where the children attend. The implementation was carried out by the researcher individually with each child. The child and the practitioner sat opposite each other at a table and the materials to be used during the implementation were kept ready in the environment where the implementation was made. In practice; finger puppets, a cardboard diagram and colored stars were used. In order to prevent the child from responding to his / her external appearance, the materials were selected in neutral colors in terms of gender patterns (yellow diagram, stars in the color that blue or pink color would not be the reason to choose), without detail and with similar features. Finger puppets for boys and girls are physically similar, except for the shapes and colors of the clothes.

The scale was administered by the researcher in one-to-one sessions with the children in the study group. In accordance with the scale directive, firstly, the introduction and sample implementation sections were carried out. In this section, two sample exercises were done with each child to guide how to answer the items. Then, each item in the scale was read to the child. In accordance with the child's response to that item; It was asked to show one of the ranges of 1 star for little / nothing, 2 stars for a little, 3 stars for a lot, 4 stars for very / very good. In the original form of the scale, only diagrams and stars were not used. However, in this study, with the approval of the researchers who developed the scale, it was thought that the concrete representation power of the stars would be more suitable for children of this age, and colored stars were also used with the diagram. The implementation took approximately 20 minutes for each child. During the implementation, children's responses to the items in the measurement tool were recorded on the coding chart. While reading the scale items, care was taken to use the same tone of voice for all positive and negative statements. During the implementation, the researcher did not initiate a conversation with the child, but responded when the child started a conversation.

*Data Analysis*

Within the scope of the PCSMS adaptation study, preschool education experts were consulted to ensure language equivalence and content validity, and the rate of consensus was determined. IBM SPSS Statistics 21.0 and AMOS 18 programs were used for statistical analysis of the study. In order to test the suitability of the data set to factor analysis in terms of sample size, the Kaiser-Meyer-Olkin test and the Barlett sphericity test were used to test the multivariate normality assumption. Exploratory factor analysis and confirmatory factor analysis were applied to determine the construct validity of the scale. Principal Component Analysis and Varimax Orthogonal Rotation technique were used to determine the structure of factors with exploratory factor analysis. Confirmatory factor analysis was performed using the maximum likelihood method to test the verification status of the structure determined by exploratory factor analysis. The reliability coefficient of the factors of the scale was determined by the Cronbach's  $\alpha$  and Composite Reliability values. First, item-total correlations were determined in order to calculate the ability of the scale items to distinguish individuals in terms of their measured characteristics. Then, the t-test was conducted to test the significance of the difference between item scores of the upper 27% and lower 27% groups. Finally, the correlation coefficients between the mean and standard deviation values and factor scores were calculated to reveal the relationships between the factors of the scale.

**Findings***Findings Regarding Validity*

In this part of the study, findings for language equivalence, language-content validity and construct validity are presented.

*Language equivalence and language-content validity*

Before starting the adaptation of the scale for Turkey, we have requested permission from Oppermann et al. (2018). In this direction, necessary permission has been obtained via e-mail. In addition, in order to increase the validity and reliability of the scale, it was aimed to carry out the process in the most accurate way, by asking Oppermann et al. for additional information and photos regarding the scale. As a first step, the scale was translated from the source language, English, to the target language, Turkish. In order to ensure the linguistic equivalence of the scale, the scale was translated from English to Turkish independently by a professional translator, researcher and two preschool education experts who have command of English. Thus, four different Turkish scale forms were reached. Independent translation forms were examined by the researchers comparatively and the item selection was made by looking at the consistency between the translations and the original form. During the selection of the items made among the translation forms, there were the items that were agreed on, as well as the statements that caused indecision.

In the second stage, the items in the obtained translation forms were collected in a single form and presented to the opinion of three preschool education experts who have command of the English language. In this form, the items that cause indecision were given optionally and opinions were requested from the experts. In line with the expert opinions,

when choosing the items for the draft form, rather than mechanical translation expressions, the expressions that are available in the Turkish preschool education system, which are thought to be easily understood by children and that they are familiar with were preferred.

In the third stage, nine expert faculty members working in the field of preschool science / science education were consulted in order to increase the linguistic equivalence of the scale and test the language-content validity. Two of the experts have a bachelor's degree in science education and are working on preschool science education. Experts were asked to examine the description, introduction, sample items and items of the scale, and to evaluate whether the item was expressed in a way that could be easily understood by the target audience and whether the item represented the sub-dimension to be measured correctly. Lawshe (1975) technique was used to evaluate the language-content validity. Feedback from experts shows that the language-content validity values of the items are 0.78 for five items and 1.00 for 23 items. Accordingly, considering that the minimum content validity rate for nine expert opinions at 0.05 significance level is 0.75 (Veneziano & Hooper, 1997), it can be said that language-content validity has sufficient criteria.

In addition to the content validity rates, the agreement levels were calculated for the suitability of each item in line with the feedback from experts. According to this, although the agreement level is expected to be 90% -100%, it is stated that the items with which the experts agree 70% -80% can remain in the measurement tool by correcting (Buyukozturk, 2009). As a result of the expert opinions taken for the PCSMS, it was determined that the experts agreed 100% on 23 items and 88.9% was reached for 5 items. The instructions and items of the scale were changed by taking into account the evaluations made by preschool science / science education experts independently from each other. As an example of the changes made, the following can be stated: i) The expression "*successful*" in the scale implementation directive has been replaced with the expression "*good*" which means being good at doing something. ii) The stars were added to the diagram used in answering the scale items. In line with the expert opinion, colored stars were used with the diagram, with the justification that the concrete representation power of the stars would be more suitable for preschool children.

In the fourth stage, in order to examine the suitability of the Turkish form in terms of language and expression, it was presented to a faculty member working in the field of Turkish Education, and the necessary changes were made on the instructions and articles in line with the suggestions and corrections received. After this stage, the Turkish scale form created using the back translation method was translated into English, the source language, by a professional translator. Thus, by looking at the consistency between the original scale and the translation scale, situations that could negatively affect the validity and reliability of the scale were tried to be eliminated. After the back translation process, the final controls before the pilot study were made.

The scale which was examined and evaluated by experts, was applied with 20 children for pilot study. In the pilot study, it was evaluated whether the instructions and items of the scale were understood by children during the implementation process. During this process, some expression changes were made. "*Have you ever watched what happened to the water in the pot while boiling pastas or potatoes?*" The expressions in the article translated as have been changed, realizing that the children are not familiar enough. This item is "*Have you ever watched what happened to the water in the pot in which water was heated?*" It has been transformed into shape. All changes made were reported to the researchers who developed the original scale, and their opinions and approvals were obtained. After the changes and corrections were made, the final form was given to the scale.

### Construct Validity

#### Exploratory Factor Analysis

For the exploratory factor analysis to test the construct validity of the PCSMS, firstly, Kaiser-Meyer-Olkin (KMO) test was applied to examine the suitability of the data set to factorization. The KMO coefficient provides information about the suitability of the data structure for factor analysis (Buyukozturk, 2009). As a result of the analysis, it was determined that the KMO value was .89. The KMO value gives an idea of whether a sufficient number of items were predicted by each factor. Leech et al. (2005) emphasize that the KMO value should be greater than .70 and states that the values below .50 are insufficient. According to Kaiser (1974), this value is; Excellent for .90, very good for .80, good for .70, medium for .60, weak for .50 and unacceptable for values below .50. Accordingly, it can be said that the sample size according to the Kaiser Meyer-Olkin sampling adequacy measure (KMO = 0.89) value obtained is perfectly adequate for factor analysis. In addition, when Bartlett's sphericity test results were examined to examine the multivariate normality assumption, it was seen that the obtained chi-square value was significant [ $\chi^2 = 2599.709$  ( $p < .001$ )]. In line with this significance value, it was accepted that the data came from multivariate normal distribution and the data set was decided to be suitable for factor analysis.

Principal component analysis was used as a factorization technique in the exploratory factor analysis, which was conducted to reveal the factor design of the PCSMS. The 28 items in the original scale were included in the analysis as a whole. In the variance table explained based on eigenvalues for the 28 items included in the analysis, it was seen that there were six components with an eigenvalue above 1. The contribution of these components to the total variance was

calculated as 53.25%. According to the cumulative variance values, it was seen that the two components contributed significantly to the variance, and the additive value after the third component was small. These components were re-evaluated in the context of their contribution to the total variance by examining their cumulative variance values and scree plot. The scree plot obtained as a result of the exploratory factor analysis is presented in Figure 2.

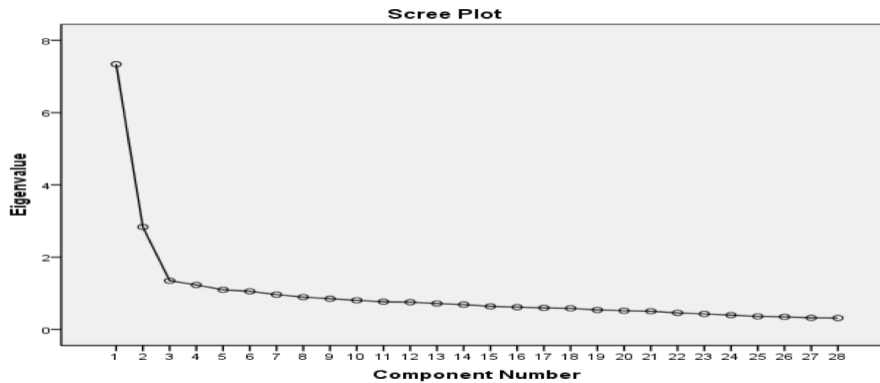


Figure 2. The scree plot of the PCSMS

In Figure 2, after the second factor, a high accelerated decrease is observed in the graph. In the scree plot, it is interpreted that the contribution of the factors to the variance is close to each other after the point where no significant downward trend is observed (Buyukozturk, 2009). Accordingly, the scree plot gives an idea that the scale can consist of two factors. Therefore, it was decided to repeat the analysis by limiting it to two factors. This decision is also meaningful in terms of compliance with the number of factors determined in the original structure of the scale.

When the analysis is repeated for two factors, the contribution of the factors to the total variance; It was determined as 18.49% for the first factor and 17.84% for the second factor and the total contribution of the two factors to the variance was calculated as 36.33%. As suggested in the literature (Cokluk et al., 2012), the lower limit of the factor load values of the items was determined as .32. In the analysis for two factors, the items were evaluated in terms of overlapping and meeting the factor load value. It was observed that item number 12 in the scale gave a load value above the acceptance level in both factors. The load value of this item was .581 in the first factor and .325 in the second factor. However, since the difference between the two load values is greater than 0.1 ( $0.581 - 0.325 = 0.26 > 0.1$ ), this item was not considered to be overlapping and was not removed from the scale. Factor pattern obtained, common factor variances and factor loads of the items are given in Table 1.

Table 1. Factor pattern of the PCSMS

Item number	Common Factor Variance	Factor Load Values	
		Factor 1 Self-Confidence	Factor 2 Enjoyment
m21	.468	.669	
m27	.449	.650	
m7	.387	.621	
m14	.403	.620	
m25	.383	.594	
m3	.351	.592	
m16	.359	.582	
m12	.443	.581	
m9	.376	.577	
m19	.391	.569	
m5	.297	.540	
m11	.369	.526	
m17	.272	.504	
m23	.235	.457	
m1	.192	.433	

Table 1. Continued

Item number	Common Factor Variance	Factor Load Values	
		Factor 1 Self-Confidence	Factor 2 Enjoyment
m20	.482		.679
m13	.506		.677
m15	.475		.672
m10	.443		.661
m24	.430		.656
m22	.470		.655
m26	.387		.590
m28	.373		.588
m8	.343		.586
m18	.335		.570
m6	.256		.468
m4	.173		.395
m2	.127		.330
Explained variance (%)		%18.49	%17.84
Total= %36.33			

As a result of the analysis, it was seen that the items defined in the original scale were collected under the same factors. As seen in Table 1, in accordance with the original scale, the first factor, named "Self-Confidence", consists of 15 items (21, 27, 7, 14, 25, 3, 16, 12, 9, 19, 5, 11, 17, 23). , 1) It was determined that the second factor, called "Enjoyment", consists of 13 items (20, 13, 15, 10, 24, 22, 26, 28, 8, 18, 6, 4, 2). The factor loading values of the items in the first factor varied between .43 and .67, while the items in the second factor ranged from .33 to .68.

*Confirmatory Factor Analysis*

Confirmatory factor analysis (Cokluk et al., 2012), which is an analysis that examines the verification status of a defined structure as a model, was used to test the two-dimensional structure obtained by exploratory factor analysis within the scope of this study. Confirmatory Factor Analysis (CFA) was performed in AMOS 18 program using the maximum probability method. The model used in this analysis is presented in Figure 3.

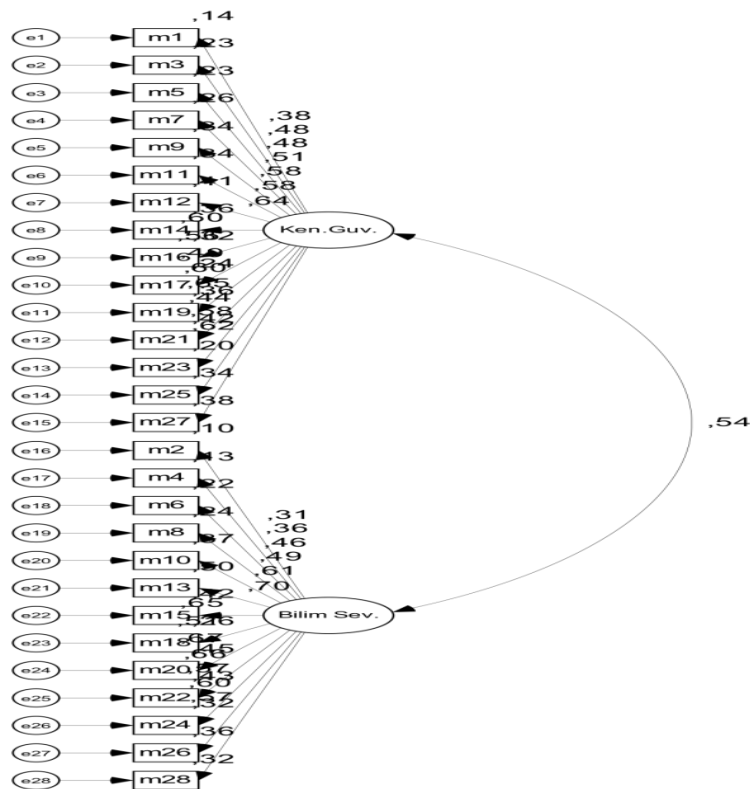


Figure 3. Suggested model for the PCSMS

The statistical values calculated for model-data fit according to the confirmatory factor analysis results of the PCSMS are presented in Table 2.

Table 2. Summary of fit indices from confirmatory factor analysis

$\chi^2$	$\chi^2/sd$	RMSEA	AGFI	GFI	NFI	CFI
441.344	1.25	.03	.90	.92	.85	.97

The Chi-square ( $\chi^2$ ) value, which is the value that tests the statistical fit of the model and the analysis data proposed in the Confirmatory Factor Analysis, gets smaller when the sample is 200 or less and the fit of the model increases (Kline, 1994; Tabachnick & Fidell, 2014). However, it is recommended to use the ratio of degrees of freedom (df) to  $\chi^2$ , since this value is sensitive to the sample size and a high value of  $\chi^2$  will be reached as the sample size increases (Hair et al., 2010). For the model proposed in this study it was calculated as  $\chi^2 = 441.344$  ( $p < .01$ ) and  $\chi^2 / df = 1.25$ . Kline (1994) states that if the ratio of chi-square to degrees of freedom is between 2 and 3, it is acceptable, while smaller values show a good fit. Therefore, it can be said that there is a good fit between the data set used in this study and the proposed model.

The fact that the approximate root mean square error (RMSEA) value of the fit indices used in CFA is equal to or less than .05 indicates the presence of a perfect fit (Jöreskog & Sörbom, 1993; Schumacker & Lomax, 2004). It can be said that the .03 RMSEA value calculated for the model proposed in this study indicates perfect fit. The goodness fit index (AGFI) value arranged in CFA is over .80 (Cole, 1987; Marsh & Balla, 1994), the goodness fit index (GFI) value is over .90 (Hair et al., 2010; Kline, 1994) corresponds to good fit. Although the normed fit index (NFI) value of .90 and above indicates good fit (Bentler & Bonnet, 1980), the cut-off value of .85 is also accepted in the literature (Kaya & Altinkurt, 2018; Shore & Tetrick, 1991). A comparative fit index (CFI) value above .95 is an indicator of perfect fit (Tabachnick & Fidell, 2014). It can be said that the AGFI = .90, GFI = .92 values obtained as a result of the analysis correspond to good fit, and CFI = .97 to perfect fit. According to these results, it can be said that an acceptable model fit has been achieved based on the knowledge that all indexes should be evaluated together to decide the fit of the model with the data (Byrne, 2010; Jöreskog & Sörbom, 1993).

#### Findings Regarding Reliability

In order to determine the reliability of the PCSMS, Cronbach's  $\alpha$  and Composite Reliability values was calculated. As a result of the analysis, Cronbach's  $\alpha$  coefficient value for Self-Confidence, which is the first factor, was calculated as .866, while the coefficient value for Enjoyment, the second factor, was calculated as .853. The Composite Reliability value for Self-Confidence was found to be .852, and the Composite Reliability value for Enjoyment was calculated as .843. In order to determine to what extent the items in the scale differentiate individuals in terms of measured behavior, the corrected item total correlations were calculated and a t-test was conducted to determine the significance of the difference between item scores of the upper 27% and lower 27% groups. Analysis results are presented in Table 3.

Table 3. t-Test results between the internal consistency coefficients of the PCSMS, adjusted item-total correlations and the scores of the upper / lower 27% groups

Factor	Internal Consistency Coefficient	Composite Reliability Value	Item	Adjusted item-total correlation	t for Items (upper / lower 27%)
Factor 1 Self-Confidence	$\alpha = .866$	CR = .852	m1	.357	7.55*
			m3	.474	9.53*
			m5	.450	8.86*
			m7	.491	11.7*
			m9	.539	13.14*
			m11	.520	10.88*
			m12	.579	12.42*
			m14	.551	14.40*
			m16	.522	12.39*
			m17	.454	9.09*
			m19	.546	11.67*
			m21	.601	15.52*
			m23	.409	8.12*
			m25	.540	14.01*
m27	.583	18.22*			



Table 3. Continued

Factor	Internal Consistency Coefficient	Composite Reliability Value	Item	Adjusted item-total correlation	t for Items (upper / lower 27%)
Factor 2 Enjoyment	$\alpha = .853$	CR = .843	m2	.305	6.35*
			m4	.357	8.47*
			m6	.444	8.94*
			m8	.485	8.31*
			m10	.567	11.37*
			m13	.620	11.06*
			m15	.593	11.36*
			m18	.479	9.20*
			m20	.595	11.62*
			m22	.586	11.94*
			m24	.520	9.66*
			m26	.543	12.05*
			m28	.522	9.46*

n= 303, n1=n2=82, \*p<.001

According to Table 3, the adjusted item-total correlations of the scale vary between .30 and .62. t-test results between the item average scores of the upper / lower 27% groups show that there is a significant difference in scores for all items. This finding shows that all items in the scale are sufficient to distinguish individuals.

#### Findings on the relationships between factors

Table 4 shows the correlation coefficients between the sample mean and standard deviation values and factor scores for the two factors determined in the PCSMS.

Table 4. The mean and standard deviations of the factors of the PCSMS and the correlation values between the factors

Factors	Items	$\bar{x}$	SD	The Correlation of Factor 1- Factor 2
Factor 1: Self-Confidence	15	46.06	10,10	.45*
Factor 2: Enjoyment	13	45.57	6,88	-

\*p<.001

As seen in Table 4, when the dual correlation between factor scores is examined, it was determined that there is a medium and significant factor scores ( $p < .001$ ). This result indicates that the factors that make up the scale are independent from each other.

### Discussion

In this study, Preschool Children's Science Motivation Scale (PCSMS) was adapted and validity-reliability analyses were made preschoolers in Turkey. In the first step of the scale adaptation study, permission and information was received from the researchers who developed the scale. After this stage, considering the scale adaptation steps suggested by Hambleton and Patsula (1999), the scale was translated into Turkish. During the translation process, support was received from preschool field education experts as well as professional translator support. The items in the obtained translation forms were collected in a single form and presented to the opinion of three preschool education experts who have mastered the English language. With the inclusion of preschool education experts in every step of the translation process, it was aimed to move away from mechanical translation and to include the expressions that exist in the Turkish preschool education program, which are thought to be easily understood by children. The draft form obtained was submitted to the opinion of nine expert faculty members working in the field of preschool science education in order to test the language content validity by increasing the language equivalence of the scale. In line with the opinions of experts, it was concluded that the language content validity values were sufficient (Veneziano & Hooper, 1997).

Exploratory and confirmatory factor analyzes were conducted to test the construct validity of the PCSMS. As a result of EFA, a two-factor structure consisting of 28 items was determined in accordance with the original structure of the scale. These factors were named as "Self-Confidence" and "Enjoyment" in line with the nomenclature in the original scale form and the literature reviews. When the distribution of scale items by factors is examined, items numbered 21, 27, 7, 14, 25, 3, 16, 12, 9, 19, 5, 11, 17, 23, 1 under the "Self-Confidence" dimension, 20, 13, 15, 10, 24, 22, 26, 28, 8, 18, 6, 4, and 2 are in the "Enjoyment" dimension. While the factor load values for the 15 items in the "Self-Confidence"

dimension ranged from .43 to .67, the values for the 13 items in the "Enjoyment" dimension ranged from .33 to .68. Accordingly, the lower limit of the factor loading values of the items in the scale was suggested. It has been determined that there are over .32 (Cokluk et al., 2012).

Confirmatory factor analysis was conducted to provide evidence for the two-factor structure of the PCSMS obtained by EFA. It is seen that the CFA values ( $\chi^2 = 499.527$ ;  $\chi^2 / df = 1.43$ ;  $p < .01$ ) made in the original scale form correspond to the results obtained in the adaptation study. Accordingly, the chi-square value and the ratio of chi-square to degrees of freedom ( $\chi^2 = 441.344$ ;  $\chi^2 / df = 1.25$ ;  $p < .01$ ) showed that there is good fit (Kline, 1994). CFI (.95) and RMSEA (.04) values were calculated as goodness of fit indices in the original form of the scale, and it was stated that model fit indices were quite suitable (Oppermann et al., 2018). The values included in this study are; RMSEA = .03; AGFI = .90; GFI = .92; NFI = .85; CFI = .97. Accordingly, the obtained RMSEA (< .05) and CFI (> .95) values indicate perfect fit (Jöreskog & Sörbom, 1993; Schumacker & Lomax, 2004; Tabachnick & Fidell, 2014), AGFI (>.80) and GFI (>.90) values indicate good fit (Cole, 1987; Marsh & Balla, 1994; Hair et al. 2010).

One of the fit indices examined within the scope of the study is the Normed Fit Index (NFI). The improved version of NFI statistics is the comparative fit index CFI, which was also examined within the scope of this study (Yaslioglu, 2017). NFI index, which indicates perfect fit as its value approaches 1, is accepted as an indicator of good fit (Bentler & Bonnet, 1980). However, in this study, the NFI value was determined as .85. Hu and Bentler (1995) reported that the cut-off value of .90 would not always be a reasonable result for fit indices. When the literature is examined, it is seen that there are different opinions about this value. Accordingly, Shore and Tetrick (1991) stated in their study that they used the .80 criterion for NFI based on the view that the value of .90 suggested by Tanaka (1987) could be very assertive. Similarly, in the study conducted by Kaya and Altinkurt (2018), the researchers stated that they took the value of .85 for the NFI cut-off point. Parallel to this, for the NFI value, researchers can accept values of .80 and above as the cut-off point as an indicator of good fit (Kaya & Altinkurt, 2018; Kilis & Yildirim, 2018; Kizildag & Yildirim, 2017). In addition, since there is no single valid criterion in the process of examining the model's suitability, it is recommended to examine all values in a holistic manner (Byrne, 2010; Hair et al., 2010). Therefore, considering the goodness of fit values that indicate good and perfect fit obtained as a result of CFA analyzes conducted within the scope of this study, it can be said that model fit is good.

The internal consistency coefficient was calculated to determine the reliability of the scale. Internal consistency coefficients in the original form of the scale; Cronbach's  $\alpha$  value was determined as .87 for the Self-Confidence dimension and .86 for the Enjoyment dimension. In the adaptation study, these coefficients are; It was calculated as .86 for Self-Confidence sub-dimension and .85 for Enjoyment sub-dimension. It is seen that the adaptation form of the scale and the internal consistency values obtained from the original form are quite similar. Additionally, within the scope of the study, the Composite Reliability value was also calculated to determine the reliability of the data. According to this, Composite Reliability for Self-Confidence was found as .852, while for Enjoyment it was calculated as .843. Both Cronbach's  $\alpha$  and Composite Reliability values exceeding the acceptable .70 threshold value indicate that the scale is reliable (Buyukozturk, 2009; Hair et al., 2010). Therefore, it can be said that the PCSMS is a reliable measurement tool.

### Conclusion

It is known that children's positive motivation towards science at an early age affects their academic success in the future. Therefore, it is important to evaluate children's motivation towards science starting from pre-school period and to carry out interventions in this direction. In this study, the PCSMS that was developed by Oppermann et al. (2018) to assess the science motivation of preschool children, adaptation study was carried out for Turkey. The original version of the scale consists of two sub-dimensions and 28 items. As a result of the analyzes made within the scope of the adaptation study, it was determined that the similar structure was repeated for the Turkish form. The results of the CFA conducted within the scope of the adaptation study show that the fit indices are at a very good level. In addition, Cronbach's  $\alpha$  reliability coefficients were calculated similar to the original scale and the PCSMS was found to be reliable. In the analysis result it was revealed that the scale is a valid and reliable instrument that can be used to assess the science of motivation 60-72 month old children in Turkey. This scale is considered important as it can be used for children who have not received a specific science education in pre-school period. As the PCSMS uses scientific concepts and skills that children encounter and are familiar with in their daily lives, equal opportunities can be created for the evaluation of all children with and without science education.

### Recommendations

In this study, the PCSMS, has been demonstrated to be a reliable and valid measurement tool that can be used in the evaluation of the science motivation of children in Turkey. This study supports future studies with the PCSMS, which was developed and adapted for young children with limited experience and knowledge of science. Firstly, examining the structure determined for the science motivation of children in the study and the verification status in different groups and larger samples can be presented as a suggestion for future research. Thus, evidence can be obtained that the scale can be used for different sample groups.

For further studies, it can be suggested to examine the relationship between children's science motivation and children's science learning. The PCSMS can be used to evaluate the effectiveness of science education offered to children. This instrument can be applied to experimental and control groups in evaluating the quality of the intervention through studies conducted in an experimental design. In line with the results obtained, appropriate steps can be taken to improve children's scientific experience.

The instrument can be used to investigate the change in children's science motivation according to their progressive development levels. It is known that early science education positively affects the science motivation of children. Based on this, it can be suggested to carry out studies on the change in the motivational beliefs of preschool children and the factors affecting this change through longitudinal studies to be designed.

The instrument which has been adapted can be used to make the relationship between scientific concepts and skills levels of children and their science motivation visible. In this way, it can be considered as a criterion in evaluating the quality of science education offered to children. In addition, it can be suggested for future studies to establish a link between the science-specific professional and pedagogical content knowledge of preschool teachers and the science motivation of children. Thus, findings on the significance of the contribution of preschool teachers' pedagogical content knowledge on children's motivational beliefs can be added to the literature.

### Limitations

There are some limitations to be considered in this study. The study was done in Adana in southern Turkey. Homogeneity was achieved by including children from all central districts of Adana in the study group. However, the selection was not made randomly. While participating in the study, the consent of the parents and the volunteering of the children were taken into account. This adaptation study is limited to pre-school children aged 60-72 months. Therefore, the validity-reliability status of the scale for preschool children younger than 60 months is unknown.

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## Appendix

## Turkish Versiyon of Preschool Children's Science Motivation Scale

## Okul Öncesi Çocuklar için Bilim Motivasyonu Ölçeği

## B1. Açıklama

Uygulayıcıda iki çift özdeş kukla bulunmaktadır. Uygulama yapılan çocuk kız ise Kiki ve Kora isimli kız kuklalar; uygulama yapılan çocuk erkek ise Bodo ve Momo isimli erkek kuklalar seçilir. Uygulayıcı, görüşme sırasında her iki kuklaya eşit davranmak ve yönergeler dışında kuklalar hakkında konuşmamak üzere eğitilmiştir. Uygulayıcı, hem olumlu hem de olumsuz ifadeleri aynı şekilde telaffuz etmelidir. Uygulama sürecinde; parmak kuklaları, renkli yıldızlar ve diyagram materyalleri kullanılır. Diyagramın en küçük alanı için 1 yıldız, en büyük alanı için 4 yıldız kullanılır. Uygulamaya başlamadan önce, uygulayıcı ve çocuk, bu yıldızları birlikte sayarak diyagrama yerleştirir ve hangi grupta daha fazla yıldız bulunduğu hakkında konuşurlar. Uygulama sırasında, uygulayıcı, diyagramdaki (Şekil 1) ilgili noktalara işaret ederken her bir madde için cevap seçeneklerini yüksek sesle okumalıdır.



Şekil 1. Yanıt diyagramı

## B2. Tanışma

Merhaba, benim adım \_\_\_\_\_ ve ben \_\_\_\_\_ yaşıdayım.

Bana kaç yaşında olduğunu söyleyebilir misin? Yaş: \_\_\_\_\_

Bir sonraki doğum gününün ne zaman olduğunu söyleyebilir misin? Tarih: \_\_\_\_\_

Ben Çukurova Üniversitesinden geliyorum ve bir araştırmacıyım. Araştırmanın anlamı, bir çok soru sorup o soruların cevaplarını bulmaya çalışmaktır. Benim araştırmam da anaokuluna giden çocukların öğrenmeyi sevdikleri şeyler ve iyi oldukları şeyler ile ilgili. Bu nedenle sana bazı sorular sormak istiyorum. Yanımda bir kağıt getirdim, konuşmamız sırasında verdiğin cevapları unutmamak için not alacağım.

Bu iki kuklayı da yanımda getirdim. Bu Kiki / Bodo ve bu da Kora / Momo. Kiki / Bodo ve Kora / Momo arkadaşlar ve aynı anaokuluna gidiyorlar. Biraz sonra, Kiki / Bodo ve Kora / Momo anaokulunda yapmayı sevdikleri ve sevmedikleri şeyler hakkında konuşacaklar. Kiki / Bodo ve Kora / Momo farklı şeyleri seviyorlar, çünkü ikisi de farklı çocuklar. Farklı çocukların farklı şeyleri sevmesi nasıl çok normal bir durumsa farklı şeyleri iyi yapmaları da çok normaldir.

*Örnek Madde 1:* Kiki/Bodo resim çizmede iyi. Kora/Momo resim çizmede iyi değil. Peki sen iyi resim çizebilir misin yoksa iyi resim çizemez misin? (Çocuk sözel olarak cevap verir). Lütfen bana resim çizmede ne kadar iyi olduğunu göster. Çok mu iyi çizersin? İyi mi çizersin? Biraz iyi mi çizersin? Hiç çizemez misin? (Uygulayıcı, her bir yanıt için ilgili noktayı diyagram üzerinde gösterir).

*Örnek Madde 2:* Kora/Momo top oynamada iyi. Kiki/Bodo top oynamada iyi değil. Peki sen iyi top oynayabilir misin yoksa iyi top oynayamaz mısın? (Çocuk sözel olarak cevap verir). Lütfen bana top oynamada ne kadar iyi olduğunu göster. Çok mu iyi oynarsın? İyi mi oynarsın? Biraz iyi mi oynarsın? Hiç oynamaz mısın? (Uygulayıcı, her bir yanıt için ilgili noktayı diyagram üzerinde gösterir).

Kiki / Bodo ve Kora / Momo şimdi doğadaki farklı şeyler hakkında ne kadar bilgili olduklarını ve neleri daha çok öğrenmek istediklerini konuşacaklar. İkisi de farklı şeylerde iyi ve farklı şeyleri seviyorlar. Daha önce olduğu gibi sana da soracağım. Eğer anlamadığın bir şey olursa sormaya çekinme lütfen.

**B3. Ölçek Maddeleri**

Daha önce hiç hayvanları izledin mi, örneğin yaprak yiyen bir tırtılı veya karıncaları?

KG-YB1	Kiki / Bodo (Kiki 'yi/ Bodo'yu göster) farklı hayvanlar hakkında çok şey biliyor. Kora / Momo (Kora / Momo'yu göster) ise hayvanlar hakkında henüz çok şey bilmiyor. Lütfen hayvanlar hakkında ne kadar şey bildiğini bana göster. Çok fazla mı biliyorsun? Çok mu biliyorsun? Biraz mı biliyorsun? Çok az mı biliyorsun?
H-YB1	Lütfen hayvanlar hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
KG- YB2	Diyelim ki öğretmenin sana karıncaların nasıl yaşadığını sordu. Lütfen bu soruya ne kadar iyi cevap verebileceğini bana göster. Çok iyi mi cevap verirsin? İyi mi cevap verirsin? Biraz iyi mi cevap verirsin? Hiç cevap veremez misin?
H-YB2	Lütfen karıncalar hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
KG-YB3	Diyelim ki öğretmenin senden kelebeklerin nasıl oluştuğunu anlatmanı istedi. Lütfen kelebeklerin nasıl oluştuğunu ne kadar iyi anlatabileceğini bana göster. Çok iyi mi anlatırsın? İyi mi anlatırsın? Biraz iyi mi anlatırsın? Hiç anlatamaz mısın?
H-YB3	Lütfen kelebekler hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
KG-YB4	Diyelim ki öğretmenin senden balıkların suyun altında nasıl nefes aldıklarını anlatmanı istedi. Lütfen balıkların suyun altında nasıl nefes aldıklarını ne kadar iyi anlatabileceğini bana göster. Çok iyi mi anlatırsın? İyi mi anlatırsın? Biraz iyi mi anlatırsın? Hiç anlatamaz mısın?
H-YB4	Lütfen balıklar hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
Daha önce hiç Bitkilere yakından baktın mı? Örneğin bir yaprağa, bir çiçeğe veya bir köke?	
KG-YB5	Kiki / Bodo (Kiki'yi / Bodo'yu göster) bitkiler hakkında çok şey biliyor. Kora / Momo (Kora / Momo'yu göster) ise bitkiler hakkında henüz çok şey bilmiyor. Lütfen bitkiler hakkında ne kadar şey bildiğini bana göster. Çok fazla mı biliyorsun? Çok mu biliyorsun? Biraz mı biliyorsun? Çok az mı biliyorsun?
H-YB5	Lütfen bitkiler hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
KG-YB6	Diyelim ki öğretmenin sana bitkilerin büyümek için neye ihtiyacı olduğunu sordu. Lütfen bitkilerin büyümek için neye ihtiyacı olduğunu ne kadar iyi anlatabileceğini bana göster. Çok iyi mi anlatırsın? İyi mi anlatırsın? Biraz iyi mi anlatırsın? Hiç anlatamaz mısın?
KG-YB7	Lütfen bitkilerin büyümek için güneş ışığına neden ihtiyaç duyduğunu ne kadar iyi anlatabileceğini bana göster. Çok iyi mi anlatırsın? İyi mi anlatırsın? Biraz iyi mi anlatırsın? Hiç anlatamaz mısın?
H-YB6	Lütfen bitkilerin büyümesi için neye ihtiyacı olduğu hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
KG- YB8	Diyelim ki öğretmenin sana bitkilerin tohumlarının nereden geldiğini sordu. Lütfen bu soruya ne kadar iyi cevap verebileceğini bana göster. Çok iyi mi cevap verirsin? İyi mi cevap verirsin? Biraz iyi mi cevap verirsin? Hiç cevap veremez misin?
H-YB7	Lütfen bitkilerin tohumları hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
Daha önce hiç mıknatıslarla oynadın mı? Mıknatıslara nelerin yapıştığını gördün mü? Örneğin, buzdolabının üzerindeki mıknatıslar gibi.	
KG-FB1	Kiki / Bodo (Kiki'yi / Bodo'yu göster) mıknatıslar hakkında çok şey biliyor. Kora / Momo (Kora'yı / Momo'yu göster) ise mıknatıslar hakkında henüz çok şey bilmiyor. Lütfen bana mıknatıslar hakkında ne kadar şey bildiğini göster. Çok fazla mı biliyorsun? Çok mu biliyorsun? Biraz mı biliyorsun? Çok az mı biliyorsun?
KG-FB2	Kora / Momo nelerin mıknatısa yapıştığını biliyor. Kiki / Bodo henüz bilmiyor. Lütfen bana nelerin mıknatısa yapıştığını ne kadar iyi anlatabileceğini göster. Çok iyi mi anlatırsın? İyi mi anlatırsın? Biraz iyi mi anlatırsın? Hiç anlatamaz mısın?
H-FB1	Lütfen mıknatıslar hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
Daha önce hiç bir küvette veya bir kovada nelerin yüzdüğünü ve nelerin battığını hiç denedin mi? Bir gölde nelerin yüzebildiğini ve nelerin battığını hiç gözlemledin mi?	
KG-FB3	Diyelim ki öğretmenin sana suda nelerin yüzdüğünü ve nelerin battığını sordu. Lütfen bu soruya ne kadar iyi cevap verebileceğini bana göster. Çok iyi mi cevap verirsin? İyi mi cevap verirsin? Biraz iyi mi cevap verirsin? Hiç cevap veremez misin?
H-FB2	Lütfen neden bazı şeylerin suyun üzerinde yüzebilirken bazı şeylerin yüzemediği hakkında daha fazla şey

	öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
Daha önce hiç içinde su ısıtılan tenceredeki suya ne olduğunu izledin mi?	
KG-FB4	Diyelim ki öğretmenin sana içerisinde su ısıtılan bir tencereden neden buhar çıktığını sordu. Lütfen bu soruya ne kadar iyi cevap verebileceğini bana göster. Çok iyi mi cevap verirsin? İyi mi cevap verirsin? Biraz iyi mi cevap verirsin? Hiç cevap veremez misin?
H-FB3	Lütfen ısınan sudan neden buhar yükseldiği hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
Daha önce hiç buzun erimesini izledin mi?	
KG-FB5	Diyelim ki öğretmenin sana buz erirken tam olarak ne olduğunu sordu. Lütfen bu soruya ne kadar iyi cevap verebileceğini bana göster. Çok iyi mi cevap verirsin? İyi mi cevap verirsin? Biraz iyi mi cevap verirsin? Hiç cevap veremez misin?
H-FB4	Lütfen buz erirken neler olduğu hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
Daha önce hiç öğretmeninle veya evde ailenle yağmurun nasıl oluştuğu hakkında konuştun mu?	
KG-FB6	Diyelim ki öğretmenin sana yağmurun nasıl oluştuğunu sordu. Lütfen bu soruya ne kadar iyi cevap verebileceğini bana göster. Çok iyi mi cevap verirsin? İyi mi cevap verirsin? Biraz iyi mi cevap verirsin? Hiç cevap veremez misin?
H-FB5	Lütfen yağmurun nasıl oluştuğu hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?
Daha önce hiç öğretmeninle veya ailenle yazın havanın neden sıcak, kışın ise neden soğuk olduğu hakkında konuştun mu?	
KG-FB7	Diyelim ki öğretmenin sana havanın yazın neden sıcak, kışın neden soğuk olduğunu sordu. Lütfen bu soruya ne kadar iyi cevap verebileceğini bana göster. Çok iyi mi cevap verirsin? İyi mi cevap verirsin? Biraz iyi mi cevap verirsin? Hiç cevap veremez misin?
H-FB6	Lütfen yaz ve kış gibi mevsimler hakkında daha fazla şey öğrenmekten ne kadar hoşlandığını bana göster. Çok fazla mı hoşlanırsın? Çok mu hoşlanırsın? Biraz mı hoşlanırsın? Çok az mı hoşlanırsın?