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# Development of a Place Attachment Scale for Adolescents (PASA) and determination of its psychometric qualities

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## Abstract

**Background** Place attachment refers to a relationship with cognitive, emotional and behavioral dimensions that develops over time depending on the interaction of individuals with the social and physical environment. This relationship not only affects the identity development process of the individual but also determines the interaction with the social and physical environment. It is very important to determine and measure the level of this attachment and the variables affecting the level of attachment, especially during adolescence when the process of gaining identity is more intense. Within the framework of this purpose, this study aimed to develop a place attachment scale for adolescents.

**Method** The scale data were obtained from 868 adolescents, 452 (52%) male and 416 (48%) female, living in the province of Istanbul in Turkey. The mean age of the adolescents was 17.18 years ( $sd = 2.13$ ), while their mean success average was 4.18 years ( $sd = 3.14$ ). Exploratory and confirmatory factor analysis and multiple group confirmatory factor analysis were conducted for test psychometric properties of the scale. Cronbach's reliability value was calculated.

**Results** As a result of the exploratory factor analysis (EFA), it was observed that the scale consisted of three subscales: cognitive, emotional and behavioral. The parallel analysis supported this three-factor structure. The structure of the scale revealed by EFA was supported by confirmatory factor analysis ( $\chi^2/df = 1.750$ ,  $GFI = 0.92$ ,  $CFI = 0.96$ ,  $AGFI = 0.90$ ,  $NFI = 0.92$ ,  $RMSEA = 0.050$ ), and the Cronbach's alpha reliability values calculated for the subscales and the total scale were found to be very high. To ensure measurement invariance of the scale according to gender, multigroup confirmatory factor analysis was performed. Measurement invariance was ensured in gender groups, and it was found that the scale had a good fit. Composite reliability (CR) and average variance extracted (AVE) tests were performed to measure convergent validity, and it was found that the scale had high reliability and internal consistency.

**Discussion** It was observed that the validity and reliability values of the scale were high.

**Keywords** Place, Place attachment, Scale development, Confirmatory factor analysis

## Background

*I'm living a life I don't want at all in a city I don't want. If I had to choose between this city and death, I would choose death.*

It would not be an exaggeration to say that there are many people who feel the same way as this line from the

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movie *The Hours*. In addition to providing us with physical space, the city in which we live also shapes our behaviors and moods. In this context, the neighborhoods, towns or cities in which people live affect people's lives. With the statement "You should first change the space to change life", [1] showed the importance of place in people's lives. However, attachment to the place one lives in is expected to make people happy and increase social interaction. According to Scannell and Gifford [2] attachment to a place is an experience that affects individuals' well-being.

Although space and place are terms used interchangeably, according to Pretty et al. [3] place is defined as the part of a space that is used, experienced and valued by people, while according to Cresswell [4] it is defined as spaces to which people establish relationships, attach and attribute meaning. According to Lewicka [5] place conceptually has a broad meaning that includes natural and structured environments, both residential areas (e.g., homes, residences, neighborhoods, and cities) and places visited for vacation or recreation (e.g., nature, summer houses, and forests). A sense of place is a combination of symbolic meanings, attachment and satisfaction with a spatial order in which an individual or a group lives [6].

People have different roles in their social lives, and they develop different identity characteristics accordingly [7]. Identity is the relationship with the place in which individuals live because, as individuals interact with a place, they cannot form an identity independent of the place in which they live [8]. As a result, individuals try to define their personal position in social life based on the attachment they feel to a place [9]. In this context, place refers not only to a physical environment but also to human activities and individuals' social and psychological behaviors [10], this situation paves the way for a multidimensional emotional and behavioral attachment between people and places. Place attachment is defined as "the degree to which an individual values or identifies with a particular environmental setting" [11]. Place attachment refers to the intensity of emotions individuals have toward the physical place they are in [5, 12] or purposeful relationships with an environment [13]. While Proshansky et al. [14] defined place attachment as the emotional development that occurs due to the cognitive, emotional and behavioral interaction between people and space, [15] included the social environment in this interaction. According to Stedman [6] a specific environment and the communication and interaction between the individuals in that environment are the basic criteria of place attachment. In this context, place attachment refers in general to an emotional tendency with cognitive, emotional and behavioral dimensions that occurs through interaction with physical and social environments. While place

attachment is sometimes used for micro spaces such as homes and neighborhoods, it is sometimes used for macro environments such as cities and countries [16]. According to scientists such as Lewicka [17], Manzo and Perkins [18] place attachment affects individuals' emotions and behaviors; those who experience this attachment intensely use public places more, they have more social interaction, and as a result, they have a greater level of motivation. Place attachment increases social activities and environmental awareness [19, 20], decreases uncivilized behaviors [21] and contributes to individuals' efforts to protect their safety [22].

As stated above, place attachment is a very important experience in terms of an individual's life and social life. As social groups interact, they become much more decisive in their relationships [23], and community commitment, which is defined as individuals' consideration of themselves as a part of the society in which they live, emerges as a process that develops with place attachment [24]. As a result, it is considered important to develop measurement tools measuring the levels of place attachment, which is very important in terms of individuals' identity and social development.

### Measuring place attachment

The concept of place attachment has been the subject of interest in different disciplines, such as environmental psychology, architecture, design and planning. It is accepted that this concept has a multidimensional structure as a result of place attachment studies in different disciplines [25]. While Kim et al. [26], one of the first researchers on attachment to place, explained attachment with Bowlby's attachment theory, Trentelman [27] explained the concept of attachment to place with social attachment and stated that this attachment is a combination of both socio-cultural and natural environment. Therefore, there are very different dimensions of place attachment and of this attachment.

Eagly and Chaiken [28] stated that positive or negative attitudes toward a specific place were based on behavioral, emotional and cognitive reactions to that place; therefore, these dimensions had to be considered when examining attitudes toward place attachment. Proshansky et al. [14] suggested that place attachment includes an interaction of emotional, cognitive and behavioral interactions and therefore considers emotions and cognitive and behavioral dimensions when measuring place attachment. Researchers who studied the biophysical aspect of place emphasized the concepts of place identity and place dependence [29]. While place identity refers to a deep connection between an individual's personal identity and a place [14], place dependence refers to functional or purposeful attachment to an environment [30].

Scientists who have discussed the social attachment process in measuring place attachment have criticized this approach, which explains place attachment biophysically, for ignoring natural and social environments [31]. From this point of view, Kyle et al. [32] added emotional and social attachment to place attachment, while Raymond et al. [33] added attachment to nature.

Scientists who work on social attachment have suggested that social and geographical attachment should be considered when measuring place attachment and have proposed that belongingness and neighborhood loyalty should also be considered when measuring place attachment [16, 31]. Similarly, Gustafson [34] stated that place attachment consists of three factors: self, other and environment. He suggested that the “self” factor depended on the relationship between emotions about the place and self-recognition, while the “other” factor referred to people living in that area and affected these people’s attachment to the place. Finally, the “environment” factor referred to the physical environment where people lived, and this was an important factor in place attachment.

In the following years, there were mostly studies in which environmental and social factors were discussed together in measuring place attachment. For example, Scannell and Gifford [2] defined attachment to the physical environment as natural and attachment to the social environment as civic attachment and developed a scale. Similarly, a different measurement instrument including the same variables was developed by [35].

Based on Hummon’s explanations for the sense of community, [36] explained attachment to a city with three different concepts: place relativity, place inheritance and place discovery. Undoubtedly, the most comprehensive model for measuring place attachment was proposed by [2]. According to this model, place attachment was examined under three main headings: person, place and process. Social groups and the individual aspect of place attachment are examined in the subheading of “person”, while social and physical characteristics are examined under the subheading of “place”, and affective, cognitive and behavioral characteristics are examined under the subheading “process”. Studies that discuss personal, environmental and social factors together are more frequently conducted today to develop a measurement instrument to measure place attachment [33].

Therefore, measurement instruments that address different dimensions were developed to measure place attachment. Since the concept of attachment is related to the psychological characteristics of individuals, psychological factors are mostly discussed in the developed measurement instruments. Raymond et al. [33], Altman ve Low’un [37], and Nielsen-Pincus et al. [38] stated that in measuring place attachment, beliefs and thoughts

about a place, emotional factors and behavioral patterns in that place should be considered, and in this context, cognitive, emotional and behavioral factors have distinguishing characteristics in place attachment. The reasons underlying why different variables should be taken into consideration when measuring place attachment are different approaches to place and place attachment and the resulting definitions. There is no doubt that new measurement instruments that discuss different variables and structures will be developed as studies conducted on place attachment continue.

In this study, an instrument that aimed to measure adolescents’ level of attachment to a place was developed. Adolescence is a period in which identity is addressed intensely, and identity acquisition is one of the most basic developmental tasks of this period [39, 40]. Place attachment has an important role in individuals’ knowledge of the self for reasons such as relationships between the place in which individuals live and their own identities [41] and the place in which they live in creating and defining their identities [42].

The fact that identity formation generally becomes more important during adolescence, and that the places where identity is established has an important effect on identity formation, makes it of significant value to identify and measure factors that influence adolescents with regard to the places where identity is shaped. The study gain importance since there is no measurement tool in the literature that measures the adolescents and place relationship. With the measurement tool developed, it will be possible to identify the factors that affect the relationship between adolescents and place of residence, to identify the variables that may be related to place of residence, to identify the factors that negatively affect the role of place of residence, and to take necessary action accordingly. Based on the limited research on place attachment in general, the development of this measurement tool will allow researchers to conduct further studies and raise their awareness towards the role of place of residence in identity formation.

## Method

### Participants

The data used in the study were obtained from students at 8 different high schools in the province of İstanbul during the 2020–2021 academic year. The data were obtained from a total of 868 adolescents, 452 (52%) boys and 416 (48%) girls, using convenience sampling method. The mean age of the adolescents was 17.18 years ( $sd=2.13$ ), while their average success rate was 4.18 years ( $sd=3.14$ ). Forty-two (49%) of the adolescents stated that they had lived in the same area since they were born, 302 (35%) stated that they had lived in the same area for 10 years,

and 145 (16%) stated that they had lived in the same area for 5 years. A total of 512 (59%) of the adolescents stated that their family had a moderate level of income, 132 (15%) stated that their family had a low level of income, and 224 (26%) stated that they had a high level of income.

### Development of the scale

Although there are different views about developing a measurement instrument, there are many common points. According to the classical and modern test theory applied in this study [43], the first usage purposes of the test to be developed were determined, and the behaviors representing the characteristics to be measured were identified. Then, the items were edited in parallel with the expert opinions on the writing items, and the psychometric characteristics of the scale were determined after the trial.

While creating the scale items, the views and thoughts of adolescents, who are the target group, about place attachment were taken into consideration. For this purpose, 100 adolescents of different ages were asked two questions, “What are your positive and negative emotions and thoughts about where you live?” and “How can you understand whether you have a sense of belonging to a place and attachment?”, and the adolescents were asked to answer these questions in an open-ended manner. The answers taken were examined, and 33 items that were thought to measure place attachment were identified. The prepared measurement instrument was examined by five academic staff members—two from the Department of Turkish and three from the Department of Psychology—and five items that were reported as “not suitable for the target” were removed from the scale, after which the content validity level was determined [44, 45]. Content validity rate was calculated in the item removal process. According to Veneziano [46], in the calculation of the content validity rate, the ratio of the number of experts who gave the “appropriate” answer for each item to the total number of experts should be calculated by taking one minus one, and items with a content validity rate below 0.51 should be removed. In this study, 5 items with an item validity ratio below 0.51 were removed from the scale and the final version of the scale consisted of 28 items. The place attachment scale has a 5-point Likert-type format and is graded as “totally agree”, “agree”, “neutral”, “disagree”, or “totally disagree”.

### Pretrial application

The scale developed should be applied to a small group to represent the target group to determine the psychometric properties of the scale. For this purpose, the 28-item Place Attachment Scale for Adolescents was applied to 16 students—four 9th graders, four 10th graders, four 11th

graders and four 12th graders. During the application, only one item was not fully understood; thus, the item was revised, and the 28-item Place Attachment Scale for Adolescents was prepared for posttrial application. In general, it was found that students answered the items in an average of 10 min.

### Trial application and data analysis

Before starting to develop the scale, the required ethics and application permissions for the study and informed consent were obtained from the participants. The place attachment scale developed for trial application was applied face-to-face to adolescents. Before the application, individuals were informed about the purpose of the study, and the measurement instrument was applied to students who volunteered to participate in the study. The measurement instrument was applied to 874 individuals. Before entering the data, the scale forms were examined, and six forms that were not answered or answered randomly were not included in the analysis. A total of 868 forms obtained with the trial application were randomly divided into two equal halves by considering the equality in the criteria of grade, gender and age. Afterwards, exploratory factor analysis (EFA) was conducted on the scores obtained from 434 forms, and confirmatory factor analysis (CFA) was conducted on the scores obtained from the other 434 forms.

EFA is recommended if the presence of a previously determined relationship between the scale items is not known, while CFA is recommended if there is a relationship [47, 48]. For this purpose, EFA was conducted to reveal the hidden structure in the developed measurement instrument [49, 50], while CFA was conducted to show whether the structure shown with EFA was confirmed as a model [51]. The direct oblimin rotation method was used because it ensures that the factors in the scale are related, in other words, it ensures that the factors are associated [52], when determining the factor structure, factors with an Eigen value of 1 The Scree Plot graph was examined and in addition, syntax was written in the SPSS program and parallel analysis was performed on 1,000 random data using a 95% confidence interval. While the chi-square goodness, root mean square error of approximation, RMSEA and goodness-of-fit index (GFI) were calculated to determine the fit values of the structure shown with CFA [53]. In addition, the normed fit index (NFI) and adjusted goodness-of-fit index (AGFI) of the data were measured [54, 55]. Acceptable fit indices should be within the following limits  $\chi^2/sd < 5$ ; SRMR < 0.10; CFI  $\geq$  0.90; GFI  $\geq$  0.90; RMSEA < 0.10; NFI > 0.90; IFI  $\geq$  0.90 and AGFI > 0.50 [48, 49].

Multigroup confirmatory factor analysis was used to determine measurement invariance with CFA in terms of female and male groups. In this study, the cross-validity of the adapted scale, structural equivalence, metric equivalence, and scalar equivalence were assessed, and the results of equivalence were analyzed according to the 0.05 level of significance in terms of the RMSEA and CFI fit indices and the CFI difference value ( $\Delta\text{CFI}$ ), chi-square difference test ( $\Delta\chi^2$ ) and difference in degrees of freedom ( $\Delta\text{sd}$ ). The discrimination values of the scale items are determined by selecting 27% of the groups from the lower and upper groups according to the scores obtained from the scale and performing an unrelated t test to determine the significance of the differences between the lower and upper groups [56, 57]. For this reason, item discrimination values were found by calculating the difference between high and low scores with a t test.

To support the distinctiveness of the scale, the average variance extracted (AVE) method [58]. Hair et al. [57], which is based on the comparison of the mean explained variance of a factor with the square of the correlation between that factor and other factors, was used, and convergent validity values of the scale were calculated. For the external validity of the developed scale, The Place Attachment Scale, which was developed by Li [66] and whose reliability and validity studies have been conducted in Turkey, was used.

Cronbach's alpha values, which show the fit of the items with each other, were calculated, and the composite reliability method was used to support the internal consistency and reliability of the scale [59]. The IBM SPSS 25.0 and AMOS 25.0 package programs were used for the analysis of the study data.

## Results

Exploratory factor analysis (EFA) was performed to determine the validity of the Place Attachment Scale for Adolescents. Before the factor analysis, Kaiser-Meyer Olkin (KMO) and Bartlett tests were performed to test the suitability and adequacy of the obtained data for factor analysis. According to the obtained data, the KMO value was calculated as 0.90. KMO value close to 1 was accepted as an indicator that the number of individuals included in the study was sufficient [60, 61]. In the analysis, Bartlett's sphericity test ( $\chi^2(136)=2354.80, p < 0.01$ ) was also found significant. Accordingly, this result shows that there is sufficient correlation between the variables to perform factor analysis. As a result, the fact that the KMO value was above 0.60 and Bartlett's test was found to be significant revealed that the data were suitable and sufficient for factor analysis. In addition, in order to decide whether each item was suitable for factor analysis, the values in the diagonal of the Anti-Image correlation

matrix (MSA) were examined and 6 items with MSA values lower than 0.50 were removed and the analysis was repeated. It was observed that the variance of the remaining 27 items was 0.50 and above [60, 62]. Finally, the maximum likelihood (ML) estimation method was used since the items were considered to be normally distributed without skewness or kurtosis issues [63].

According to the EFA data, the scale consisted of 6 factors with an eigenvalue  $> 1$ , and the variance explained by these 6 factors was 53.73%. Ten items had an item factor loading of  $< 0.05$ . Ten items factors that were included in more than one factor or that were not loaded on any factor were excluded from the analysis, and the analysis was repeated. When the scree plot and eigenvalues were reexamined after item deletion, the scale consisted of three factors, and these three factors explained 52,85% of the variance in the scale. The eigenvalues of the three factors and the variance values they explained are shown in Table 1.

As shown in Table 1, the eigenvalue of the first factor is 6,97, the variance it explains is 38,66%, the eigenvalue of the second factor is 2,24, the variance it explains is 9,02%, the eigenvalue of the third factor is 2,18, and the variance it explains is 5,17%. After the rotation, the first factor included 8 items, the second factor included 5 items, and the third factor included 4 items.

The three-factor structure obtained as a result of EFA was tested using the scree slope graph and parallel analysis. The slope graph obtained as a result of EFA with 17 items is presented in Fig. 1.

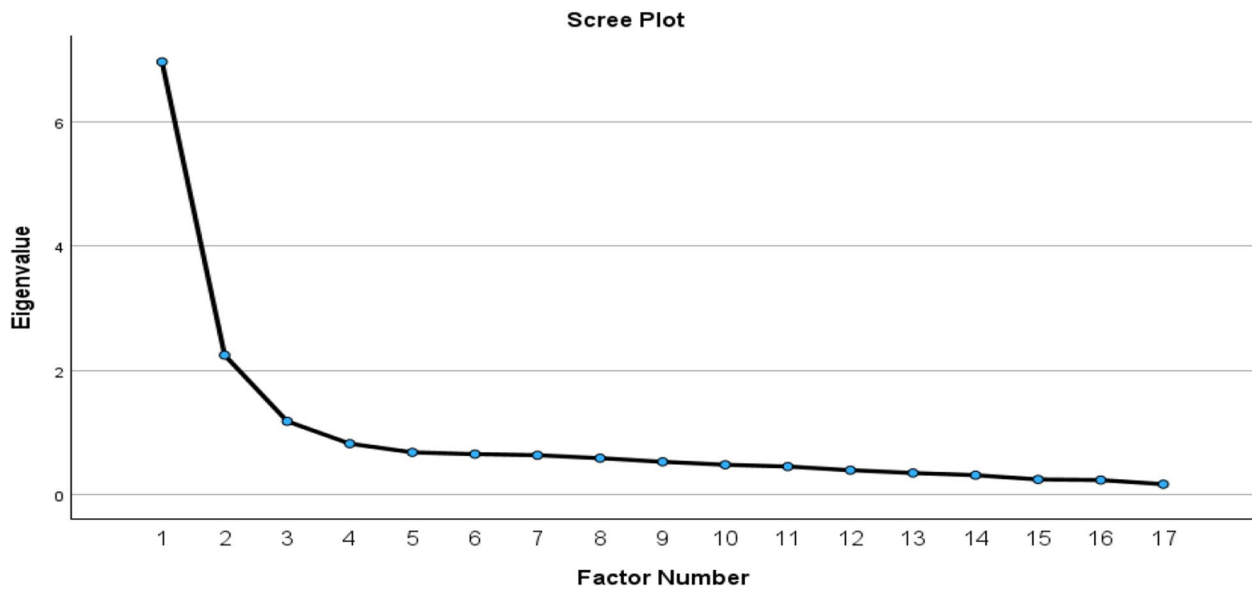
When the scree slope graph in Fig. 1 is examined, it can be said that the scale consists of three factors since there are three factors with eigenvalues of one and more than one. The results of the parallel analysis of maximum likelihood (ML) and comparison of critical values with eigenvalues are presented in Table 2.

Parallel analysis was conducted to verify the appropriate number of factors for the dataset. In this analysis, the eigenvalues from the actual dataset were compared to those obtained from randomly generated datasets. Table 2 presents the eigenvalues for each factor and the corresponding random eigenvalues.

Table 3 shows the descriptive statistics and rotated component matrix results for the remaining 17 items.

**Table 1** Eigenvalues and variance values of the subscales

Subscales	Eigenvalue	Explained variance percentage (%)
Factor 1	6,97	38,66
Factor 2	2,24	9,02
Factor 3	2,18	5,17



**Fig. 1** Scree-plot graph of the scale

**Table 2** Comparison of eigen values obtained from EFA and parallel analysis

Factor	Actual Eigenvalue	Random Eigenvalue	Conclusion
1	6,97	1,71	Significant
2	2,24	1,62	Significant
3	2,18	1,54	Significant
4	1,10	1,48	Not Significant
5	1,01	1,43	Not Significant

Based on the results of the parallel analysis, three factors were identified as significant, as their actual eigenvalues exceeded the random eigenvalues. Consequently, a three-factor structure is deemed appropriate for the dataset

According to the exploratory factor analysis results, communalities vary between, 403 and, 683, item means vary between 1,915 and 4,472, and standard deviation values vary between 762 and 1,190. Since the items in the first factor consisted of emotional items such as loving, being happy and missing the environment one lived in, this factor was called “emotional attachment”; since the items in the second factor consisted of the importance given to this environment and values, it was called “cognitive attachment”; and since the items in the last factor included meanings such as organizing and protecting the urban space, the factor was called “behavioral attachment”. The factor loads of emotional attachment varied between, 575 and 849, the factor loads of cognitive attachment varied between, 409 and, 826 and the factor loads of behavioral attachment varied between, 575 and, 639.

After the EFA of the scale items was calculated, 27% of the participants in the upper-lower group were compared to calculate the distinctiveness values of 17 items. Those who received high scores on all subscales and the total scale were assigned to the upper group, while those who received low scores were assigned to the lower group. The results obtained are shown in Table 4.

As shown in Table 4, the difference between the scores taken by individuals in the upper and lower groups for all items and the scores taken from the total scale is significant ( $p < 0.000$ ). In this context, it can be stated that all the items included in the scale and total scale scores have high discrimination values. The item total test correlations of the scale were found to vary between 13 and 81, and the values obtained were found to be statistically significant. Before testing confirmatory factor analysis of the developed scale, the descriptive statistics of the scale items and the kurtosis and skewness values of each item were calculated. The findings are given in Table 5.

In Tables 4 and 5 the arithmetic mean and standard deviation of all items included in the scale were calculated. For the normality test of the scale items, kurtosis and skewness values were calculated. The fact that the kurtosis and skewness values are between  $\pm 2$  shows that the scale items are normally distributed [63]. In this context, the scale items show normal distribution.

CFA was performed to determine which factor the items obtained showed a greater association with and to test whether these variables were represented sufficiently with the determined factors. The path diagram obtained is shown below (Fig. 2).

**Table 3** Exploratory factor analysis results

Factors	Item number	Communalities	Mean	Std.. Dev	Rotated Component Matrix <sup>a</sup>		
					Factor 1	Factor 2	Factor 3
Emotional attachment	15	,562	2,311	1,160	,756		
	18	,676	2,959	1,240	,688		
	19	,507	2,241	1,015	,575		
	22	,614	2,322	1,024	,579		
	25	,405	1,915	1,023	,563		
	28	,683	2,487	1,182	,826		
	29	,665	2,333	1,141	,785		
Cognitive attachment	31	,643	2,010	,956	,849		
	1	,651	2,945	1,188		,795	
	2	,741	2,677	1,156		,826	
	3	,610	2,604	1,152		,777	
	5	,498	2,501	1,125		,678	
Behavioral attachment	26	,461	2,186	1,097		,409	
	10	,512	3,454	1,159			,622
	12	,420	4,472	,762			,613
	21	,403	3,904	1,136			,639
	32	,462	3,981	1,030			,575

<sup>a</sup> The values ± 0, 30 are not shown

**Table 4** Corrected item total correlations and discrimination values of the t test results for all the items included in the scale

Item	Group (sd)		t	r
	Upper	Lower		
1	4,17 (.74)	1,92 (.97)	13,74	,68
2	3,94 (.81)	1,54 (.71)	16,68	,76
3	3,75 (.84)	1,73 (.97)	11,78	,65
5	3,44 (.85)	1,57 (.82)	11,96	,59
10	4,05 (.69)	2,73 (1,40)	6,27	,36
12	4,57 (.70)	2,28 (.92)	4,87	,25
15	3,51 (1,00)	1,22 (.59)	14,70	,68
18	4,23 (.57)	1,42 (.75)	22,28	,81
19	3,16 (.92)	1,29 (.49)	13,30	,69
21	4,07 (1,05)	2,61 (1,43)	2,92	,13
22	3,37 (.79)	1,21 (.49)	17,38	,76
25	2,66 (.99)	1,24 (.80)	8,30	,55
26	3,01 (.90)	1,40 (.82)	9,94	,58
28	3,71 (.88)	1,26 (.64)	16,83	,78
29	3,51 (.97)	1,21 (.49)	15,96	,76
31	2,96 (1,00)	1,15(.49)	12,13	,72
32	4,28 (.59)	3,50 (1,41)	3,79	,25

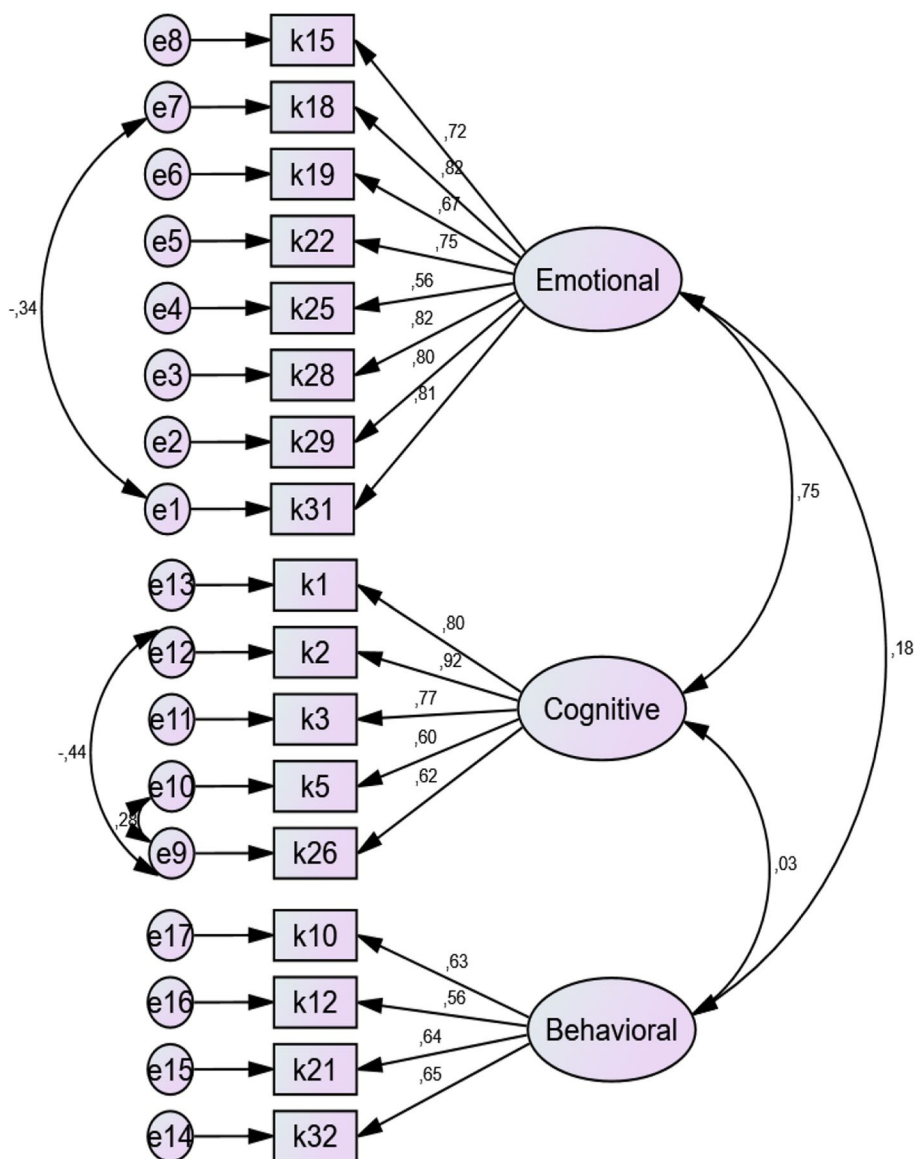
**Table 5** Descriptive statistics of scale items and skewness and kurtosis values

Items	M	Std	Skewness	Kurtosis
1	2,94	1,18	,147	-,919
2	2,67	1,15	,208	-,766
3	2,60	1,15	,338	-,777
5	2,50	1,12	,183	-,869
26	2,18	1,09	,481	-,835
10	3,45	1,15	-,679	-,270
12	3,47	,726	-,039	,765
21	3,90	1,13	,115	,810
32	3,98	1,03	-,114	,104
15	2,31	1,16	,564	-,549
18	2,95	1,24	-,284	-,102
19	2,24	1,01	,532	-,281
22	2,32	1,02	,209	-,843
25	1,91	1,02	,104	,636
28	2,48	1,18	,327	-,932
29	2,33	1,14	,543	-,491
31	2,01	,956	,815	,252

M Mean, Std standard deviation

According to the analysis results, the chi-square value of the Place Attachment Scale for Adolescents [ $\chi^2 = 197,780$   $df = 113$ ,  $p < 0.01$ ] was found to be significant. The ratio of the chi-square value to the degrees

of freedom was 1.75. A value lower than 5 indicates that the fit index of the model is good [64]. One way to increase the fit values of the scale is to create covariance [60]; therefore, covariance was created between some items. The fit values of the place attachment scale were



**Fig. 2** Path diagram of the place attachment scale for adolescents

as follows: goodness-of-fit index (GFI)=0.92, adjusted goodness-of-fit index (AGFI)=0.90, comparative fit index (CFI)=0.96, normed fit index NFI=0.92, root mean square error of approximation (RMSEA)=0.050, and standardized RMR (SRMR)=0.069. GFI, AGFI and CFI values of 0.90 and  $\leq$ RMSEA indicate that the fit index values are good [65]. In this context, it is possible to say that the fit values of the place attachment scale obtained with CFA are within acceptable limits.

Multiple group CFA was administered to show whether the data obtained from the study group and place attachment scale for adolescents had equivalence

of measurement in terms of female and male groups. Table 6 shows the measurement equivalences obtained.

The critical  $\chi^2$  values of the  $\Delta sd^b$  values are given in parentheses. CFA was administered separately for female and male students to analyze the measurement equivalence of the place attachment scale for adolescents. As a result of CFA, modifications were made to associate the error variances in two items (items 1 and 7) for the female group, and a better fit was achieved between the items. The fit values obtained for the male group were at an acceptable level. Next, structural equivalence was started, and when all parameters were free, the fit values

**Table 6** Measurement invariance and fit values of the place attachment scale

Model Tests	Model Fit Criteria			Model Difference Statistics			
	$\chi^2$	Sd	RMSEA <sup>a</sup>	CFI	$\Delta\chi^2$	$\Delta\text{sdb}$	$\Delta\text{CFI}$
Individual groups							
Females	127.13	112	0.067	0.91			
Males	128.90	113	0.079	0.90			
All groups	198,34	78	0.082	0.93			
Structural equivalence	241.51	80	0.076	0.94			
Metric equivalence	252.55	81	0.074	0.93	11.04	13 (25.12)	.01
Scalar equivalence	311.74	82	0.082	0.94	59.19	14 (28.11)	.02
Partial scalar	260,12	91	0.084	0.90	7.57	8 (20.11)	.00
Strict equivalence	276,65	80	0.085	0.93	16.53	14 (28.11)	.01

<sup>a</sup> 90% confidence intervals of the RMSEA values are given in parentheses

obtained ( $\chi^2=241,51$ ,  $sd=80$ ,  $RMSEA=,076$ ,  $CFI=,94$ ) were found to be good. In other words, structural equivalence was achieved between the female and male groups. Next, metric invariance was performed to determine whether factor loads were perceived at the same level between groups. The  $\Delta\text{CFI}=0.01$  and  $RMSEA=0.07$  values obtained in the difference of structural equivalence and metric equivalence models show that there is no significant deterioration in the model. When the values obtained from the chi-square test were examined (11.04, 13,  $p<0.05$ ), the significance level was equivalent to the factor structure at the structural equivalence level and the factor loads at the metric invariance level. This result shows that metric invariance is equal for the male group and female group on the developed scale. Next, a scalar invariance calculation, in which regression constants are restricted for groups, was performed. According to the data obtained,  $\Delta\text{CFI}=0.02$  and  $RMSEA=0.08$ , significant deterioration was observed in the model. When the values obtained from the chi-square test were examined (59, 19, 14,  $p<0.05$ ), the item regression constant values were not equivalent at the level of scalar invariance between the female and male groups. For this reason, partial scalar equivalence was performed. In the partial scalar

equivalence test, regression constant values for items 2 and 12 for males and items 1 and 7 for females became free. As a result, partial scalar equivalence was met for both female students and male students. The  $\Delta\text{CFI}=0.00$  and  $RMSEA=0.08$  values obtained from partial scalar equivalence with metric equivalence show that there is no deterioration in the model. The values obtained from the chi-square difference test (7.57, 8,  $p<0.05$ ) show that the item regression constant values are equivalent at the partial scalar invariance level between the female and male groups. Finally, all parameters were limited by strict equivalence. The  $\Delta\text{CFI}=0.01$  and  $RMSEA=0.08$  values obtained from the difference between the partial scalar equivalence and strict equivalence models show that there is no significant deterioration in the model. In addition, the values obtained from the chi-square difference test (16,53, 14,  $p<0.05$ ) show that the level of significance provides equivalence at the strict equivalence level between male and female groups. To examine the measurement equivalence of the place attachment scale for adolescents, CFA was performed separately for the female and male groups.

Table 7 shows the correlation analysis, mean subscale scores and standard deviations of the relationships

**Table 7** The relationships between the place attachment scale subscales and the place attachment scale (pas) for adolescents and the mean and standard deviation of the scale

Subscales	1	2	3	4	5	Mean	Sd
1. Emotional	–					20.66	7.62
2. Cognitive	,71**	–				12,91	4,59
3. Behavioral	,16*	,13*	–			15,81	3,02
4. Total	,93**	,81**	,29**	–		49,39	12,04
5. PAS	,34**	,45**	,58**	,72**	–	42,11	9,86

\*\*  $p<.01$

\* $p<.05$

between the subscales of the Place Attachment Scale for adolescents.

As shown in Table 7, a significant positive correlation was found between cognitive attachment and emotional attachment ( $r=0.71, p < .01$ ) and behavioral attachment ( $r=0.13, p < .05$ ) subscale scores; similarly, a significant positive correlation was found between emotional attachment and behavioral attachment ( $r=0.16, p < .05$ ) subscale scores. A positive significant correlation was also found between total scale scores and emotional status ( $r=0.93, p < .01$ ), cognitive ( $r=0.81, p < .01$ ) and behavioral ( $r=0.29, p < .05$ ) attachment subscale scores. The mean score on the emotional attachment subscale was 20.66 (7.62), while the mean score on the cognitive attachment subscale was 12.91 (4.59), the mean score on the behavioral attachment subscale was 15.81 (3.02), and the mean score on the total scale was 49.39 (12.04).

The Place Attachment Scale, which was developed by [66] and adapted to Turkish culture by [67], was used for the external validity study of the developed scale. The Pearson correlation coefficient was used to calculate the relationship between the two scales. Place attachment scale scores and emotional attachment ( $r=0.34, p < .01$ ), cognitive attachment ( $r=0.45, p < .01$ ), behavioral attachment ( $r=0.58, p < .01$ ), and total scale There were significant positive correlations between the scores ( $r=0.72, p < .01$ ).

Table 8 shows the Cronbach’s alpha values calculated for the reliability values of all subtests and total scale scores of the developed measurement instrument.

The Cronbach’s alpha values of all the subscales and total scale scores were 91 for emotional attachment, 86 for cognitive attachment, 71 for behavioral attachment and 90 for the total scale. The composite reliability (CR) and average variance extracted (AVE) values of the place attachment scale were CR=0.89 and AVE=0.65 (65%) for the emotional attachment subscale; CR=0.86 and AVE=0.62 (62%) for the cognitive attachment subscale; CR=0.71 and AVE=0.49 (49%) for the behavioral attachment subscale; and CR=0.92 and AVE=0.66 (66%) for the total scale. In general, the CR is expected to be  $\geq 0.70$ , while the AVE is expected to be  $\geq 0.50$  [55]. The results showed that the developed scale, which has internal

consistency, composite reliability and convergent validity, is a valid and reliable measurement tool.

### Discussion

This study aimed to develop a place attachment scale for adolescents. The data obtained can be summarized as follows. EFA was performed to determine the correlations between the items and the possible structures, and it was found that the scale had three subscales. The parallel analysis supported this three-factor structure. The fact that the three factors obtained explain 61.04% of the variance in the scale shows that the scale has a strong structure. When the subscales were examined, it was found that the factors included cognitive, emotional and behavioral meanings for place attachment, and the names of the factors were determined accordingly. The cognitive, emotional and behavioral dimensions of the defined place attachment parallel those of previously conducted studies [28, 41, 68].

Place attachment occurs with the interaction of emotions, thoughts and behaviors between individuals and the place [41], and it is also reported to occur between the individual’s physical and social environments, generally unconsciously, through feelings, thoughts and behaviors [15, 66]. Similarly, attitudes toward a place are also reportedly shaped by emotions, cognitions and behaviors created for that place [69]. In this context, it can be seen that the three subscales determined with the developed scale (cognitive, emotional and behavioral) are also supported by studies. The structures of the scale revealed by EFA are confirmed with CFA, and the fit indices obtained are very high.

In this study, multiple-group confirmatory factor analysis (CFA) was used to determine the measurement invariance of the female and male groups. In this study, the cross-validity of the adapted scale, structural equivalence, metric equivalence, and scalar equivalence were assessed, and the results of equivalence were analyzed according to the 0.05 level of significance in terms of the RMSEA and CFI fit indices and the CFI difference value ( $\Delta CFI$ ), chi-square difference test ( $\Delta \chi^2$ ) and difference in degrees of freedom ( $\Delta sd$ ). As a result of the analyses, measurement invariance was met in gender groups, and the scale was found to have a good fit. Composite reliability and average variance extraction tests were conducted to measure convergent validity. In general, the CR is expected to be  $\geq 0.70$ , while the AVE is expected to be  $\geq 0.50$  [55, 70]. The findings revealed that the developed scale had high reliability and internal consistency.

According to classical test theory, it is expected for the items in the developed scale to be consistent and stable, to measure the features that the scale aims to measure and to show the difference between the items that have

**Table 8** Cronbach’s alpha values of the PAS and subscales

Subscales	K (number of items)	Cronbach Alpha value	CR	AVE
Emotional attachment	8	,91	,89	,65
Cognitive attachment	5	,86	,86	,62
Behavioral attachment	4	,71	,71	,49
Total	17	,90	,92	,66

those features and those that do not [43, 68]. Testing the significance of the difference between the highest score and the lowest score from the measurement tool provides information about the validity of the measurement tool [53]. For this purpose, the difference between the participants who received high scores from the measurement instrument and those who received low scores was shown with the t test, and the difference between all of the items included in the scale was found to be significant between the upper and lower groups. In addition, the corrected item total correlations of all items included in the scale were calculated, and the correlations between the items were found to be significant. The reliability values of the total scale and its subscales were calculated with Cronbach's alpha, and the reliability values were found to be very high. The Place Attachment Scale, which was developed by [63] and adapted to Turkish culture by [64], was used for the external validity study of the developed scale. Finding significant relationships between both scales shows that the developed scale has external validity.

The strength of this study is that the scale has very high psychometric value, the subscales obtained overlap with the existing theoretical framework on place attachment in the literature, and the items were obtained from the emotions and thoughts of adolescents, who are the target audience. Another strength of this study is that the developed scale will meet the existing needs as a result of the limited number of measurement instruments for place attachment and to create awareness for studies to be conducted. Although the psychometric values of the scale are within acceptable limits, it is recommended to be flexible in applying and evaluating the scale in different cultures.

Although it is possible to reach a large number of people and data in a short time with measurement instruments, it should be remembered that it is not possible to reach healthy results as long as they are not supported with other methods of data collection, such as observations and interviews. It is recommended that this scale be developed on different cultures and samples so that it is valid and comprehensive and its psychometric structure becomes stronger. The psychometric data of the scale were obtained from a specific culture and a limited number of sample groups. In order to generalize the data obtained from the scale, it is necessary to apply the scale to different cultures and sample groups.

#### Abbreviations

PASA	A Place Attachment Scale for Adolescents
SD	Standard deviation
EFA	Exploratory factor analysis
CFA	Confirmatory factor analysis
CR	Composite reliability
AVE	Average variance extracted
AMOS	Analysis of moment structures

SPSS Statistical package for the social sciences

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40359-025-02448-y>.

Supplementary Material 1.

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#### Author's contributions

MYE, prepared the main text of the draft. MYE prepared the figures and reports.

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#### Data availability

No datasets were generated or analysed during the current study.

#### Declarations

##### Ethics approval and consent to participate

This study was approved by the responsible Institutional Review Board of the Istanbul Sabahattin Zaim University (Date and Number: 10.11.2021-E.16582). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Ethical Committee of the responsible University. Consent to participate Informed consent was obtained from all participants and their legal guardians included in the study.

##### Consent for publication

Not applicable.

##### Competing interests

The authors declare no competing interests.

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