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CONTENT

SIBEL YOLERI, Examination of Variables Affecting Pre-school Teachers' Levels of Liking of Children.....	4
SEMA SOYDAN, Development of a Scale for Addition and Subtraction Skills of 61 to 72 Month old Children: Validity and Reliability Study.....	23

Examination of Variables Affecting Pre-school Teachers' Levels of Liking of Children¹

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Abstract

The main purpose of this study is to investigate the relation between some socio-demographic characteristics of the teachers and liking of the children. The study group of the research consists of 135 teachers working in kindergarten and nursery schools in Uşak province that are bound to the Ministry of Education. The research has a general screening model and conducted with quantitative research technique. Data collection tools of the study are Barnett Liking of Children Scale and Personal Data Form. According to the results of the study, which was conducted to examine the children liking level of the teachers based on different variables, it was found out that the variables of service of years and having a child did not lead to change in the children liking level of the teachers whereas the variables of age and marital status showed statistically significant differences in the levels of the teachers for liking the children.

Key Words: Preschool teachers, liking of children, preschool period.

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preschool period has an importance as much as

1.Introduction

Teachers are the most fundamental elements of the education systems. Teachers have a great importance in the development of a country, raising qualified manpower, providing comfort and national peace in the society, making the individuals social and prepared for the social life, and transferring the culture and values of the society to the next generations (Özden, 1999; Çelikten, Şanal &Yeni, 2005).

The preschool period is a stage that has a vital importance in many areas in terms of human life (Bernstein et al., 1994). In an effective and productive preschool process, one of the most important components is the teacher. The teacher in the

materials and the curriculum, and even more. The person welcoming the children who leave their parents and come to the school is the teacher (Oktay, 1991). Therefore, the qualifications that the teacher has gain more importance in preschool period (Saltalı & Erbay, 2013). In this case, a good preschool teacher must have a good field information, teacher knowledge and skills, general culture as well as some personal and physical features and abilities (Öztürk, 2006). Before anything else, the teacher must accept the children as individuals, be patient, lovely and tolerant, have many positive attitudes

such as loving the nature and the people (Gürkan, 2005; Özsoy et al, 2010; Üstünoğlu, 1990).

There are lots of variables affecting their level of educational efforts and being target-oriented.

Some researchers (Rimm-Kaufman & Sawyer, 2004; Beyazkürk & Kesner, 2005) state that the attitudes of the teachers and their ways of relations with the children are directly related with their behaviors and applications in the class. The attitude towards children is a reflection of one's basic belief in terms of children and being with together with children (Barnett & Sinisi, 1990; Erdem & Duyan, 2011). Loving a child is one of the most accepted

ways unrequited love (Fromm, 2011; Yapıcı & Yapıcı, 2004). Lasley (1980), emphasizes that loving children is a prior condition for those who preferred to be a teacher and for being an effective teacher whether loving children or not and being lovely are crucial characteristics (Cited in Brown, Morehead, & Smith, 2008). In many studies conducted abroad about the reasons of becoming a teacher, "wanting to work with children" is among the most outstanding reasons (Brown, 1992). The studies mention the importance of teachers' and prospective teachers' being lovely and liking children for an effective teaching (Walls et al., 2002). In a research carried out with

prospective teachers, Marso and Piggie (1994), also state that liking working with the children is one of the most important variables in being a teacher. In Üstün, Erkan and Akman's (2004) study examining the attitudes of prospective preschool teachers towards the job of teaching, prospective teachers expressed that their reason to choose that job was their liking children.

When the studies conducted on job areas, where people work with children, are examined, it is observed that the number of qualitative and quantitative studies focusing on the tendency of the jobholders on liking the children is quite insufficient. In a limited number of studies

analyzing the preschool teachers' and/or prospective teachers', who have important places in children's lives, levels of liking the children; the empathy skills of the teachers, and the tendencies and attitudes of prospective teachers on liking the children are handled (Çelik, Sarıtaş & Çatalbaş, 2013; Çakmak, Elibol & Erdem, 2014; Saltalı & Erbay, 2013). By reviewing of the literature, this study is thought to contribute to the field since the number of studies focusing on the characteristics that the preschool teachers, who are quite important in children's lives, must have and the relation between and the socio-demographic features that can affect liking the children and

teacher characteristics is limited. Therefore, the purpose of this study is to analyze the relation between some socio-demographic and professional characteristics of the preschool teachers and the level of liking children. With this purpose, answers for the following research questions are sought:

Is there a statistically significant difference between the age variable of the teachers and the scores that they get from the liking of children scale?

Is there a statistically significant difference between the marital status variable of the teachers and the scores that they get from the liking of children scale?

Is there a statistically significant difference between having a child or not variable of the teachers and the scores that they get from the liking of children scale?

Is there a statistically significant difference between the years of service variable of the teachers and the scores that they get from the liking of children scale?

2. Method

2.1. Model

Relational survey method was used in this study.

2.2. Participants

By making contact with the Uşak Provincial Directorate of the National Education, the number of the teachers working in the province and their schools were identified. After

the necessary permissions were granted from the Provincial Directorate of the National Education, the data collection tools were sent to all the preschool teachers working in Uşak province center with an explanation on the purpose of the study and how to fill in the scales, all as printed documents in closed envelopes. Later, the teachers were asked to fill in the scales and send them back again in closed envelopes without writing their names. After the scales filled in a wrong way were omitted, the research was carried out with the remaining 135 respondents.

2.3. Measures

The first instrument, prepared by the researcher, aims to gather demographic

information regarding age, marital status, income level and teaching experience.

Barnett Liking of Children

Scale: This scale was developed by Barnett and Sinisi (1990). Duyan and Gelbal (2008) conducted reliability–validity studies on the scale for the Turkish version. There are 14 items in the scale ranging from “strongly disagree” to “strongly agree” on 7-point Likert scale. Four of the items are negative means (items 3,6,10 and 13), and ten items are positive means. The high scores from the scale mean that the participants’ love children more; the low scores mean that their liking of children level is low.

2.4. Data Analysis

Before analyzing the data, the test of normality of the collected data was done. In order to test whether the scores of the teachers for Liking of Children Scale vary based on their marital status variable, t-test was applied. To test whether the scores of the teachers for Liking of Children Scale vary based on their age variable, one-way analysis of variance (ANOVA) was done.

Kruskal Wallis H test was applied to evaluate the data that were detected not to have a normal distribution. In order to test whether the scores of the teachers for Liking of Children Scale vary based on their years of service and having a child variables, Kruskal Wallis H test was done. The data was analyzed using SPSS 20 software.

3. Results

Table1. The results of the t-test related to the scores of the teachers for Liking of Children Scale based on their marital status variable

	<i>Marital Status</i>	N	X	Ss	T	p
Liking of Children	Married	95	87.85	7.38	1.184	0.02*
	Single	40	83.35	6.83		
	Total	135				

*p<0.05

According to Table 1, the scores for liking of the children scale of the teachers that participated in the study show a statistically significant difference based on the variable of their marital status ($p < .05$). The mean scores of the married teachers for liking of the children are found to be significantly different from those of single teachers.

Table 2. The results of ANOVA regarding the children liking scores of the teachers based on their age variable

		n		Sum of Squares	df	Mean Square	F	p
Liking of Children	20-30	76	Between Groups	37.46	2	18,73	2,67	.04*
	31-40	41	Within Groups	9433.87	132	71,46		
	41-50	18	Total	9471.33	134			
								Source of Differences (20-30 with 31-40 and 41-50 meaning

* $p < 0.05$

According to Table 2, the scores for children liking scale of the teachers that participated in the study show a statistically significant difference based on the age variable ($p < .05$). As a result of the multiple comparisons made to identify where the difference is in different age groups, the children liking scores of the 20-30 year-

old age group teachers are higher than those of 31-40 and 41-50 year-old ones.

Table 3. The results of Kruskal Wallis H test related to the scores of the teachers for children liking based on their year of service variable

Year of service variable	n	Mean Rank	χ^2	Sd	<i>p</i>
1-10 year	102	71.28	2.976	2	.23
11-20 year	16	56.59			
21-30 year	17	59.06			

In Table 3, the scores for children liking based on the years of service variable are seen. It was found out that there is no statistically significant difference between teachers' years of service and their children liking level ($\chi^2 (2) = 2.976, p > .05$).

Table 4. The results of Kruskal Wallis H test related to the children liking scores of the teachers based on their having a child variable

Status of having children	n	Mean Rank	χ^2	Sd	<i>p</i>
I have no children	61	66.75	2.962	3	.40

One	34	72.09			
Two	34	62.37			
Three and older	6	89.50			

When Table 4 is examined, it can be seen that the children liking scores of the children do not show a significant difference based on having a child variable ($\chi^2 (3) = 2.962, p > .05$).

4. Discussion

As a result of the current research, which was conducted to examine the children liking level of the teachers based on different variables, it was found out that the variables of service of years and having a child did not lead to change in the children liking level of the teachers whereas the variables of age and marital status showed statistically significant differences in the levels of the teachers for liking the children.

The teachers, who are married a between 20-30 years old, had higher points for the children liking level.

The results of the study support the findings of this study. Studies show that the level of liking children is affected by age, gender, some socio-demographic features, and experiences related to childhood and children (Barnet & Sinisi, 1990; Erdem & Duyan, 2011; Happell, 2000). The

married teachers were detected to like the children more than the single ones. Gelbal and Duyan (2010) found out that the primary school teachers had no difference from each other in terms of liking the children based on the gender variable. Again in the same study, the married teachers were spotted as to have the highest scores for children liking while single and divorced ones' scores were lower. Bowen, Radhakrishna, and Keyser (1994) revealed that the married children were happier in their jobs compared to the single teachers. It was found out that based on the age variable, the teachers who are between 20-30 years old have higher scores for children

liking than the teachers who are between 31-40 and 41-50 years old. In a study carried out to define the children liking tendencies of prospective preschool teachers, (Yazıcı, 2013), it was explored that the age is a very effective variable in the tendencies of prospective teachers towards children liking.

No significant differences were found in the children liking levels of the teachers based on the years of service variable. In a study conducted by Çakmak, Elibol and Erdem (2014) with 109 preschool teachers, the variables of age, having a child, and professional seniority did not affect the children liking levels of the teachers.

The variable of having a child did not lead to any difference in the children liking scores of the teachers. Different findings were achieved about this topic in the relevant literature. Gelbal and Duyan (2010) found that the teachers having a child had higher scores for children liking. Erdem and Duyan (2011), who did a research to define the children liking of the nurses working in pediatric services, on the other hand, found out that there were no significant differences between the children liking scores and the variable of having a child.

The findings of the prior study (Bastick, 2000; Boz & Boz, 2008; Brown, 1992; Kyriacou, & Coulthard, 2000;

Saban, 2003) indicate that the job preferences of the prospective teachers are shaped on the basis of factors in three main categories. These are altruist reasons (e.g. the wish to be useful for the society), internal reasons (e.g. loving the job, liking the children), and thirdly external reasons (long holidays, social security). In preschool education, it is important to like the children so as to meet the interest and needs of them, manage the classroom, and create enjoyable and pleasurable learning environments (Ergün & Özdaş, 1999). Kasapoğlu and Akyol (2012) suggested that there is a relationship between attitudes of teachers who are in

charge in preschool education institutions towards child rights and their behaviors related to the liking of children; the liking of children affected teachers' attitudes towards child rights.

To conclude, in providing the job satisfaction of the teachers who are one of the most important components of a successful education, their interest, willingness, and liking of the children by planning a quality education process have crucial importance. Therefore, while placing prospective teachers into universities, choosing the individuals who like the children and are

interested in working with them can be envisaged. Supporting and developing the positive characteristics that the teachers have might contribute to them in terms of their understanding, listening and showing empathy to children.

The current study is limited with the data collected from the preschool teachers. For further research, studies related to the children liking and variables affecting the liking of the children of the people from other professions who work with children might be carried out.

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Development of a Scale for Addition and Subtraction Skills of 61 to 72 Month old Children: Validity and Reliability Study

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Abstract

The principal aim of this study was to carry out a validity and reliability study on the Scale For Addition and Subtraction Skills (SASS) developed to determine addition and subtraction skills of 61 to 72-months-old children. The sampling group of the study comprised 200 children aged 61 to 72 months who are attending official nursery schools. A literature study concerning the addition and subtraction skills which preschool age children are expected to have was conducted by the author in order to develop the SASS with 20 items. The validity study on the scale was conducted through exploratory factor analysis with the opinions of experts. Results from the exploratory factor analysis backed up the finding that the scale is composed of two dimensions. In the statistics for the reliability study of the scale, the Cronbach's alpha reliability coefficient was found to be 0.97 and the Sperman-Brown coefficient was 0.91. A t-test analysis comparing the upper and lower 27% of the total scores a significant difference in favour of the upper group. The mean item strength of the scale was 0.72. In addition, the overall mean inter-item correlation of the scale was 0.73. Considering the results obtained from the study it can be concluded that the SASS scale consisting of 20 items and two factors that has been developed has structural validity.

Keywords: Addition and Subtraction Skills, Scale Development, Preschool Education.

Introduction

In the preschool age several skills are taught to children to prepare them for primary school education. One of the most important of these skills is the basic addition and subtraction skill mathematics. Children bring with them to preschool educational institutions various perceptions and skills related to numbers and basic mathematical operations that they have experienced in their everyday lives. They have opportunities to use numbers, for example, related to vehicle licence plates and phone numbers, and in simple addition-subtraction operations in shopping (Akman, 2002; Carrasumada, Vendrell, Ribera and Montserrat, 2006; Clements and Sarama, 2003; Gözübatık Tarım and Deretarla Gül, 2003). They also learn the mathematical way of thinking during preschool age education and get used to mathematical concepts in the primary school age by expressing their thoughts in mathematical terms (Ginsburg, Lee and Boyd, 2008). In other words, quality preschool programs serve a substantial function in

improving early mathematical skills of children that are necessary for primary school mathematics education (Charlesworth and Lind, 1999; Dearing, McCartney and Taylor, 2009; National Research Council, 2001; NMAP, 2008).

Preschool programs in Turkey cover various activities to enable preschool-age children to learn basic mathematical concepts. Interrelations, equalling, grouping, pattern forming, ranking, counting, addition-subtraction, recognizing geometric shapes and drawing graphs are among these mathematical activities (MEB, 2012).

Through such activities, preschool-age children who

already have mathematics-related skills are able to recognize addition when they mix a group of items with another and subtraction when they separate a group of items from another group (Butterworth, 2005). They can easily understand if the question asked is about addition or subtraction operations and try to solve the problem through various means. Addition and subtraction is directly linked to counting and by use of that link children can for example, say it should be two when a bead is added to another or it should be one when two beads are subtracted from three beads (Greenberg, 1994; Lansdell, 1999, Aktaş, 2012).

Zur and Gelman (2004), in his study, showed that 3- and 4-year old children understand that addition corresponds to increase in the number of items and subtraction corresponds to a decrease.

However, it is essential to use real items in order to enable little children to learn such operations (Greenberg, 1994; Lansdell, 1999, Aktaş, 2012). Gilmore and Braynt (2005) showed that use of concrete items and various presentations methods positively affect the children's mathematical thinking. Providing children in their pre-operational age with concrete cases when introducing concepts also has an important role in accomplishing the

desired goal. Therefore, the question "What is two plus one equals to?" asked to preschool children should be replaced with "I had two balls, and someone gave me another ball. How many balls do I now have?" (Aktaş 2012; Greenberg 1994, Lansdell 1999). When such verbal problems which cover addition operations are introduced to the children, every combination should be showed to them with concrete items or materials. In addition, several studies have shown that changes in the place of numbers does not change the result of the operation. In other words, studies to be carried out should be conducted using the principle $N+1$ (e.g., $1+0=1$, $1+1=2$,

$1+2=3, 1+3=4$). In addition, several studies have shown that changes in the place of numbers does not change the result of the operation (e.g., $2+3=5, 3+2=5$). Such exercises may be carried out by using numbers less than 10 depending on the age of the target population. Addition and subtraction operations are complementary, commutative and inter-related operations. For example, the operation $5+3=8$ can be written by the children in the form of $8-5=3$ or $8-3=5$. Comprehension of this relationship by preschool age children would facilitate understanding of the operation of the concept (Baroody, Ginsburg and Waxman, 1983).

Moreover, it can be observed from the relevant literature that researchers group verbal problems relating to addition and subtraction into several categories depending on the relationships included in them (Carpenter and Moser, 1983, Gutstein and Romberg, 1995, Fenneme, Carpenter, Levi Franke and Empson, 1997 cited Van De Walle, 2001), for example, join, separate, compare and part-whole problems. These main categories are then divided into sub-categories depending on three elements, initiation, change and result.

Join problems. For the action of joining, there are three quantities involved: an initial amount, a change

amount (the part being added or joined), and the resulting amount (the amount after the action is over). In other words, for children, addition corresponds to joining or adding two quantities to each other. Joining two groups of items means an addition operation for children. A child, after sufficient experience with addition problems thinks that he/she could use the addition operation in order to solve this problem. After the child joins the quantitative amounts within the item groups, he/she counts the newly generated quantity and gives the answer (Tucker, Singleton and Weaver, 2002).

Separate problems. In the separate problems, the initial

amount is the whole or the largest amount, whereas in the join problems, the result was the whole.

Part-part-whole problems. Part-part-whole problems involve two parts that are combined into one whole. The combining may be a physical action, or it may be a mental combination where the parts are not physically combined.

Compare problems. Compare problems involve the comparison of two quantities. The third amount is not actually present but is the difference between the two amounts.

Charlesworth and Leali (2012), state that measurement of how children understand

mathematics is an important factor. Thus, problem solving skill is an important tool that can be employed to assess mathematical thinking of children (Charlesworth and Leali, 2012). After reviewing studies assessing preschool-age children's mathematical skills in the literature, it is observed that several training programs which enable improvement of mathematical skills of children have been developed and are applied, to fill the international void in this field (Bermejo, Morales and DeOsuna, 2004; Gilmore and Braynt, 2006; Sandra, Linder, Powers-Costello and Stegelin, 2011; Starkey, Klein and Wakeley, 2004; Wolfgang, Stannard and Jones, 2003).

When the literature in Turkey in this field is reviewed it is seen that measuring tools for assessment of mathematical skills are limited in number. In addition, it is observed that the said scales for determination of mathematical skills concentrate mainly on number-related skills while items concerning addition and subtraction skills are highly limited (Aktaş Arnas, Deretarla-Gül, Sığirtmaç, 2003; Başaran, 2006; Erdoğan and Baran, 2006; Unutkan, 2003).

Table 1 shows that there is no scale in Turkey designed specifically for determination of addition-subtraction skills of preschool-age children and that existing scales employ very limited number of items which are for operation skills

and are not capable of to addition-subtraction skills.
 assessing all the steps relating

Table 1. Turkish scales on addition-subtraction skills

SCALE PREPARED BY	NAME OF SCALE	SCALE ITEMS
Unutkan (2003)	Marmara Scale of Readiness to Primary School	5 questions on mathematical exercises sub-aspect
Somwari, adopted into Turkish by Başaran (2006)	Test of Early Learning Skills (TELS)	2 questions on sub-scale of number skills
Arnas, Deretarla-Gül and Sığırtmaç (2003)	Number and Operation Comprehension Test for 48 to 86-months-old Children	88 items including counting, number writing, number recognition, matching, number conservation, ordinal numbers, addition and subtraction
Ginsburg and Baroody (2003), adopted into Turkish by Erdoğan and Baran (2006)	Test of Early Mathematics Ability-3 (TEMA-3)	72 questions measuring informal mathematics such as more-less, counting, informal calculation and formal mathematics such as numbers, relations between numbers, calculation and decimal concept

Since the children who have already acquired addition and subtraction skills should be able to count up to 10, recognize numbers, read and write, know how to rhythmic count upwards and downwards, be familiar with basic arithmetic skills (such as one-to-one matching, classification and ordering), number conservation success of children in operational skills is considered as a significant indication of their mathematical skills. However, there is no specific and comprehensive measuring tool concerning mathematical skills of preschool-age children that would provide important information about those skills, which means there is a significant shortage in this field. Therefore in this study, in order to determine addition

and subtraction skills of 61 to 73-month-old children who are attending preschool educational institutions in Turkey, it is aimed to develop a Scale for Addition and Subtraction Skills (SAAS) and to conduct validity and reliability tests on it.

Method

Participants

The target population consisted of 61 to 72-months-old children attending official independent nursery schools of the Ministry of National Education in Konya, Turkey in the 2011-2012 academic year. The study population was selected through the stratified sampling method among schools which represent families and their children of three different socio-economic and cultural levels (low, mid and

high) in three central districts of Konya, determined by the Directorate of National Education. The sampling group consisted of 200 male and female children, 80 of whom were from Selçuklu district, 70 from Karatay district and 50 from Meram district, representing 4%, 4% and 2% of the population, respectively (Neuman, 2007). The sampling group was composed of 112 female (56%) and 88 (44%) male students. The mean age of the children was $X = 71,08$ ($\pm 0,83$) months.

Scale Development Process

The first step taken to develop the scale was to determine addition-subtraction skills that the 6-year old children are expected to have.

While designing the scale items, an extensive literature review was conducted on addition and subtraction operations (Aktaş Arnas, 2012; Artut and Tarım, 2006; Avcı and Dere, 2002; Barth, La Mont, Lipton and Spelke, 2005; Barth et al., 2006; Butterworth, 2005; Diaz et al, 2009; Gifford, 2005; Gilmore and Braynt, 2006; Greenberg 1994; Griffin, 2004; Kamii and Housmann, 2000; Ktoridou, Eteokleous and Gregoriou, 2005; Lansdell 1999; MEB; 2012; Slaughter, Kamppi, and Paynter, 2006; McCrink and Wynn, 2004, Tarım and Deretarla Gül, 2003; Tucker, Singleton and Weaver, 2002; Zhou and Wang, 2004; Zur and Gelman, 2004;) Sources relating to scale development

and scales already developed for addition and subtraction skills were analysed (Aktaş Arnas, Deretarla-Gül, Sığirtmaç, 2003; Başaran, 2006; Erdoğan and Baran, 2006; Unutkan, 2003). Through the scales examined in the literature, information on stages of development of an addition-subtraction skills scale was collected. From these sources it was observed that preschool age children were more successful at verbal questions such as “I had two balls, and someone gave me another ball. Now how many balls have I got?”, in comparison with direct questions such as “what is two plus one equals to?”

In addition, many researchers state that

preschool-age children are able to easily understand, when asked a question, whether the problem is about addition or subtraction (Aktaş Arnas 2012; Greenberg 1994, Lansdell 1999) and that it is necessary to explain what the symbols “+” “-” “=” do mean (Aktaş Arnas, 2012; Baykul, 1999; Nair and Pool, 1991; Orton, Frobisher, 1996; Charlesworth and Radloff, 1991). In light of the foregoing studies, the children were asked to explain whether the verbal question involves an addition or a subtraction operation and to show the symbol relating to that operation.

In addition, in the literature review conducted during determination of the

verbal problems to be included in the scale it was identified that there are four different problem types (Carpenter and Moser, 1983, Gutstein and Romberg, 1995, Fenneme, Carpenter, Levi Franke and Empson, 1997 cited Van De Walle, 2001); which are joining, separation, part-whole and comparison problems. While developing the scale items, 10 joining problems with unknown results for addition, 3 joining problems with unknown change, 2 separation problems with unknown result, 1 separation problem with unknown change, 2 separation and 2 comparison problems were included. In addition, while selecting the numbers to be used in addition questions,

findings of a study relating to which numbers children are more successful in adding and those they find it hard to add were utilized (Kamii and Housman 2000).

Twenty items in total, 10 involving measuring addition skills and 10 involving subtraction skills, were developed by the researcher based on the theoretical basis given in the sources mentioned above. The millipede toy with magnetic beads, number and symbol cards were prepared for the scale. The children were asked all questions in the scale using the toy "Koki".

An example of scale item for addition

Tell the children that “Koki has got two feet now” and place magnetic beads on Koki’s feet one by one. Then place the number card under the beads. Tell them that “Koki has eaten food cooked by her mother for 1-2 days” and place magnetic beads near Koki’s foot one by one. Then place the number card under the beads.

Next use the addition operation by saying “Koki wants to know how many feet she will have when two more feet are added to her. Can you show me the total number of legs on the big millipede with the beads? Can you find the number card showing the total number of legs and place it

here (under the beads)?” After the child gives his/her answer place the number cards onto the table like “2 2 4”. Then after showing all symbol cards to the child ask the him/her to find relevant mathematical symbols (+ - =) and place them on appropriate points.

An example of scale item for subtraction

Tell the children that “Koki has got 1-2-3-4-5 legs now” and place magnetic beads to on Koki’s legs one by one, then place the number card under the beads. Then tell them that “One day Koki got injured and lost two legs” and place the number card under the beads.

Then tell them that “Koki, now, wants to know how many

legs she have got now. Can you show the remaining number of legs on the big millipede with the beads? Can you find the number card showing the remaining number of legs and place it here (under the beads)? After the child gives

his/her answer place the number cards onto the table like "5 2 3". Then after showing all symbol cards to the child ask the him/her to find the relevant mathematical symbols (+ - =) and place them on appropriate points.

The structures of problems in the SAAS are as follows:

Table 2: Structures of problems in the SAAS

Category	Structure	Problem no.	Operation
		1	$2+2=?$
		2	$5+5=?$
		3	$1+5=?$
		4	$4+2=?$
Join	Result	5	$2+3=?$
	unknown	6	$3+2=?$
		7	$5+2=?$
		8	$3+4=?$
		9	$6+3=?$
		10	$3+6=?$
	Change	14	$3+?=5$

	unknown	15	$5+?=8$
		16	$3+?=8$
	Result	11	$5-2=?$
	unknown	13	$7-3=?$
Separate	Change	12	$5-?=3$
	unknown		
Part-		17	$6-1=?$
whole		18	$8-3=?$
Compare		19	$6-4=?$
		20	$6-2=?$

The problems are as follows:

Joining: with unknown result:

“Koki has got 3 feet now. Koki had insisted on eating food cooked by their mom regularly for 4 days. Koki wants to know how many feet will he have when 4 additional feet are added to his existing 3 feet. ($3+4=?$)

Joining - with unknown change:

“Koki has got 3 feet now but Koki has to have 5 feet in order

to start school. Koki wants to

know how many additional feet

Koki needs to have 5 feet in total. ($3+?=5$)

Separation- with unknown

result: *“Koki has got 5 feet. One day Koki got injured and lost 2 feet. Koki wants to know how many feet he has got now. ($5-2=?$)*

Separation- with unknown

change: *Koki has got 5 feet. One day Koki got injured and lost*

some of his feet. Koki knows that he has got 3 feet now but also wants to know how many feet he has lost. (5-?=3)

Part-whole: "Koki has got 6 feet. One of his feet is red and remaining are blue. Koki wants to know how many blue feet he has got. Can you show me the number of blue legs of Koki by using the bead on the millipede? Can you show me the number card relating to the number of blue legs? (6-1=?)

Comparison: "Koki has got 6 feet but his classmate has got 4 feet. Koki wants to know how many more feet he has got in comparison with his classmate. Can you show me the number of extra feet by using the millipede? Can you show me the

number card relating to the result you found?"(6-4=2)

The draft scale developed was submitted to ten specialists in preschool age mathematics education and preschool age education for their opinions. The specialists examined the scale to ascertain whether or not the items were appropriate for preschool age students' knowledge level and for measuring their addition and subtraction skills. All the specialists highlighted that items included in the scale covered addition and subtraction skills, no additional item or aspect should be supplied, the scale uniformly included behaviours relating to all addition and subtraction skills, behaviours

were matching one another in terms of coverage and level and that a clear and understandable way of expression was used for the preschool-age children.

Procedure

For the data acquisition stage, interviews with schools and explaining the purpose of the study were of primary concern. Then children who had agreed to be included in the study were gathered in a suitable room in the school. After informing the children of the study, the SAAS was administered to each child individually. The scale was administered in a quiet environment in order not to disturb the researcher and the children. All items were administered to children

starting from the addition questions in the same order. The test took about 20 minutes for each child.

Pre-test Stage

In the pre-test stage the scale was administered to 50 children, 23 of whom were females and the remaining 27 were males. The children included in the study were selected by use of the stratified sampling method in schools that represent families and their children of different socioeconomic and cultural levels (low, mid and high) that were determined by the Directorate of National Education from three central districts of Konya. Twenty children from Selçuklu district, 15 from Karatay district and

another 15 from Meram district (50 children in total) were included in the study. No problem or interruption was observed during the practices. The Cronbach's alpha reliability coefficient was found to be 0.93 in the reliability analysis that was conducted., The SAAS was next administered to 200 preschool-age students other than those who were included in the pre-test stage and analysis of the distribution of scale scores was conducted.

Data Analysis

The data obtained after the administration of the SAAS to the sampling group was uploaded to SPSS 16 software in order to conduct validity and

reliability analysis on the scale by statistical means.

Correct answers given by the children to each question were scored 2 points, short answers scored 1 point and wrong answers scored 0 points. When a child gave the correct answer but incorrectly placed the symbol cards or correctly placed the symbol cards but gave wrong answers then these were deemed to be short answers. The validity and reliability studies were conducted using the scores obtained from the answers given by the children.

Exploratory Factor Analysis was employed to determine the structural validity and factorial structure of the SAAS. In addition, the

Cronbach's alpha internal consistency coefficient and the Spearman-Brown formula were utilized, and corrected item-total correlations and item strength indices were examined. Moreover, in order to identify the scale's distinctiveness the total scores of the upper and lower 27% of the students were assessed.

Findings

Findings on the Validity of the Scale

Structural Validity

The Kaiser-Meyer-Olkin (KMO) coefficient and the Barlett Sphericity Test were employed firstly in the study in order to determine the

compliance of the data with the factor analysis. Kaiser says that the value is perfect as it approaches to 1, unacceptable when smaller than 0.50 (perfect at 0.90's, very good at 0.80's, moderate at 0.70's and 0.60's and poor at 0.50's) (Tavşancıl, 2005). In addition, the Barlett Sphericity Test was employed to determine if the data comes from a multi-variable normal distribution. The statistics of the Chi-square test derived from the test was reasonable which indicates that the data comes from a multi-variable normal distribution (Şencan, 2005; Tavşancıl, 2005).

Table 3. Results of KMO and Barlett Tests (N = 200)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		
		0.95
<hr/>		
	X ²	4.12
Bartlett Sphericity Test	df	19
	P	0.00
<hr/>		

It is observed that the KMO value was 0.95 and the Bartlett Test was significant (chi-square: 4.12, df = 19, p = 0.00, p < 0.001) which shows that the scale is perfectly suitable for factor analysis of the data.

The factor analysis test of the SAAS was performed using Principle Component Analysis. In order to support this study and to have a consistent factor number, Scree plots based on the eigenvalues of the factors were also examined (Büyüköztürk, 2011). During the examination the discontinuities in the graph were also taken into consideration; it was observed that the structure of the scale was concentrated on two factors as determined earlier. Factor analysis was employed in order to provide structural validity for the scale. For the next step the Varimax Vertical Rotation (Büyüköztürk, 2011) technique was found appropriate to group items which showed close relationships with each other. The criteria used while determining the items measuring the same structure were that load

value of an item in its factor was 0.35 and the difference between the factor load value of an item whose load value is equal to or greater than 0.35 and load factors in other factors was at least 0.10 (Hair et al., 2006).

Table 4. Results of Factor Analysis of the Scale for Addition and Subtraction Skills (N = 200)

	<u>Factor</u>	Varimax Vertical
	<u>Load</u>	Rotation
	<i>Values</i>	
	<i>before</i>	
	<i>Rotation</i>	
		Addition
		Skill
		Subtraction
		Skill
Item 1	0.70	0.74
Item 2	0.75	0.77
Item 3	0.77	0.80
Item 7	0.76	0.76
Item 5	0.75	0.76
Item 6	0.70	0.72
Item 7	0.76	0.74
Item 8	0.79	0.81
Item 9	0.82	0.80

Item 10	0.77	0.79
Item 11	0.63	0.59
Item 12	0.69	0.64
Item 13	0.70	0.63
Item 14	0.76	0.78
Item 15	0.79	0.80
Item 16	0.79	0.81
Item 17	0.56	0.54
Item 18	0.48	0.57
Item 19	0.69	0.75
Item 20	0.79	0.83

One can observe after examining Table 4 that load factor of the Scale for Addition and Subtraction Skills, Varimax Rotation and Rotated Component Matrix for the first factor varies between 0.72 and 0.81 and between 0.54 and 0.83 for the second factor load level. According to the total variance observed from the Component Analysis 2 factors exist which corresponds to 72.66% of the total variance. The findings show that the eigenvalue of the first and second factor is 7.9 and 6.5, respectively and they correspond to variance levels of 39.68% and 32.98%, respectively. The inter-subscale correlation coefficient of the scale is 0.84.

Findings on the Reliability of the Scale

In order to determine the reliability of the SAAS Cronbach's alpha and Spearman Brown reliability coefficient calculations were utilized. Reliability values for each factor and for the entire scale are summarized in Table 5.

Table 5. Reliability Values for Each Factor and for the Entire Scale (N = 200)

Factors	Number of items	Spearman Brown	Cronbach's Alpha
Addition Skill	10	0.95	0.96
Subtraction Skill	10	0.93	0.94
Total	20	0.91	0.97

As given in Table 5, the Spearman Brown reliability coefficient for the aspect "Addition Skills" which is the first aspect of the SAAS is 0.95 and the Cronbach's alpha reliability coefficient is 0.96. Corresponding values for the "Subtraction Skills" which is the second aspect are 0.93 and 0.94, respectively. Spearman Brown reliability coefficient and Cronbach's alpha reliability coefficient

for the entire scale was found to be 0.91 and 0.97, respectively. Internal consistency coefficients calculated indicated high level of reliability for the scale.

Item Distinctiveness

In this part item distinctiveness levels were tested by calculating correlations between the scores obtained from the factors and scores obtained from each item in the factors, by use of the item total correlation method. Item-factor correlation values for each item are given in Table 6.

Table 6. Item Distinctiveness Strength (r) and Item Strength (p) Values for the Scale for The AAS (N = 200)

Addition Skill			Subtraction Skill		
I.	r	p	I.	r	p
1	0.78(**)	0.89	11	0.76(**)	0.82
2	0.81(**)	0.74	12	0.80(**)	0.69
3	0.81(**)	0.78	13	0.81(**)	0.79
4	0.83(**)	0.78	14	0.80(**)	0.55
5	0.81(**)	0.82	15	0.80(**)	0.55
6	0.79(**)	0.82	16	0.79(**)	0.50
7	0.83(**)	0.77	17	0.72(**)	0.84
8	0.82(**)	0.80	18	0.64(**)	0.80
9	0.85(**)	0.75	19	0.74(**)	0.57

10	0.82(**)	0.75	20	0.77(**)	0.50
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As seen in Table 6 item factor correlation coefficients vary between 0.78 and 0.85 for the first factor and between 0.64 and 0.81 for the second one. Mean item distinctiveness power of the scale is 79. Each item is in a significant and positive relationship with the entire factor ($p < 0.001$). As seen in Table 6, item strength values of the scale vary between 0.74 and 0.89 for the first factor and between 0.50 and 0.84 for the second factor. Mean item strength of the scale is 0.72. In addition, overall mean inter-item correlation of the scale is 0.73.

In order to measure the efficiency of each item included in the scale in distinguishing individuals and assess their internal consistency, the scale scores were ordered from lowest to highest and the lower and upper 27% groups were compared. T-tests were employed to determine the significance level of the differences between item scores. The test scores were first ranked from lowest to highest and the lower and upper 27% of the groups were determined. Then scores of individuals included in these groups were compared.

Table 7. Results of Independent t-test analysis for Comparison of Average Scores of Lower and Upper 27% Groups taken from the SAAS

	Groups	N	x	Ss	t
Addition	Upper-group	52	17.30	3.72	21.4***
	Lower-group	52	3.60	2.55	
Subtraction	Upper-group	52	15.09	4.32	19.9***
	Lower-group	52	2.17	1.62	
Total	Upper-group	52	14.67	4.77	16.81***
	Lower-group	52	2.63	1.96	

Average scores of the upper group are higher in terms of both the total score and the sub-aspects of the scale and there was a significant difference in favour of the upper group ($p < 0.001$).

Findings on Accomplishment Level of Children in Addition and Subtraction Operations

The accomplishment level of children in addition and subtraction operations is given below in Table 8:

Table 8. Accomplishment level of children in addition and subtraction operations

Category	Structure	Question	Operation	Score	Number of correct answers	%
Join	Result unknown	1	$2 + 2 = ?$	0	22	11
				1	138	69
				2	40	20
		2	$5 + 5 = ?$	0	53	26,5
				1	102	51
				2	45	22,5
		3	$1 + 5 = ?$	0	43	21,5
				1	113	56,5
				2	44	22
		4	$4 + 2 = ?$	0	44	22
				1	114	57
				2	42	21
		5	$2 + 3 = ?$	0	36	18
				1	120	60
				2	44	22
		6	$3 + 2 = ?$	0	32	16
				1	120	60

				2	48	24
		7	$5 + 2 = ?$	0	41	20,5
				1	114	57
				2	45	22,5
		8	$3 + 4 = ?$	0	39	19,5
				1	116	58
				2	45	22,5
		9	$6 + 3 = ?$	0	47	23,5
				1	110	55
				2	43	21,5
		10	$3 + 6 = ?$	0	51	25,5
				1	104	52
				2	45	22,5
	Change unknown	14	$3 + ? = 5$	0	94	47
				1	74	37
				2	32	16
		15	$5 + ? = 8$	0	93	46,5
				1	74	37
				2	33	16,5
		16	$3 + ? = 8$	0	101	50,5
				1	65	32,5
				2	34	17

Separate	Result unknown	11	$5 - 2 = ?$	0	33	16,5
				1	132	66
				2	35	17,5
		13	$7 - 3 = ?$	0	42	21
				1	116	58
				2	42	21
Change unknown	12	$5 - ? = 3$	0	61	30,5	
			1	99	49,5	
			2	40	20	
Part-whole		17	$6 - 1 = ?$	0	31	15,5
				1	132	66
				2	37	18,5
		18	$8 - 3 = ?$	0	38	19
				1	128	64
				2	34	17
Compare		19	$6 - 4 = ?$	0	85	42,5
				1	85	42,5
				2	30	15
		20	$6 - 2 = ?$	0	115	57,5
				1	51	25,5
				2	34	17

From Table 8, it is seen that more than half of the children were successful in the additional problems. The questions which were verbal problems including numbers which resulted in the lowest success level were $5+5=?$ and $3+6=?$. It is thought that the success level was lower due to results being 9 and 10. It is found that more than half of the children were successful in the verbal separation and part-whole problems relating to the subtraction operation and that about half of them were unsuccessful in joining and comparison problems with unknown change. Nevertheless, it is was found that about 20% of the children were successful in addition problems, 20% in separation and part-whole problems relating to subtraction operation and 17% in joining and comparison problems by showing correct symbols.

Discussion

The aim of this study was to develop a Scale for Addition and Subtraction Skills (the SAAS) and to carry out validity and reliability studies in order to measure addition and subtraction skills of 61 to 72-

months-old children. The test finalized after considering the opinions of experts was administered to 200 individuals and the test was analysed in terms of validity and reliability using the data obtained from the test.

In order to determine structural validity of the scale factor analysis was selected which is a multi-variable statistical method, used to convert many variables among which various relations exist into significant and independent factors (Hair, Black, Babin, Anderson and Tatham, 2006). Cronbach (1990) states that structural validity is one of the important factors that enhance the validity of tests. Considering these facts, before starting the factor analysis, values obtained from Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity were examined in order to verify conformance of the data obtained from the pre-test in

terms of the factor analysis. According to the analyses the KMO value of the scale is 0.95 and its Bartlett's Test is meaningful (chi-square: 4.12, $df= 19$, $p=0.00$, $p<0.001$). In other words, the KMO coefficient which is used to determine whether the data and the sampling size is suitable and adequate for the analysis selected and the results of the Bartlett's test of sphericity which checks whether or not the data comes from multi-variable normal distribution are much higher than the acceptable levels (Hair et. al., 2006). Varimax Rotation and Rotated Component Matrix at of the first factor varied between 0.72 and 0.81, and between 0.54 and 0.83 for the second

factor load level. According to the total variance observed from the Component Analysis there were two factors, which correspond to 72.66% of the total variance. The findings show that the eigenvalues of the first and second factors were 7.9 and 6.5, respectively. These values correspond to variance levels of 39.68% and 32.98%, respectively. The inter-subscale correlation coefficient of the scale was 0.84. These results indicate that the scale developed in order to determine the addition and subtraction skills of 61 to 72-months-old children is composed of two factors and items relating to addition and subtraction concentrate on two different components, as

expected. This finding corresponds to the accuracy of the theoretical structure included in the literature concerning the addition-subtraction skills. The findings confirm that scale developed to determine addition and subtraction skills which is composed of 2 factors is able to completely measure this structure and is a powerful and reliable tool.

In the statistics for the reliability study of the scale, Cronbach's alpha reliability coefficient was calculated to be 0.97 and Spearman-Brown coefficient was 0.91. The internal consistency coefficients calculated indicate high level of scale reliability. According to the results of the

t-test concerning the significance of the difference of the upper and lower 27% groups carried out to determine distinctiveness of the scale, there was a significant difference in favour of the upper group ($p < 0.001$). The scale developed by the method relating to the significance of difference between the upper and lower 27% groups was applied to two groups (successful and unsuccessful). If the average score of the successful group is significantly higher than that of the unsuccessful group then the scale is considered to be reliable. In both of the sub-aspects and total scores of the scale for addition-subtraction skills the average score of the

upper group was found to be higher with a significant difference in favour of the same group; showing that the questions asked are highly distinctive and have self-validity.

According to the analysis conducted for the item distinctiveness, item factor correlation coefficients of the scale varied between 0.78 and 0.85 for the first factor and between 0.64 and 0.81 for the second one. Each item is in a significant and positive relationship with the entire factor ($p < 0.001$). The item-total score correlation reveals the relationship between the score obtained from the test items and the total score of the test. Positive and higher item-

total correlation indicates that items show similar behaviours and their internal consistency is high (Büyüköztürk, 2011). Therefore, with this analysis each item can be tested for their positive contribution to the overall purpose of the scale. Büyüköztürk (2011) argues that items with item-total correlation values equal to or greater than 30 distinguished individuals at a sufficient level. Accordingly, it can be said that that the scale considerably serves the overall purpose. The mean item distinctiveness power of the scale is 79. These coefficients reveal the ability to serve for the overall purpose. Item strength values of the scale varied between 0.74 and 0.89

for the first factor and between 0.50 and 0.84 for the second factor. The mean item strength of the scale was 0.72. In addition, the overall mean inter-item correlation of the scale was 0.73.

The validity and reliability results obtained from this study resemble those of other scales developed to measure addition and subtraction skills of children and adopted for use in Turkey. The KR-20 value of the number and operation concepts for children 48 to 86 months in age was found to be 0.98 for the entire test (Aktaş Arnas, Deretarla Gül, Sığırtmaç, 2003). The KR-20 value of the Test of Early Mathematics Ability-3 (TEMA-3) for which adaptation

and validity-reliability study was conducted for children 60 to 72 months in age was 0.93 for Form A and .93 for Form B (Erdoğan and Baran, 2006).

Findings from the test results, according to validity and reliability studies conducted for 200 61 to 72-months-old children who are attending their nursery schools in Konya province included in the Scale for Addition and Subtraction Skills (SAAS) study, indicate that the test can be utilized as a valid and reliable tool to determine the level of children's addition and subtraction skills.

Moreover, during the study it was found that more than half of the children were successful in addition

operation, separation and part-whole related verbal problems. In addition, about 20% of the children were successful in addition operation, 20% in separation and part-whole problems of subtraction operation, 17% in joining and comparison problems by showing the right symbol of operation. These values suggest that 61 to 72 months-old children are able to acquire basic mathematical skills relating to addition and subtraction operations and that they are developmentally ready to learn such skills.

Considering the findings obtained after the validity and reliability tests on the SAAS it could be concluded that the scale is a valid and reliable

way to measure addition-subtraction skills of preschool-age children. The scale developed during the study may be considered as a measuring tool that enables examination of addition and subtraction skills of the children included in the target population as well as a scale that has the validity to correctly and reliably measure addition-subtraction skills of children who had received a preschool education or who were included in an early mathematics program. However, it is obvious that administration of this scale to different sampling groups of various characteristics by various researchers and re-analysis of the scale's validity and reliability would be useful

for further confirming the usefulness of the scale.

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