RELIABILITY AND VALIDITY ANALYSIS OF THE MULTIPLE INTELLIGENCE PERCEPTION SCALE

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This study mainly aims to develop a scale to determine individual intelligence profiles based on self-perceptions. The study group consists of 925 students studying in various departments of the Faculty of Education at Ahi Evran University. A logical and statistical approach was adopted in scale development. Expert opinion was obtained for the content validity of the scale. Thus, the draft scale was written in the form of a 228-item five-point Likert-type rating scale. To determine its validity, (i) factor analysis, (ii) item-total correlations, and (iii) item discrimination power were calculated. In the light of the obtained data, it could be concluded that 143-item Multiple Intelligence Self-Perception Scale consisting of eight subscales is a valid and reliable instrument used to determine individual intelligence profiles.

Keywords: The Theory of Multiple Intelligences, Scale Development, Self-perception, Validity, Reliability

Introduction

Intelligence is one of the basic variables that influence learning. Instructional approaches and models that are well-established in the world of modern education consider intelligence as either a direct or indirect variable. The Theory of Multiple Intelligences formulated by Gardner is one of the theories that conceive intelligence as a basic variable influencing learning. Gardner (1999) defines intelligence as an individual's capacity to fashion a product that is valued in one or more cultures; skill to work out effective solutions to real-time problems; and ability to discover new or complex problems that need to be resolved.

The theory of multiple intelligences is a product of the research on the development of cognitive potentials of normal and talented children and on defective intelligences occurring as a result of brain damage (Gardner, 1999). The main hypothesis of Gardner's (1993a) study is that "every child has potential for development in one or several domains". Human intelligence comprises too many abilities to be explained by a single domain (Gardner, 1999). To offer a broader perspective for intelligence, Gardner (1997) referred in his theory to human abilities and potentials acquired in various ways as "intelligence domains". He argues that humans can cultivate, improve, and modify their innate intelligence; that is, one

can learn to become intelligent.

Gardner (1993b; 1989) asserts that an individual has at least seven main intelligence domains; however, this number does not sufficiently express the abundance of abilities. Therefore, there might be more intelligence domains. As a matter of fact, Gardner (1999) later noted the presence of an eighth intelligence domain and restructured the theory of multiple intelligences to include this new domain. In this new version, the eight intelligence domains include verbal-linguistic intelligence, logical-mathematical intelligence, visual-spatial intelligence, musical-rhythmic intelligence, bodily-kinesthetic intelligence, interpersonal intelligence, intrapersonal intelligence, and naturalistic intelligence.

The theory of multiple intelligences encapsulates an approach that is different from and alternative to traditional education insights and practices. It has offered significant explanations concerning learning methods, process of learning, and the relationships between types of intelligence. These explanations contain many principles ranging from learning-teaching activities to the organization of teaching environment.

As the theory suggests, there are important relationships between types of intelligence and learning modes (Gardner, 1989). Individuals' learning modes vary with their dominant intelligence characteristics (Harvey, et al., 1997; Stephen, 2004). On the other hand, certain activities contribute more to the improvement of certain types of intelligence. It follows that the use of different learning-teaching methods in classroom could make it possible both to reach all students and to create educational environments that are appropriate to improve all intelligence levels (Krechevsky & Seidel, 1998). In fact, research on learning indicates that students learn and structure what they learn in different ways (Kelly & Tangney, 2004). Therefore, environments that offer different learning methods and use learning-teaching activities that suit different learning-teaching modes are not only more efficient for learning and teaching, but also more favorable for intelligence improvement

Many studies reveal that implementation of the theory of multiple intelligences could make very positive contributions to individual development and the efficiency of learning environments. Studies conducted by Allen (1997), Açıkgöz (2003), and Campbell (1989) found that instruction guided by the principles of the theory of multiple intelligences significantly contributed to academic development of students.

Modern education is grounded on the idea that the strengths and characteristics of a student should be correctly identified and promoted in the best way possible (Orr, 1991). Therefore, educational institutions are responsible for recognizing students' intelligence characteristics and ensuring that they use their characteristics in the best way possible. The theory of multiple intelligences also argues that the aim of education is not only to improve academic achievement of students by taking individual differences into consideration, but also to reveal and improve their mul-

Table 1. Distribution of the Study Group in terms of Departments and Gender

Departments	Female	Male
Department of Computer and Instructional Technologies Teaching	24	11
Mathematics Teaching Programme	21	16
Counseling and Guidance Programme	43	44
Early Childhood Teaching Programme	29	11
Primary School Teaching Programme	111	88
Social Studies Teaching Programme	113	78
Science Teaching Programme	83	83
Turkish Language Teaching Programme	102	68
Total	**526**	**399**

tiple intelligence potentials (Saban, 2002).

Armstrong (1994) underlines the importance of identifying and discussing with students their intelligence domains. According to the author, students with good self-knowledge can make more objective and realistic decisions concerning themselves. As a matter of fact, the last five decades have witnessed the conduction of numerous studies on intelligence; and more than twenty recently-published studies have particularly focused on assessing intelligence levels (Furnham, 2001).

Students' intelligence profiles can be identified by using various methods of assessment. These could be exemplified by methods such as observation, interview, peer review and self-evaluation. When identifying students' intelligence characteristics using these methods, instruments such as IQ tests, rubrics, observation and interview forms, and self evaluation forms are used.

One of the sources of data on student intelligence characteristics is the students themselves. Significant findings about students' intelligence profiles could be obtained drawing upon the way they perceive themselves. In fact, some of the recent studies to determine intelligence levels deal with the attempts to determine intelligence types or levels based on individual self-perceptions (Furnham, 2001). Development of assessment tools such as interest inventory, attitude scales and perception scales relies on this assumption. Thus, the basic aim of the present study is to develop a scale that will be used to identify individual intelligence profiles according to their self-perceptions.

Method

Sample Group

The study group consists of 925 students receiving education at different departments of the Faculty of Education at Ahi Evran University. Of the study group, 399 students are male and 526 are female. Table 1 presents the distribution of the study group in terms of departments and gender.

Developing Process of the Multiple Intelligence Self-Perception Scale

Student self perceptions were used as the data source in developing the scale which is the interest of the study. First, according to eight intelligence subcategories, the items were formulated following a relevant literature review. Apart from the works on the theory of multiple intelligences, the researcher made use of the items in "the Inventory of Multiple Intelligence Domains" (Saban, 2002), "Academic Self-Conception Scale" (Kuzgun, 1996) and "California Critical Thinking Disposition Scale" (Kökdemir, 2003) in the formulation of items. Adding new items to those selected from this scales, the researcher created an item pool consisting of a total of 228 items.

The Multiple Intelligence Self-Perception Scale includes eight subscales, which could be listed as follows (Gardner, 1999; Smith, 2002):

1. Linguistic Intelligence Subscale: Linguistic intelligence involves sensitivity to spoken and written language, the ability to learn languages, and the capacity to use language to accomplish certain goals. This intelligence includes the ability to effectively use language to express oneself rhetorically or poetically; and language as a means to remember information. Writers, poets, lawyers and speakers are among those that Howard Gardner sees as having high linguistic intelligence. This subscale was designed to identify student self-perceptions concerning their linguistic intelligence levels.

2. Logical-Mathematical Intelligence Subscale: Logical-mathematical intelligence consists of the capacity to analyze problems logically, carry out mathematical operations, and investigate issues scientifically. In Howard Gardner's words, it entails the ability to detect patterns, reason deductively and think logically. This intelligence is most often associated with scientific and mathematical thinking. This subscale was designed to identify student self-perceptions concerning their logical-mathematical intelligence levels.

3. Musical Intelligence Subscale: Musical intelligence involves skill in the performance, composition, and appreciation of musical patterns. It encompasses the capacity to recognize and compose musical pitches, tones, and rhythms. According to Howard Gardner musical intelligence runs in an almost structural parallel to linguistic intelligence. This subscale was designed to identify student self-perceptions concerning their musical intelligence levels.

4. Bodily-Kinesthetic Intelligence Subscale: Musical intelligence involves skill in the performance, composition, and appreciation of musical patterns. It encompasses the capacity to recognize and compose musical pitches, tones, and rhythms. According to Howard Gardner musical intelligence runs in an almost structural parallel to linguistic intelligence. This subscale was designed to identify student self-perceptions concerning their bodily-kinesthetic intelligence levels.

5. Spatial Intelligence Subscale: Spatial intelligence involves the potential to recognize and use the patterns of wide space and more confined areas. This subscale was designed to identify student

Table2. The results of KMO and Bartlett's tests regarding the subscales

Subscales	KMO	Bartlett
Linguistic	,835	,000
Logical-Mathematical	,952	,000
Musical	,946	,000
Bodily-Kinesthetic	,908	,000
Spatial	,933	,000
Intrapersonal	,833	,000
Intrapersonal	,871	,000
Naturalistic	,936	,000

self-perceptions concerning their spatial intelligence levels.

6. Interpersonal Intelligence Subscale: Interpersonal intelligence is concerned with the capacity to understand the intentions, motivations and desires of other people. It allows people to work effectively with others. Educators, salespeople, religious and political leaders and counsellors all need a well-developed interpersonal intelligence. This subscale was designed to identify student self-perceptions concerning their interpersonal intelligence levels.

7. Intrapersonal Intelligence Subscale: Intrapersonal intelligence entails the capacity to understand oneself, to appreciate one's feelings, fears and motivations. In Howard Gardner's view it involves having an effective working model of ourselves, and to be able to use such information to regulate our lives. This subscale was designed to identify student self-perceptions concerning their intrapersonal intelligence levels.

8. Naturalistic Intelligence Subscale: Naturalist intelligence enables human beings to recognize, categorize and draw upon certain features of the environment. It combines a description of the core ability with a characterization of the role that many cultures value. This subscale was designed to identify student self-perceptions concerning their naturalistic intelligence levels.

The researcher pursued a logical and statistical approach in developing the Multiple Intelligence Self-Perception Scale. First, expert opinion was referred to determine the content validity of the scale. The scale initially consisted of 228 items. The items were written down in the form of a five-point Likert-type rating scale. The statistical analyses performed during the process of scale development and the findings are presented below.

Finding in accordance with the validity of scale

Structure Validity

For the structure validity of the eight subscales included in Multiple Intelligence Self-Perception Scale, the researcher first subjected to Kaiser-Meyer-Oklin (KMO) and Bartlett's test analyses the data col-

lected during the process of scale development, and it was understood that they were suitable for factor analysis. Table 2 presents the KMO and Bartlett's tests regarding the subscales:

In order to determine the content validity of the trial questionnaire of the scale consisting of 228 items, a factor analysis was performed on the data. The factor analysis is performed with the aim to reveal whether the items of a certain scale are grouped into mutually exclusive fewer factors. Items in the same group are assigned a name according to the content of the items (Harmani, 1976; Gorsuch, 1983). Furthermore, factor analysis is used to test whether a particular scale is one-dimensional (Rummel, 1988; Balcı, 2000, p. 68). In the first stage, the Principal Components Analysis was performed to determine whether the eight subscales included in the Multiple Intelligence Self-Perception Scale are one-dimensional. In order to dissociate the scale into non-related factors, the scale was analyzed applying the Varimax Orthogonal Rotation Technique.

The main criteria in evaluating the results of the factor analysis are the factor loadings that are found in the scale and could be interpreted as correlations between the variables and factors (Harmani, 1976; Gorsuch, 1983: Rummel, 1988; Karadağ, 2007). Higher factor loadings are considered as indicating that the variable might be located under the factor in question (Büyüköztürk, 2002, p. 51).

As a result of the Principal Components Analysis used in the factor analysis and correspondingly the Varimax Orthogonal Rotation Technique, factors in different numbers were determined for each subscale. Factor loadings lower than .30 and items found in more than one factor (85 items in total) were removed from the scale, and the same process was reiterated. Table 3-10 presents the results of the factor analysis for the remaining total of 143 items after these processes according to the subscales.

It was found that the linguistic intelligence self-perception subscale is further divided into three different factors, which account for 48.682% of the total variance. Loadings of the first factor range between 0.536 and 0.724, contributing to the total variance by 17.152%. Loadings of the second factor range between 0.571 and 0.753, with a contribution to the total variance by 15,942%. Finally, Loadings of the third factor range from 0.558 to 0.743, contributing to the total variance by 15.588%.

Table 3. Results of the Factor Analysis for the Linguistic Intelligence Subscale

	Items	Factor Loadings	Factors		
			F1	F2	F3
Verbal and Written Explanation	1.I believe I am fluent in writing and speaking	,534	,724		
	2.I do not have difficulty in expressing my feelings and ideas	,480	,679		
	3. I can easily establish relations between ideas while speaking or writing	,478	,652		
	4. About any particular subject, I can express my feelings and ideas s in oral and written form in a compact way.	,496	,639		
	5. I believe my vocabulary is richer than those of my peers	,342	,536		
Openness to Verbal Message	6. I examine the writing styles of different authors	,601		,753	
	7. I read literary and theater critics in newspapers	,550		,727	
	8. I like writing poems, stories, memoirs, etc.	,472		,659	
	9. I can carefully follow long-winded speeches and articles	,371		,571	
Linguistic Awareness	10. I can easily notice grammar mistakes in a piece of writing	,574			,743
	11. I use properly use the language	,506			,677
	12. I can easily identify expressive mistakes in a piece of writing or statement	,528			,641
	13. I am enthusiastic for learning grammatical rules	,391			,578
	14. I like correcting the mistakes in a piece of writing	,492			,558
		Eigenvalue	2,401	2,232	2,182
		Explained Variance	17,152	15,942	15,588

Table 4. Results of the Factor Analysis for the Logical-Mathematical Intelligence Subscale

	Items	Factor Loadings	Factors F1 A	Factors F1 B	Factors F2
Mathematical Ability (A. Mathematical Transfer, B. Mathematical Relationship	15. I believe I could easily learn mathematical concepts such as zero, equation, infinite	,737	,794		
	16. I believe I have special interest in mathematical operations	,713	,772		
	17. I can easily and keenly read statements including special symbols Π, $\square$, X^2, v, $\square$, sin(x), log 5, H_2O	,678	,769		
	18. I can quickly construct the equation which would yield the solution of any problem	,723	,758		
	19. I believe I can easily capture the relationship between numbers	,636	,715		
	20. I believe I can more easily learn statements constructed using mathematical symbols and concepts	,641	,648		
	21. I can calculate arithmetic problems in my head	,628	,637		
	22. I consider myself successful in recalling and interpreting mathematical formulas	,705	,614		
	23. I associate the objects in my environment with geometric figures	,691		,796	
	24. I consider myself successful in expressing my ideas using mathematical concepts and symbols (classification, listing, charting)	,712		,760	
	25. I believe I can effectively use in daily life the mathematical rules and principles that I learn in mathematics course	,682		,751	
	26. I believe I can make a research or a project about a particular question in the field of physics, chemistry or mathematics	,613		,699	
	27. I can apply the mathematical rules and principles that I learn to	,607		,659	

	the problems I encounter in physics and chemistry courses			
	28. I can come up with different ways to solve a particular problem	,462	,562	
	29. I consider myself successful in solving mathematical puzzles such as Sudoku and A Word and an Operation	,406	,517	
Logical Relationship	30. I try to comprehend the question before answering	,596		,769
	31. It is important for me to understand ideas and perspectives of others on several subjects	,535		,732
	32. I need logical reasons to believe in anything	,492		,695
	33. It troubles me to see people rely on illogical, groundless or hearsay ideas to defend a good case	,473		,687
	34. You can define me as a person of logic	,421		,648
	35. Once I learn how to solve a particular problem, I develop confidence to solve other similar problems	,356		,518
	Eigenvalue		8,742	2,932
	Explained Variance		41,627	13,964

It was also found that the logical-mathematical intelligence self-perception subscale is divided into two different factors, the first of which is further divided into two. These two factors account for 55.591% of the total variance. Loadings for the first sub-factor of the first factor (F1A) range between 0.614 and 0.794; and those for the second sub-factor (F2A) range between 0.517 and 0.796. The contribution of the first factor (F1) to total variance is 41.627%. On the other hand, loadings for the second factor (F2) range between 0.518 and 0.769, contributing to the total variance by 13.964%.

Table 5. Results of the Factor Analysis for the Musical Intelligence Subscale

	Items	Factor Loadings	Factors F1	Factors F2
Musical Expression	36. I compose small pieces of music	,720	,844	
	37. I believe that I can become a good singer, musician or conductor	,706	,824	
	38. I participate in musical contests	,660	,813	
	39. I believe that I sing well	,610	,730	
	40. I am interested in studying the lives of famous composers	,563	,713	
	41. I like visiting exhibitions or shops of musical instruments whenever I have the chance	,546	,590	
	42. I like watching programs that promote folk songs of different countries	,462	,578	
	43. I believe I talk and move in a rhythmic fashion	,543	,528	
Musical Perception	44. I can easily notice an arrhythmic or inharmonious melody	,525		,682
	45. I start to keep rhythm unconsciously whenever I hear a piece of music	,551		,681
	46. I can easily recall the melodies of songs	,512		,680
	47. I unconsciously hum songs	,432		,647
	48. I have a special interest in music	,579		,639
	49. The sounds in the environment capture my ear	,400		,625
	50. I listen to different musical genres	,393		,623
	51. I am willing to participate in musical events	,559		,585
	52. I keep rhythm with my hands or feet even when I am engaged in another task	,378		,573
	53. I am willing to take music courses	,607		,557
	54. I consider myself as enthusiastic and successful in playing a musical instrument	,479		,521
	Eigenvalue		5,218	5,006
	Explained Variance		27,465	26,348

It was found that the musical intelligence self-perception subscale is further divided into two different factors, which account for 53.813% of the total variance. Loadings for the first factor range between 0.528 and 0.784, with a contribution to the total variance by 27.465%. Loadings for the second factor range between 0.521 and 0.682, contributing to the total variance by 26.348%.

Table 6. Results of the Factor Analysis for the Bodily-Kinesthetic Intelligence Subscale

	Items	Factor Loadings	Factors F1	Factors F2
Bodily and Kinesthetic Learning	55. I believe that I will be more successful in fields of sports	,696	,818	
	56. I consider myself as competent in bodily movements	,713	,789	
	57. I consider myself as balanced, swift, skilled and aesthetic in my physical movements	,668	,773	
	58. I like practicing sports much more than talking about sports	,601	,729	
	59. I prefer becoming teacher of physical education rather than other fields of teaching	,518	,719	
	60. I believe I will be more successful in professions based on movements such as sports, dancing and theater	,566	,692	
	61. I regularly and continuously practice sports	,414	,639	
Bodily and Kinesthetic Expression	62. I cannot sit still, I feel the need to move in my chair at least	,530		,723
	63. I can express my knowledge, feelings and ideas effectively using gestures and mimics	,498		,705
	64. I like playing games with my friends that are based on movement	,512		,655
	65. I often and skillfully make gestures at work and in my relationships	,423		,639
	66. I prefer to pick up and examine things that catch my attention	,352		,586
	67. I like to spend my leisure time outdoors and in moving	,329		,510
	68. I believe that I will be successful in role-playing or theater performance	,378		,507
		Eigenvalue	4,131	3,067
		Explained Variance	29,504	21,906

It was found that the bodily-kinesthetic intelligence self-perception subscale is further divided into two different factors, which account for 51.410% of the total variance. Loadings for the first factor range between 0.639 and 0.818, contributing to the total variance by 29.504%. On the other hand, loadings for the second factor range between 0.507 and 0.723, with a contribution to the total variance by 21.906%.

Table 7. Results of the Factor Analysis for the Spatial Intelligence Subscale

	Items	Factor Loadings	Factors F1	Factors F2
Visual Ability	69. I believe I am enthusiastic to produce works of art	,690	,806	
	70. I believe I will achieve success if I participate in art or handcraft contests	,652	,803	
	71. I believe I will be successful in the professions of painting, sculpture and architecture	,665	,798	
	72. I try to add an aesthetic aspect or elegance to any work I produce	,612	,770	
	73. I consider myself skillful in designing and producing three dimensional materials	,598	,723	
	74. I consider myself as successful in drawing	,535	,721	
	75. I have pleasure in reading books about architecture or history of art in general	,537	,692	
	76. I examine and try to discover the particularities of works of art	,567	,689	
	77. I believe I am very sensitive to colors	,345	,480	
Spatial Ability	78. I can imagine small part of a complicated geometric shape independently from the whole	,623		,770
	79. I can easily imagine how a complicated geometric shape will look like when it is shifted rightwards, leftwards, upwards or downwards	,616		,757
	80. I can make correct guesses about an angle, length or area	,590		,749
	81.I do not have difficulty in drawing the unfolded forms of unfamiliar geometric shapes	,558		,722
	82. I can imagine before my eyes the finished appearance or a house when I look at its plan	,544		,695
	83. I can immediately notice trivial differences between two complicated shapes that look very similar to each other	,438		,647
	84. I am successful at interpreting graphs, maps and tables	,410		,602
	85. I can install a machine by examining the figures in its manual	,305		,546
		Eigenvalue	5,027	4,259
		Explained Variance	29,568	25,054

It was found that the spatial intelligence self-perception subscale is further divided into two different factors, which account for 54.622% of the total variance. Loadings for the first factor range between 0.480 and 0.806, contributing to the total variance by 29.568%. On the other hand, loadings for the second factor range from 0.546 to 0.770, making a contribution to the total variance by 25.054%.

Table 8. Results of the Factor Analysis for the Interpersonal Intelligence Subscale

	Items	Factor Loadings	Factors F1	F2	F3
Social Awareness	86. I respect individual rights and freedoms	,499	,695		
	87. I believe I can accurately comprehend the reasons behind social norms	,412	,638		
	88. I have sufficient knowledge about the particular values and characteristics of the society I live in	,363	,594		
	89. I help others solve their problems	,376	,584		
	90. I empathize with others when deciding on my actions	,426	,581		
	91. I believe I am a sharing person	,384	,515		
	92. I consider others' feelings or ideas important	,303	,469		
Social Interaction	93. I believe the people around me are happy to make a friend of me	,634		,786	
	94. My friends like to have me with them at social events	,591		,760	
	95. I often call my friends to ask how they are	,413		,556	
	96. I can easily communicate my beliefs and ideas to others	,336		,469	
	97. The impacts of my words and actions upon others are important for me	,339		,459	
	98. I believe I will achieve better results when I work cooperate	,620			,777
	99. I prefer group work to individual work	,468			,683
	100. I like to spend my leisure time with others	,416			,572
	101. I like playing games with my friends	,382			,559
	Eigenvalue		2,711	2,246	2,007
	Explained Variance		16,946	14,038	12,546

It was found that the interpersonal intelligence self-perception subscale is further divided into three different factors, which explain 43.529% of the total variance. Loadings for the first factor range between 0.469 and 0.695, contributing to the total variance by 16.946%. Loadings for the second factor range from 0.459 to 0.786, contributing to the total variance by 14.038%. The loadings for the second factor range between 0.559 and 0.777, making a contribution to the total variance by 12.546%.

Table 9. Results of the Factor Analysis for the Intrapersonal Intelligence Subscale

	Items	Factor Loadings	Factors F1	F2	F3
Self - Self-confidence	102. I appreciate myself as a person, a friend, etc.	,488	,690		
	103. I am at peace with myself	,462	,647		
	104. It is important for me that I myself first appreciate what I do	,432	,640		
	105. I make healthy evaluations about my past	,412	,632		
	106. My own evaluations are more important for me than those of others about things concerning myself	,362	,590		
	107. I have a high self-esteem	,403	,570		
	108. I am considered as a self-confident person by others	,371	,567		
	109. I believe I am a free spirit	,332	,560		
	110. I usually feel myself happy and comfortable	,356	,491		
Leadership	111. Others leave me the decision about when to solve a problem	,552		,713	
	112. I believe I can become a good psychologist or philosopher	,471		,681	
	113. My friends take into account my expectations about their actions	,400		,623	
	114. It is important for me to be a well-known person	,378		,611	
	115. I believe I have good leadership qualities	,506		,607	
	116. My friends ask my opinion when making decisions as I make the right decisions	,443		,592	
Perseverance	117. I believe I can solve any problem that fits my level when I work on it	,575			,737
	118. I am good at making well-organized plans to solve complicated problems	,461			,636
	119. I do not have difficulty in looking from others' perspectives to events or situations	,413			,633
	120. I keep on working on the problem even when it gets tough	,418			,596
	121. I trust myself in working independently	,353			,513
		Eigenvalue	3,530	2,764	2,294
		Explained Variance	17,652	13,819	11,471

It was found that the naturalistic intelligence subscale is further divided into three factors, which explain 42.942% of the total variance. While loadings for the first factor range between 0.491 and 0.690, with a 17.652% contribution to the total variance; those for the second factor vary between 0.592 and 0.713, and contribute to the total variance by 13.819%. Loadings for the first factor range between 0.513 and 0.737, with a contribution of 11.471% to the total variance.

Table 10. Results of the Factor Analysis for the Naturalistic Intelligence Subscale

	Items	Factor Loadings	Factors F1	Factors F2
Interest in Natural Life	122. I am interested in gardening and enjoy such hobbies	,628	,788	
	123. I examine the lives of various animals and plants	,645	,781	
	124. I believe I will be successful in professions related to nature such as biology, zoology and geology	,625	,781	
	125. I attempt at growing new flower species	,592	,769	
	126. I would like to become a farm manager	,587	,762	
	127. I would enjoy listening to a conference on how to grow tropical flowers at home	,533	,724	
	128. I enjoy reading an essay on the adaptation of wild animals to zoos	,532	,702	
	129. I am interested in studying the world of living beings	,562	,697	
	130. I'd rather engage with plants or animals in my leisure time	,497	,693	
	131. I can easily learn the names of different species	,469	,597	
	132. I enjoy having a pet (bird, fish, cat, etc.) at home	,409	,593	
	133. I consider animal care and protection as important	,420	,509	
	134. I enjoy watching documentaries about the world of animals or plants	,304	,392	
Observation	135. I am informed and sensitive about environmental protection	,445		,667
	136. I am annoyed by those who are insensitive towards the nature	,437		,661
	137. I am aware of the strong relationship between humans and nature	,455		,657
	138. I feel at home in nature	,469		,655
	139. I really enjoy traveling and watching the surrounding environment while traveling	,426		,651
	140. I am a careful observer of beings or phenomena	,485		,641
	141. I have a special interest in nature and natural phenomena	,442		,591
		Eigenvalue	6,589	4,087
		Explained Variance	29,949	18,579

It was also observed that the naturalistic intelligence subscale is divided into two different factors, which account for 48.528% of the total variance. While loadings for the first factor range from 0.392 to 0.788, with a 29.949% contribution to the total variance; those for the second factor vary between 0.452 and 0.667, contributing to the total variance by 18.579%.

The eigenvalues and explained variance percentages for the eight subscales included in the Multiple Intelligence Self-Perception Scale are presented in the above tables. An explained variance ratio of higher than 30% is deemed sufficient in scale development studies in behavioral sciences (Büyüköztürk, 2002, p. 76).

Total Item Correlation

In this section, the scores obtained from each subscale were compared to those obtained from the whole of that particular subscale. Table 11 presents the item test correlation values obtained for each item.

Table 11. Item-Test Scores Correlation for the Multiple Intelligence Self-Perception Scale

I. Nu.	r	I. Nu	r	I. Nu	r	I. Nu	r	I. Nu	r
1	,503*	30	,301*	59	,571*	88	,395*	117	,491*
2	,495*	31	,234*	60	,719*	89	,503*	118	,435*
3	,528*	32	,306*	61	,567*	90	,556*	119	,409*
4	,595*	33	,199*	62	,514*	91	,568*	120	,492*
5	,495*	34	,243*	63	,461*	92	,504*	121	,500*
6	,603*	35	,439*	64	,621*	93	,535*	122	,712*
7	,571*	36	,668*	65	,497*	94	,512*	123	,752*
8	,547*	37	,704*	66	,444*	95	,484*	124	,720*
9	,529*	38	,590*	67	,524*	96	,511*	125	,666*
10	,431*	39	,717*	68	,595*	97	,508*	126	,688*
11	,481*	40	,675*	69	,746*	98	,469*	127	,664*
12	,505*	41	,665*	70	,676*	99	,407*	128	,699*
13	,444*	42	,727*	71	,722*	100	,514*	129	,726*
14	,522*	43	,729*	72	,682*	101	,498*	130	,660*
15	,799*	44	,651*	73	,727*	102	,533*	131	,675*
16	,779*	45	,682*	74	,647*	103	,551*	132	,630*
17	,741*	46	,636*	75	,684*	104	,495*	133	,641*
18	,808*	47	,541*	76	,716*	105	,502*	134	,538*
19	,744*	48	,735*	77	,584*	106	,481*	135	,382*

20	,770*	**49**	,516*	**78**	,619*	**107**	,468*	**136**	,383*
21	,767*	**50**	,406*	**79**	,638*	**108**	,521*	**137**	,481*
22	,812*	**51**	,734*	**80**	,602*	**109**	,466*	**138**	,516*
23	,696*	**52**	,566*	**81**	,610*	**110**	,451*	**139**	,325*
24	,761*	**53**	,772*	**82**	,631*	**111**	,521*	**140**	,568*
25	,738*	**54**	,687*	**83**	,627*	**112**	,465*	**141**	,570*
26	,697*	**55**	,737*	**84**	,523*	**113**	,441*	**142**	,548*
27	,724*	**56**	,790*	**85**	,431*	**114**	,427*	**143**	,555*
28	,663*	**57**	,756*	**86**	,514*	**115**	,629*		
29	,617*	**58**	,723*	**87**	,470*	**116**	,559*		

As could be seen in Table 11, item-test correlation coefficients vary between 0.199 and 0.812. These coefficients refer to the validity coefficient of each particular item, and indicate their consistency with the entire subscale. Although test correlation coefficients are low for items 31 (r=.234), 33 (r=.199) and 34 (r=.243), it was deemed appropriate not to remove these items from the scale so as not to damage the content validity.

Item Discrimination

Item analysis was performed to determine the discrimination power of the 143 items included in the scale. To this end, raw scores obtained from each subscale were listed in descending order, and the groups making bottom 27% and top 27% were identified. Subsequently, independent groups t-test values were calculated drawing on the mean scores for students included in the top and bottom groups. Thus, Table 12 presents the figures pertaining to the discrimination power of the calculated items.

Table 12 demonstrates that each item is discriminative at the desired level ($p<.001$).

Validity of Similar Scales

A literature review was performed to identify the present validity of the scale, and it was not possible to check the validity for similar scales as there was not any similar scale based on the self-perceptions of individuals.

Findings Relating to Reliability of the Scale

Line of Internal Consistency for the Multiple Intelligence Self-Perception Scale

The Cronbach's alpha coefficients were calculated in the studies for the internal consistency of the scale. Table 13 presents the reliability coefficients for the 143-item scale, their subscales, the subdimensions in the subscales and the overall scale.

Table 12. Results of the independent groups t-test performed for the item discrimination power of the Multiple Intelligence Self-Perception Scale

I. Nu.	*t*	I. Nu.	*t*	I. Nu.	*t*	I. Nu.	*t*	I. Nu.	*t*
1	-15,515*	30	-31,201*	59	-20,998*	88	-10,983*	117	-14,596*
2	-15,022*	31	-30,888*	60	-25,959*	89	-12,196*	118	-12,983*
3	-16,533*	32	-33,038*	61	-19,369*	90	-16,767*	119	-11,778*
4	-19,711*	33	-25,182*	62	-14,509*	91	-16,674*	120	-13,638*
5	-15,008*	34	-30,771*	63	-13,666*	92	-13,724*	121	-15,408*
6	-20,724*	35	-28,492*	64	-18,649*	93	-16,575*	122	-27,559*
7	-19,014*	36	-29,398*	65	-15,261*	94	-15,105*	123	-29,867*
8	-18,257*	37	-28,098*	66	-11,731*	95	-14,810*	124	-28,924*
9	-16.362*	38	-17.836*	67	-14,747*	96	-14,927*	125	-24,305*
10	-9,851*	39	-29,942*	68	-18,572*	97	-14,245*	126	-27,101*
11	-13,256*	40	-25,508*	69	-32,325*	98	-13,434*	127	-25,124*
12	-14,229*	41	-29,334*	70	-28,898*	99	-11,480*	128	-25,912*
13	-13,531*	42	-24,799*	71	-33,497*	100	-15,224*	129	-25,978*
14	-15,353*	43	-31,267*	72	-24,484*	101	-14,837*	130	-20,412*
15	-29,016*	44	-21,490*	73	-28,232*	102	-16,127*	131	-22,944*
16	-31,201*	45	-24,963*	74	-21,526*	103	-17,072*	132	-20,106*
17	-30,888*	46	-21,501*	75	-24,640*	104	-15,174*	133	-20,393*
18	-33,038*	47	-17,905*	76	-27,439*	105	-14,571*	134	-15,279*
19	-25,182*	48	-28,288*	77	-18,210*	106	-12,868*	135	-9,643*
20	-30,771*	49	-15,042*	78	-19,693*	107	-14,695*	136	-10,081*
21	-28,492*	50	-11,016*	79	-20,815*	108	-13,632*	137	-13,528*
22	-29,398*	51	-31,219*	80	-18,215*	109	-14,449*	138	-15,921*
23	-24,219*	52	-18,707*	81	-18,253*	110	-12,820*	139	-8,020*
24	-30,190*	53	-38,497*	82	-20,428*	111	-13,363*	140	-16,028*
25	-25,103*	54	-26,053*	83	-13,942*	112	-13,885*	141	-18,118*
26	-26,825*	55	-29,163*	84	-15,154*	113	-11,843*	142	-16,636*
27	-29,323*	56	-31,619*	85	-12,523*	114	-10,930*	143	-16,345*
28	-20,240*	57	-29,603*	86	-12,235*	115	-20,148*		
29	-29,016*	58	-25,212*	87	-11,885*	116	-17,467*		

Sd=498; N=250; *=p< ,001

Table 13. Internal Consistency Coefficients of the Multiple Intelligence Self-Perception Scale

Subscales	Faktor	Alpha
Linguistic Intelligence	1. Verbal and Written Explanation	,710
	2. Openness to Verbal Message	,686
	3. Linguistic Awareness	,661
	Total	**,785**
Logical-Mathematical Intelligence	1. Mathematical Transfer	,930
	2. Mathematical Relationship	,885
	3. Logical Relationship	,769
	Total	**,925**
Musical Intelligence	1. Musical Expression	,896
	2. Musical Perception	,887
	Total	**,926**
Bodily-Kinesthetic Intelligence	1. Bodily and Kinesthetic Learning	,879
	2. Bodily and Kinesthetic Expression	,767
	Total	**,872**
Spatial Intelligence	1. Visual Ability	,903
	2. Spatial Ability	,861
	Total	**,908**
Interpersonal Intelligence	1. Social Awareness	,724
	2. Social Interaction	,675
	3. Cooperative Attitude	,617
	Total	**,792**
Intrapersonal Intelligence	1. Self – Self-confidence	,795
	2. Leadership	,744
	3. Perseverance	,680
	Total	**,831**
Naturalistic Intelligence	1. Interest in Natural Life	,918
	2. Observation	,821
	Total	**,917**
Total		**,957**

Table 13 demonstrates that the Cronbach's alpha of the eight subscales range between 0.617–0.930. The Cronbach's alpha coefficient was calculated as 0.957 for the overall scale.

In order to identify the consistency between the subscales and the factors in each subscale, Pearson's r coefficients were calculated and summarized in Table 14.

As seen in Table 14, values of the relations among the subscales range between 0.028 and 0.524. It was found that there is not any relationship between interpersonal intelligence and musical intelligence, as well as spatial intelligence and naturalistic intelligence. On the other hand, a significantly positive relationship was identified between the other scales. It was also found that values for the relations between the factors of each subscale range between 0.151-0.822; thus indicating a significantly positive relationship.

Consistency between Two Practices

Reliability level of the scale was determined using the test-retest method. The finalized form of the 143-item scale was re-administered to the 100 subject students three weeks later. Table 15 summarizes the correlation values for the reliability level of the subscales.

Table 14. The Relationship between the Subscales of the Multiple Intelligence Self-Perception Scale and their Factors

Subscales	Correlation Between Factors			Correlation Between Subscale					
	F1	F3	2	3	4	5	6	7	8
1. Linguistic Intelligence	F2 ,406 **	,322 **	,128**	,266**	,288**	,302**	,295**	,394**	,261**
	F3 ,349 **	-							
2. Logical-Mathematical Intelligence	F2 ,822 **	,151**		,210**	,191**	,524**	,174**	,323**	,305**
	F3 ,227 **	-							
3. Musical Intelligence	F2 ,669 **	-		-	,522**	,524**	,028	,221**	,438**
4. Bodily-Kinesthetic Intelligence	F2 ,494 **	-				,456**	,139**	,313**	,425**
5. Spatial Intelligence	F2 ,499 **	-					,036	,278**	,516**
	F2 ,462 **	,312 **						,464**	,084*

6. Interpersonal Intelligence	F2	,462 **	,312 **				,464**	,084*
7. Intrapersonal Intelligence	F2	,321**	,400 **					,235**
	F3	,360 **	-					
8. Naturalistic Intelligence	F2	,514 **	-					-

Table 15. Test-Retest Results of the Multiple Intelligence Self-Perception Scale

Subscales	Linguistic	Logical-Mathematical	Musical	Bodily-Kinesthetic	Spatial	Interpersonal	Intrapersonal	Naturalistic
Linguistic	,756*							
Logical-Mathematical		,739*						
Musical			,721*					
Bodily-Kinesthetic				,696*				
Spatial					,760*			
Interpersonal						,555*		
Intrapersonal							,792*	
Naturalistic								,549*

*=p<,001

As seen in Table 15, correlation coefficients of each subscale constituting the scale vary between 0.549-0.792, and they are all significant (p<.001). As is known, reliability pertains to the reliability, consistency and sensitivity characteristics of the scale. Thus, these values identified as reliability coefficient also indicates the reliability of the scale.

Conclusion

This study developed a scale to determine individual intelligence profiles based on their self-perceptions. The scale is five-point Likert-type rating scale consisting of 143 items. Table 16 summarizes the item distribution according to the subscales and factors.

Table 16. Item Distribution according to the Subscales and Factors, and their Minimum-Maximum Scores

Subscales	Faktors	Item Number	Min. S.	Max. S.
Linguistic Intelligence	1. Verbal and Written Explanation	5	5	25
	2. Openness to Verbal Message	4	4	20
	3. Linguistic Awareness	5	5	25
	Total	**14**	**14**	**70**
Logical-Mathematical Intelligence	1. Mathematical Transfer	8	8	40
	2. Mathematical Relationship	7	7	35
	3. Logical Relationship	6	6	30
	Total	**21**	**21**	**105**
Musical Intelligence	1. Musical Expression	8	8	40
	2. Musical Perception	11	11	55
	Total	**19**	**19**	**95**
Bodily-Kinesthetic Intelligence	1. Bodily and Kinesthetic Learning	7	7	35
	2. Bodily and Kinesthetic Expression	7	7	35
	Total	**14**	**14**	**70**
Spatial Intelligence	1. Visual Ability	9	9	45
	2. Spatial Ability	8	8	40
	Total	**17**	**17**	**85**
Interpersonal Intelligence	1. Social Awareness	7	7	35
	2. Social Interaction	5	5	25
	3. Cooperative Attitude	4	4	20
	Total	**16**	**16**	**80**
Intrapersonal Intelligence	1. Self – Self-confidence	9	9	45
	2. Leadership	6	6	30
	3. Perseverance	5	5	25
	Total	**20**	**20**	**100**
Naturalistic Intelligence	1. Interest in Natural Life	13	13	65
	2. Observation	9	9	45
	Total	**22**	**22**	**110**
	Total	**143**	**-**	**-**

Each item was scaled as *never (1), seldom (2), sometimes (3), usually (4), always (5)*. Due to the different number of items in the subscales, the scores obtained from student responses to the five-point Likert-type scale do not display a standard nature. Therefore, it would be suitable to convert the obtained raw scores into standard scores with 20 as the lowest and 100 as the highest. Because the developed scale in question is intended to attain an intelligence score that could be standardized regardless of the characteristics of the group administered with the scale. In converting raw scores into standard scores, one could use the following:

The levels corresponding to the scores obtained from the subscales could be summarized as follows:

20-35	: Very low level
36-51	: Low level
52-67	: Medium Level
68-83	: High level
84-100	: Very high level

The validity of the scale was examined using three different methods, which are (1) factor analysis, (2) item-total correlations and (3) the item discrimination characteristic.

According to the results of the factor analysis, as could be seen in Table 16, the Multiple Intelligence Self-Perception Scale consists of eight subscales, which is also consistent with the eight types of intelligence suggested by Gardner (1999) in his Theory of Multiple Intelligences. Furthermore, each subscale is further divided into factors, which is largely in line with the factors offered by Gardner (1999) regarding the components of each intelligence type. For instance, in his theory Gardner (1999) argues that the intelligence type he termed as Logical-Mathematical has both logical and mathematical aspects. Similarly, in the Logical-Mathematical Intelligence Self-Perception Subscale, this intelligence type was identified as consisting of two factors, i.e. *Mathematical Ability and Logical Relationship*.

Factor loadings for the items in the Multiple Intelligence Self-Perception Scale range between 0.303 and 0.737. A factor loading for an item lower than 0.30 is considered to be at a low level and supposed to be removed from the scale (Rummel, 1988). Examining the factor loadings of the study, loadings not below 0.30 demonstrates the high validity of the factor analysis. Moreover, the explained variance percentages of the subscales range between 42.942 and 55.591. An explained variance ratio of higher than 30% is deemed sufficient in scale development studies in behavioral sciences (Gorsuch, 1983; Büyüköztürk, 2002). Thus, it could be suggested that the Multiple Intelligence Self-Perception Scale is a valid scale in terms of its item loadings and its variance explanation rates.

In order to evaluate to what extent the items of the scale discriminate the self perceptions, the researcher determined the item-total correlations and discrimination power of each item. Item-test correlation coefficients of the items in the scale vary between 0.199 and 0.812, all of which are statistically significant ($p<.001$). Although test correlation coefficients are low for items 31 ($r=.234$), 33 ($r=.199$) and 34 ($r=.243$), it was deemed appropriate not to

remove these items from the scale so as not to damage the content validity. Furthermore, in order to determine the discrimination power of the scale items, raw scores were listed in descending order, and independent sample t-test values were calculated for the mean scores of the groups making bottom 27% and top 27%. It was found that, for all of the items, mean scores of the top 27% group are significantly higher than those of the bottom 27% group ($p<.001$), indicating that all items have relatively a good level of discrimination power.

A relevant literature review was performed to identify the criterion validity of the scale, and it was not possible to check the validity for similar scales as there was not any similar scale.

Internal consistency coefficients Cronbach Alpha for the subscales of the Multiple Intelligence Self-Perception Scale vary between 0.785 and 0.926. For the overall scale, the Cronbach Alpha is 0.957. A reliability coefficient of 0.70 and higher is generally considered to be an indicator of the reliability of the scale (Gorsuch, 1983; Özgüven, 1994).

In order to identify the consistency between the subscales and the factors in each subscale, Pearson's r coefficients were calculated. It was subsequently found that the correlations between the factors of the subscales range between 0.151 and 0.822; indicating a significantly positive relationship for each of these relationships ($p<.001$). Another results was that values of the relations among the subscales range between 0.028 and 0.524; and that there is not any relationship between interpersonal intelligence and musical intelligence, as well as spatial intelligence and naturalistic intelligence, while there exist significantly positive relationships among other subscales ($p<.05$).

In order to determine the temporal reliability a level of the subscales included in the Multiple Intelligence Self-Perception Scale, the test-retest method was applied, which yielded total score correlation coefficients ranging between 0.549 and 0.792. The degree of consistency increases as the reliability coefficient gets closer to 1.00, and decreases when the same coefficient gets closer to 0.00 (Gorsuch, 1983). Thus, it could be suggested that the reliability coefficients obtained for the overall scale and its sub-dimensions are at a high level.

In conclusion, it could be suggested that the Multiple Intelligence Self-Perception Scale is an effective and reliable instrument in determining individuals' intelligence profiles according to their self-perceptions.

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