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Development and validation of Multiple Intelligences Scale in Indian Context

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Abstract: *The aim of the present study was to develop and validate a Multiple Intelligences Scale in Indian context. Howard Gardner(1999) questioned the idea of intelligence as a single entity, resulted from a single factor, and proposed Multiple intelligences, a multidimensional construct, and gave equal weight age to all the 9 types of intelligence, ("verbal intelligence", "logical/ mathematical intelligence", "spatial/visual intelligence", "musical intelligence", "bodily-kinaesthetic intelligence", "interpersonal intelligence", "intrapersonal intelligence", "naturalistic intelligence" and "existential intelligence"), each independent of all others, but all interacting to produce a person's intellectual capacities. The study was carried out in two phases. In the pilot study, a scale of 114 items was prepared and data was collected from 200 respondents (boys = 50% girls = 50%). In the main study, data was collected from 400 participants (boys = 50% girls = 50%) on the 81 finalized items from pilot study to re-validate Multiple Intelligences Scale. The present study was directed towards the development of a modular scale of multiple intelligences, so items analysis of individual intelligence (i.e. each type of intelligence) has been done, followed by "Exploratory Factor analysis" and "Confirmatory Factor Analysis" using SPSS Amos Ver.23 which provided the "goodness of fit" measures for the model. Results showed that the newly developed scale was a valid and reliable measure of Multiple Intelligences.*

Keywords: multiple intelligences, Indian context

Introduction

Early works in the field of mental abilities claimed that general intelligence was genetically determined and was constant throughout the life span of child. General intelligence was conceived as one of the 'givens' which the educator should accept in his efforts to educate

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the child. Intelligence seems to have been conceived as 'a thing' or a causative agent possessed in different degrees rather than as a construct to summarize an observed level of functioning. In 1883, Sir Francis Galton, suggested that "intelligence could be quantified and measured in an objective manner". Then Alfred Binet in 1905 developed the first intelligence test, followed by William Stern (1912) who introduced the concept of IQ. Later David Wechsler attempted to provide a broad definition of intelligence as "the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment." After eighty years of development of intelligence tests, the traditional beliefs and conceptualization of intelligence was challenged by Howard Gardner in 1983, a Harvard Psychologist. Project Zero at Harvard provided, Gardner an environment where he began to explore his interest in human cognition. Gardner had the perception that intelligence's conventional definition was too narrow, thus he developed the "Multiple intelligence theory" in 1983. Howard Gardner proposed a theory of intelligence called the "theory of Multiple Intelligence", that appeared in his book, "Frames of Mind: The theory of Multiple Intelligences". Howard Gardner regarded intelligence as "the capacity to solve problems or to fashion products that are valued in one or more cultural setting" (Gardner and Hatch, 1989). Gardner questioned the notion of general intelligence, "g" and prevailing intelligence tests and stressed that how one can capture an individual's intellectual abilities in "a single measure of intelligence." In fact, he tried to provide a wide base to the concept of intelligence and its measurement by providing multiple frames. According to Gardner, "human intelligence or cognitive competence can be better described as a set of an individual's multiple abilities, talents and mental skills related to a multiple number of domains of knowledge in a particular cultural setting" (as cited by Mangal, 2009). Further expanding his pluralistic view of intelligence, Gardner emphasized that each individual possess seven intelligences that differ, develops and grows differently depending upon their environmental experiences or hereditary characteristics. The listing of seven intelligences was provisional and were named as, "linguistic intelligence, the ability to use words effectively in writing, reading and speech", "logical/mathematical intelligence the ability of reasoning, analysing and dealing with numbers", "spatial intelligence the ability to recognize the world and space and present information visually", "musical intelligence, as related to reflective composition and appreciation of musical patterns", "bodily/kinaesthetic intelligence as related to physical ability", "interpersonal intelligence, the ability to build relationships with other people and interact effectively with them", "intrapersonal intelligence, the ability to understand and communicate

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within a person's self". Gardner in 1999 purported one more intelligence and called it as the eight intelligence "Naturalist Intelligence" intelligence related to nature. Later in 1999, Howard Gardner decided to include one more intelligence as ninth intelligence, named as "Existential Intelligence, ability to question about the existence of human, death, the meaning of life and the reason for existence" and mentioned this in his book "Intelligence Reframed: Multiple Intelligences for the 21st Century". The central idea behind "multiple intelligences" was to assist people recognize their strengths and weaknesses, so that they draw upon their strengths and work on their weaknesses. The established intelligence tests measured limited areas of intelligence, mainly maths and linguistics. Gardner indicated that "there are nine main intelligences, and there is also the possibility to add more". (Gardner,1999). Gardner claimed that all the seven types' intelligences seldom function independently; all tend to complement one another as people develop skills or solve problems. Two vital claims were made by Gardener about multiple intelligences; firstly, "the theory is an account of human cognition in its fullness. The intelligences provided 'a new definition of human nature, cognitively speaking" (Gardner, 1999). "Human beings are organisms who possess a basic set of intelligences." Secondly, "people have a unique blend of intelligences. Howard Gardner argues that the big challenge facing the deployment of human resources 'is how to best take advantage of the uniqueness conferred on us as a species exhibiting several intelligences" (Gardner, 1999). Another important feature and contribution of "Gardner's theory of multiple intelligences" is its bold declaration that "the concept of a measureable 'g' is at best limited and worst educationally misleading. It is not at all essential that an individual highly loaded with logical- mathematical and linguistic abilities will also display exceptional ability in all or remaining domains, i.e. musical, spatial, bodily, kinaesthetic, interpersonal, intrapersonal, natural and existential intelligences". It happens on account of a sort of autonomy maintained by each type of the nine different human intelligences which are said to be quite capable of developing independently of each other and also quite independently of an all-encompassing general intelligence's'. Assuming that there is no single core of 'intelligence', Gardner gave equal weight age to nine types, each independent of all others, but all interacting to produce a person's intellectual capacities. (as cited by Sebastian, 2013). As per the traditional view of intelligence people are born with a fixed amount of intelligence, consisting mainly of logical and linguistic abilities. Further the level of intelligence remains the same throughout life. On the contrary, Gardner argued that human being possess different types of intelligence and differ in strength and combination of intelligence.

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Students come to the class with distinctive set of intellectual strengths and weaknesses and these intellectual abilities govern the ease or difficulty in learning, that is, their learning styles. Chan (2004) attempted to study multiple intelligences of Chinese gifted students in Hong Kong and found that "logical- mathematical intelligence" received the highest rating while "bodily-kinaesthetic and naturalist intelligences" were given lowest rating. Mohan, Rose and Parks (2004) found that students with higher scores on "logical- mathematical intelligence" were more likely to show at or above grade level in reading comprehension scores in comparison to the students that scored less on logical-mathematical intelligence. Tirri and Nokelainen (2008) tried to identify multiple intelligences on Finish elementary school, revealed that male students had rated them as high in "logical-mathematical intelligence" as compared to females; further females rated their "linguistic abilities" greater than their male counter parts. Chhikara and Kaur (2008) assessed the multiple intelligence levels in adolescents (12-14) rural areas of Haryana and found that girls took slight lead in linguistic multiple intelligence in comparison to boys, while boys were lead in logical and bodily kinaesthetic intelligence as compared to girls. Khataybeh, Abdalla, Sheikh and Kholoud (2011) studied the diverse intelligence types in students in both public and private universities of Joradan and found significant difference were also found in the linguistic and interpersonal intelligence among female students. Further significance differences were also found in the musical intelligence among graduates. Shearer, Kayiran and Isik (2012) conducted a study on "validity and reliability of Turkish version of the Multiple Intelligences" development assessment scale on undergraduate students. Patrani and Sonawat (2013) undertook the development and standardization of multiple intelligences scale for preschool teachers and children at Mumbai and found that education practice in early childhood years through assessment of activities help to identify the abilities of the child in early stages which lead to their development in respective area. Waree (2013) conducted a study on the "development of the Multiple Intelligence measurement of elementary students" and found that multiple intelligences can be put into three categories viz. high, medium and low according to the scores. Al- Onizat (2014) studied the "psychometric properties of an Arabic version of Multiple Intelligence Development Assessment Scale for Adolescents" and found no significance differences in male and female students in the total scale, while females were found to have higher the musical and spatial intelligences than males, further males had higher naturalist intelligence than females. Mohanlal (2014) conducted a study on the construction and standardization of multiple intelligence inventory for the students of secondary schools in

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Gujarat and found that girls of secondary schools have more intelligence as compared to their boys counterparts. Emmiyati and Rasyid(2014) investigated "multiple intelligences profile" of junior students in Indonesia and found that intelligence possessed by the students belonged to weak, moderate and strong categories. Further "existential intelligence" remained as the strongest intelligence of all the multiple intelligences while the females were found to be stronger in "musical intelligence", "interpersonal intelligence" and "existential intelligence." Isias (2016) revealed that multiple intelligences test for secondary school students in Meghalaya worked as a diagnostic tool to assess the multiple intelligences of students and thus helped in undertaking appropriate streams of study that would help in creation of career. Kale and Yaratan (2016) conducted a study on multiple intelligence scale for exploring the "multiple intelligence profiles of students" in disciplines of engineering and education revealed that students from faculty of education had moderately high interpersonal intelligence while students of engineering had moderately high visual intelligence. Vidhyanathan (2017) studied the multiple intelligences of primary students with hearing impairment and revealed significant differences in verbal, interpersonal and bodily intelligences among students. Henceforth on the basis of review of literature, the present study was directed towards the development and standardization of "Multiple Intelligences scale in the light Gardner's theory of multiple intelligences". Teacher must recognize and think of all intelligences as equally significant. Further the teachers must present material in a style that involves most of all the intelligences. (as cited by Brualdi, 1996). Gardner's Theory of Multiple Intelligences has numerous implications for teachers. The multiple intelligence scale can be extremely helpful to the teaching community to enhance and enrich the teaching learning process in order to achieve maximum results of learning outcome. Gardner stated that there is not just one way to approach any subject matter. One can teach every discipline in a number of ways. No teacher needs to be contented with one particular way of approaching the teaching of a subject. "Nevertheless the teacher can show students how to use their more developed intelligences to assist in the understanding of a subject which normally employs their weaker intelligences" (Lazear, 1992). In fact the essence of "Gardner's multiple intelligence theory", is that any topic related to any discipline can be taught in more than one way. The objective of present research was to construct and standardize a tool for multiple intelligences for secondary school students, as secondary stage is a deciding stage, where students make career choices for future keeping in view their interest, capacities, abilities and preferences. The psychological testing will facilitate decision making related to placement of

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individual's at school as well as at work. Consequently, it is important to develop and validate a scale to assess multiple intelligences of students. Hence, keeping this in view, the study was conducted so as to fulfil the following objectives:

Objectives

1. To develop "multiple intelligences scale" for secondary school students.
2. To standardize "multiple intelligences scale" for secondary school students.

Method

Keeping in view the objectives of the study scale development procedures by Churchill (1979) and Hinkin (1995) was adopted to develop and standardise the instrument that sufficiently measures the construct.

Participants

The population of the study was secondary school students of Jalandhar district. The participants were 400 secondary school students (200 boys and 200 girls) from Government schools and private schools of Jalandhar district of Punjab selected by employing simple random sampling. For scale development the minimum acceptable size of sample is 150 (Hinkin, 1995).

1. **Statistical techniques:** "Cronbach's alpha" was used to measure the "internal consistency of the items". "Exploratory Factor Analysis" and "Confirmatory Factor Analysis" was employed for data reduction and scale refinement. **"**Exploratory factor analysis" was used to show the various factors associated with the construct. "Confirmatory factor analysis" was used to test the goodness of fit. Measures like percentage of variance explained by each of the factors, p-value, RMSEA, CMIN/DF, IFI, TLI and CFI were used in the study.

Procedure of development and standardization of scale

In the present study "deductive approach" for item generation and steps of tool construction and validation given by Hinkin (1995) have been adopted. "Deductive approach requires an understanding of the phenomenon to be investigated and a thorough review of the literature to develop the theoretical definition of the construct under examination" (Hinkin,

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1995). "The definition is then used as a guide for the development of items" (Schwab, 1980, as cited in Hinkin, 1995). Further the construct of multiple intelligences is multi-dimensional and comprises of nine components of intelligences, namely, (1) "Verbal/Linguistic Intelligence" (2) "Logical/ Mathematical Intelligence" (3) "Spatial/ visual Intelligence" (4) "Musical Intelligence" (5) "Bodily/ Kinaesthetic Intelligence" (6) "Interpersonal Intelligence" (7) "Intrapersonal Intelligence" (8) "Naturalistic Intelligence", (9) "Existential Intelligence" as proposed by Gardener(1999). On the basic research findings (Armstrong, 1993; Haley, 2003; Jain, 2007; and McKenzie, 1999;), it has been found that all the nine intelligence are mutually exclusive, and are not related to each other, independent but interacting, so instead of one single scale, modular scale, measuring each intelligence has been developed. The present study was inclined towards the construction of a modular scale (subscales) for each type of intelligence so as to assess each intelligence individually as well as together (i.e. all sub scales) and thus to discover natural inclinations and abilities of an individual. The following steps were involved in development and standardization of scale:

STAGE 1: Item Generation and Selection

- Content Validity
- First Try out

STAGE 2: Scale Development

- **Step I:** Design of the development study
- **Step II:** Scale Construction (Item analysis, "Exploratory Factor Analysis" and "Confirmatory Factor Analysis")
- **Step III:** Reliability Assessment

STAGE 3: Scale Evaluation

STAGE 1: **Item generation and Selection**

During the construction of scale, to clarify the objectives is very essential. The aim of the present study was to identify the extent to which an individual possesses all 9 types of intelligence as per Gardener's Multiple Intelligences theory, so for that it was necessary to construct the scale. To construct the "multiple intelligences scale", for students of secondary schools the researcher critically studied the theoretical background, previous researches as well as the necessary related reference material. The review of literature by McKenzie, 1999; Jain, 2007; Armstrong, 1993; and Haley, 2003 provided a solid base to the researcher to draw items

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for the scale**.** From the review of literature, the researcher initially framed 137 statements distributed over nine components of multiple intelligence as purported by Gardner. Researcher used a three-point scale, for measuring multiple intelligences, with Disagree, Neutral and Agree as options with rating of 0, 1 and 2 respectively. According to Hinkin (1995), the scale can be constructed without negatively worded statements. Three-points Likert scale was used to generate variance among the respondents.

Content validity: To check the content validity, the initial pool of items was given to 10 experts in field of education, for reviewing the statements and evaluating the content accuracy and coverage, repetition, editorial quality with suggestion for additions, deletions and modifications of items. On the basis of consensus of experts, preliminary draft of 137 items was finalized by deleting 23 items, and this resulted into the retention of 114 items in the finalised scale. Then, for conducting the pilot testing, this preliminary draft of 114 items assessing multiple intelligences was administered to 200 secondary school students (100 boys and 100 girls) from Government schools and private schools of Jalandhar district of Punjab by employing simple random sampling. For scale development the minimum acceptable size of sample is 150 (Hinkin, 1995). The researcher administered the preliminary draft of multiple intelligences on 200 secondary school students. The scale comprised of two parts, the first dealt with respondents demographic information such as gender, class, age, school, name, academic achievement of previous class, father occupation and mother occupations and the second section included 114 items for assessing multiple intelligence.

STAGE 2: Scale Development

Step I: Design of the development study

At this stage, the researcher defined set of items that were generated in the first stage for the construct under consideration. The researcher generated 114 positively worded items during scale construction. The tool was administered on 400 secondary school students (50% boys and 50% girls) of Jalandhar district, which is sufficient size of sample for the tool construction.

Step II: Scale construction

Factor analysis is the most frequently employed technique for reducing the data and the refinement of constructs. Two techniques of factor analysis i.e. “Exploratory Factor Analysis”

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and "Confirmatory Factor Analysis" were employed by the researcher. The objective of analysis was to assess the "goodness-of-fit" of factor model. The prime purpose of these two techniques of factor analysis in scale construction is to examine the stability of the factor structure and to provide required information that facilitates the refinement of new measure.

All the nine types of intelligence are mutually exclusive and cannot be taken collectively as supported by research studies (Armstrong, 1993; Haley, 2003; Jain, 2007; and McKenzie, 1999**).** As the present study was directed towards the development of a modular scale of multiple intelligences, so items analysis of individual intelligence (i.e. each type of intelligence**)** has been done individually, followed by "Exploratory Factor analysis" and "Confirmatory Factor Analysis".

Item analysis: The first step in scale construction is computation of the "Cronbach's Alpha" (Churchill, 1979). Cronbach's alpha is a measure of "scale's reliability" and measures the internal consistency of items, how closely a set of items are related as a group" (Cronbach, 1984). In the present study researcher has used SPSS 23 to calculate "Cronbach's alpha". "Cronbach's alpha" values for various the statements related to "verbal intelligence", "logical-mathematical intelligence," "spatial intelligence," "musical intelligence," "kinaesthetic intelligence", "interpersonal intelligence," "intrapersonal intelligence," "naturalistic intelligence" and "existential intelligence" were found to be 0.772,0.789,0.752,0.819, 0.707,0.737, 0.769,0.753, 0.696 respectively. "The minimum value for Cronbach's alpha should be .70" (Nunnally, 1978). Before applying EFA the investigator, in order to purify the scale, examined the item total correlations and items with low correlations were deleted with the cut-off value of 0.30. This process lead to the deletion of items related to different intelligences and resulted in the retention of 81 items. The value of Cronbach's alpha after the deletion of items related to "verbal intelligence", "logical-mathematical intelligence", "spatial intelligence", "musical intelligence", "kinaesthetic intelligence", "interpersonal intelligence", "intrapersonal intelligence", "naturalistic intelligence" and "existential intelligence" was found to be 0.740,0.738, 0.737,0.754,0.702,0.729, 0.769,0.722,0.692 respectively.

Table 1.1 showing reliability and validity analysis of all the nine types of multiple intelligences

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Multiple Intelligence	**Item**	**Factor loadings**	**KMO**	**Bartlett's test of sphericity**	**Eigen Value**	**Variance explained**	**Cronbach Alpha**
Verbal Intelligence	9	.428 to .820	0.800	619.501 p<0.01	2.158 2.018	46.395%	0.740
Logical-Mathematical Intelligence	9	.527 to .741	0.813	579.175 p<0.01	2.241 1.943	46.486%	0.738
Spatial Intelligence	9	.515 to .789	0.796	539.531 p<0.01	2.103 1.926	44.770%	0.737
Musical Intelligence	9	.232 to .433	0.816	593.560 p<0.01	3.069	3.069%	0.754
Bodily-kinaesthetic intelligence	9	.394 to .822	0.785	424.692 p<0.01	2.687 1.052	41.550%	0.702
Interpersonal Intelligence	9	.327 to .774	0.822	524.728 p<0.01	2.187 1.894	45.346%	0.729
Intrapersonal Intelligence	10	.420 to .818	0.783	525.213 p<0.01	2.367 1.610	44.194%	0.769
Naturalistic Intelligence	9	.511 to .770	0.801	512.306 p<0.01	2.828 1.210	44.871%	0.722
Existential intelligence	8	.414 to .761	0.736	416.219 p<0.01	2.551 1.2367	45.881%	0.692

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Exploratory factor analysis: After item analysis in scale development, next step is the application of "exploratory factor analysis" on the remaining set of 81 items. Principal axis factoring method of extraction was chosen to find the factor structure (Fabrigar et.al., 1999). Parallel analysis is a correct technique to decide regarding the factor to be retained (Velicer and Jackson, 1990). It was used with the help of "Monte Carlo PCA Parallel Analysis Software". For minimum loading of an item on a factor, the thumb rule of 0.32 was considered (Tabachnick and Fidell, 2001) and a factor with less than three items loading on it was considered as weak while with five or more was considered as strong. Researcher has applied factor analysis using SPSS 23 and further in order to determine the relevance of applying factor analysis, investigator employed Kaiser- Meyer-Olkin (KMO) to test the sample adequacy. "For a good factor structure, the minimum value of KMO must be at least .60 or above" (Tabachnick and Fidell 1996). In order to determine whether the data and sampling size are adequate for analysis, Kaiser- Meyer- Olkin(KMO) value is used. Kaiser-Meyer-Olkin(KMO) value for "verbal intelligence", "logical/ mathematical intelligence", "spatial/visual intelligence", "musical intelligence", "bodily-kinaesthetic intelligence", "interpersonal intelligence", "intrapersonal intelligence", "naturalistic intelligence" and "existential intelligence was found to be 0.800, 0.813,0.796,0.816,0.785,0.822,0.783,0.801 and 0.736 respectively (as evident in table 1.1) which was well above the threshold level. In addition Bartlett Sphericity test, which is used to find out whether the data comes from multivariate normal distribution or not, was applied and the result was found to be statistically significant ($\chi 2$= 619.501, 579.175, 539.531, 593.560, 424.692, 524.728, 525.213, 512.306 and 416.219, $p< 0.01$, (as evident in table 1.1) for all the nine types of intelligences respectively. KMO value must be .60 and above and the result of Bartlett's test of sphericity should be statistically significant. Hence the values obtained revealed that the data was accurate for factor analysis. Further the value of determinant was found to be 0.209,0.231, 0.254, 0.223 , 0.341, 0.265 , 0.265, 0.274 and0.349 for "verbal intelligence", "logical/ mathematical intelligence", "spatial/visual intelligence," "musical intelligence", "bodily-kinaesthetic intelligence", "interpersonal intelligence", "intrapersonal intelligence", "naturalistic intelligence" and "existential intelligence respectively which was greater than 0.00001. So we can say that there is no multicollinearity between the items.

In "Exploratory factor analysis" varimax rotation and principal component analysis extraction method was applied which lead to two factors with Eigen value 2.158 and 2.018 for verbal intelligence, greater than the randomly generated Eigen value by "Monte Carlo PCA

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parallel analysis software" for 100 iterations. Only these 2 components explained for 46.395% of the total variance in the analysed factor. Similarly two factors emerged with Eigen value 2.241 and 1.943; 2.103 and1.926, for logical intelligence, spatial/ visual intelligence respectively, one factor emerged with Eigen value 3.069 for musical intelligence, two factors emerged with Eigen value 2.687 and 1.052**,** 2.187 and 1.894; 2.367 and1.610; 2.828 and 1.210; and 2.551 and 1.114 for bodily kinaesthetic intelligence, interpersonal intelligence, intrapersonal intelligence, naturalistic intelligence and existential intelligence respectively which explained for 46.486%, 44.770%, 34.100% , 41.550%, 45.346%, 44.194%, 44.871% and 45.811% of the total variance in the analysed factors respectively.

Confirmatory factor analysis: The next step after the exploration of factor structure, in the scale construction is to purify the items using "Confirmatory Factor Analysis." "Confirmatory factor analysis is a distinct case of structural equation modelling which is also known as linear structural relationship modal" (Joreskog & Sorbom 2004). "Confirmatory factor analysis" is a statistical method which used to confirm the factor structure of a set of observed variables. "Confirmatory factor analysis" enables the investigator to test whether there exists an association between the underlying latent construct and observed variables (Suhr, 2006). Researcher has used AMOS 23 to apply Confirmatory Factor Analysis to the nine factors extracted in exploratory factor analysis. The multiple intelligences scale structure which comprised of 81 items and 9 factors, namely, verbal intelligence"(9 items), "logical/ mathematical intelligence" (9 items), "spatial/visual intelligence"(9 items), "musical intelligence" (9items), "bodily-kinaesthetic intelligence"(9items), "interpersonal intelligence"(9items), "intrapersonal intelligence"(10 items), "naturalistic intelligence" (9 items), and "existential intelligence(8 items), was tested by employing the confirmatory factor analysis. Table 1.2 shows the final indices of the model for verbal intelligence were CMIN/DF value = 1.962, "Incremental Fit Indices "(IFI) value=.958, "Tucker Lewis Index "(TLI) value=.941 and "Comparative Fit Index" (CFI) value = .958 respectively. The "Root Mean Square of Approximation" (RMSEA) value is 0.049 and chi test found was insignificant with p > 0.01 for verbal intelligence. The above evidences confirmed the two factor structure of verbal intelligence. Further, final indices of the model for logical intelligence were CMIN/DF value= 2.072, IFI value=.950, TLI value=.930 and CFI value = .949 respectively. RMSEA value is 0.052. and chi test found was insignificant with p > 0.01 for logical intelligence. These evidences confirmed the two factor structure of logical intelligence. The final indices of the

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model for spatial intelligence with CMIN/DF value = 2.475, IFI value=.926, TLI value=, 0.868 and CFI value = 0.923 respectively. While RMSEA value is 0.061 and chi test found was insignificant with p > 0.01 for spatial intelligence. These evidences confirmed the two factor structure of spatial intelligence. Similarly, the final indices of the model for musical intelligence with CMIN/DF value = 2.475, IFI value= 3.533, TLI value= .880 and CFI value = 0.905 respectively. RMSEA value is 0.071 and chi test found was insignificant with p > 0.01 for musical intelligence. These evidences confirmed the one factor structure of musical intelligence. The final indices of the model for Bodily- Kinaesthetic intelligence with CMIN/DF value = 2.338, IFI value=0.914, TLI value= .877and CFI value = .911 respectively. RMSEA value is 0.058 and chi test found was insignificant with p > 0.01 for Bodily- Kinaesthetic intelligence. These evidences confirmed the two factor structure of Bodily- Kinaesthetic intelligence. Further, the final indices of the model for Interpersonal intelligence were CMIN/DF value = 1.583, IFI value=.970, TLI value=, 0.957 and CFI value = 0.969 respectively. RMSEA value is 0.038 and chi test found was insignificant with p > 0.01 for Interpersonal intelligence. These evidences confirmed the two factor structure of Interpersonal intelligence. The final indices of the model for Intrapersonal intelligence were CMIN/DF value = 2.359, IFI value=.930, TLI value=, 0.901 and CFI value = 0.929 respectively. RMSEA value is 0.058 and chi test found was insignificant with p > 0.01 for Intrapersonal intelligence. These evidences confirmed the two factor structure of Intrapersonal intelligence. The final indices of the model for naturalistic intelligence were CMIN/DF value = 2.475, IFI value=.991, TLI value=, 0.987 and CFI value = 0.991 respectively. RMSEA value is 0.021 and chi test found was insignificant with p > 0.01 for naturalistic intelligence. These evidences confirmed the two factor structure of naturalistic intelligence. Lastly, The final indices of the model for existential intelligence were CMIN/DF value = 3.533, IFI value=.880, TLI value=, 0.819 and CFI value = 0.877 respectively. While RMSEA value is 0.080 and chi test found was insignificant with p > 0.01 for existential intelligence. These evidences confirmed the two factor structure of existential intelligence. The cut off values for all the measures of goodness of fit (IFI, TLI and CFI) is 0.9. In the literature, though there is no consensus on these values, if the values are above 0.90, this indicates a good fit (Schumavker and Lomax, 2016). While Hair et al. (2010) suggested that CFI value > 0.85 is acceptable but CFI value > 0.90 is considered as a better fit. RMSEA values also vary between 0 and 1, while RMSEA value of less than .08 is acceptable (Browne and Cudeck, 1993). All these indicators of good fit (CMIN/DF, TLI, IFI and CFI) are above the threshold value. The more these values are

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closer to 0, the more they indicate a good fit. All the values of the model fit indicators are satisfying, the threshold values of CMIN/DF, TLI, IFI and CFI in case of "spatial/visual intelligence", "musical intelligence", "bodily-kinaesthetic intelligence" and "existential intelligence indicates moderate fit while in case of verbal intelligence", "logical/ mathematical intelligence", bodily-kinaesthetic intelligence", "interpersonal intelligence", "intrapersonal intelligence", and "naturalistic intelligence" indicates that all the values of CMIN/DF, TLI, IFI and CFI are above the threshold value. So this indicates goodness of fit of the model, while the value of RMSEA which is the indicator of bad fit which is below the threshold value. So this implies that our model fulfils the criteria of goodness of fit.

Table 1.3: Goodness of fit measures for within- network constructs validity for nine types of Multiple Intelligences, namely, "verbal intelligence", "logical/ mathematical intelligence", "spatial/visual intelligence", "musical intelligence", "bodily-kinaesthetic intelligence", "interpersonal intelligence", "intrapersonal intelligence", "naturalistic intelligence" and "existential intelligence".

Goodness of fit Measures / **Benchmark Values** / **Multiple Intelligence**	**P value >0.05**	**CMIN/DF <3**	**RMSEA <0.08**	**IFI >0.90**	**TLI >0.90**	**CFI >0.90**
Verbal Intelligence	0.002	1.962	.049	.958	.941	.958
Logical-Mathematical Intelligence	0.001	2.072	0.052	.950	.930	.949
Spatial Intelligence	0.000	2.475	0.061	.926	.868	.923
Musical Intelligence	0.000	2.987	.071	.906	.873	.905

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Bodily Intelligence	0.000	2.338	.058	.914	.877	.911
Interpersonal Intelligence	0.030	1.583	.038	.970	.957	.969
Intrapersonal Intelligence	0.000	2.359	0.58	.930	0.901	0.929
Naturalistic Intelligence	0.030	1.173	.021	.991	.987	.991
Existential intelligence	0.000	3.533	.080	.880	.819	.877

Step III: Reliability Assessment

Researcher has used "Cronbach's Alpha" to measure the "internal consistency among the items". "Cronbach's Alpha is the most commonly accepted measure of internal reliability". For each of the intelligence namely, "verbal intelligence," "logical intelligence," "spatial intelligence", "musical intelligence,""bodily-kinaesthetic intelligence," "interpersonal intelligence", "intrapersonal intelligence", "naturalistic intelligence" and "existential intelligence" individual "Cronbach's Alpha's" were calculated and values of Cronbach's Alpha ranged from 0.692 to 0.754 (as evident in table 1.1).

Stage 3: Scale evaluation

Reliability: "Reliability refers to the consistency of a test, or the degree to which the test produces approximately the same results over time under similar conditions. Ultimately, reliability can be seen as a measure of a test's precision. The reliability of the respondents indicate that the interpretation is equivalent to that of Cronbach's alpha" (Wright and Master,1982). The instrument reliability was determined by computing internal consistency. The internal consistency of the individual intelligences was computed by employing Cronbach's alpha after completing Exploratory Factor Analysis. The value of Cronbach's alpha found for each type of intelligence was, viz. "verbal intelligence" (0.740), "logical intelligence" (0.738),

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spatial intelligence (0.737), "musical intelligence" (0.754), "bodily- kinaesthetic intelligence" (0.702), "interpersonal intelligence" (0.729), "intrapersonal intelligence" (0.724), "naturalistic intelligence" (0.722) and "existential intelligence" (0.692). The results highlight that each item is related to one and only one fundamental construct, hence this indicates unidimensionality of measures.

Composite reliability: "Composite reliability," also called "construct reliability is a "measure of internal consistency in scale items, much like Cronbach's alpha" (Netemeyer,2003). **"**Composite reliability" can be considered as "being equal to the total amount of true score variance relative to the total scale score variance" (Brunner and Süß, 2005). According to Fornell and Larcker (1981) composite reliability is an "indicator of the shared variance among the observed variables used as an indicator of a latent construct." The composite reliability (CR) for each type of intelligence viz. "verbal intelligence" (0.799), "logical intelligence" (0.797), spatial intelligence (0.777), "musical intelligence" (0.758), "bodily- kinaesthetic intelligence" (0.711), "interpersonal intelligence" (0.806), "intrapersonal intelligence" (0.797), "naturalistic intelligence" (0.787) and "existential intelligence" (0.741). In literature there is no general consensus regarding the value of composite reliability, but a reasonable threshold lies between .60 and more). All the values obtained were above the threshold value , that is, above .60.

Construct Validity: "Validity refers to the degree to which a test measures what it claims to measure. A test is valid to the extent that inferences made from it are appropriate, meaningful and useful". (as cited in Koul,2010). "Structural Equation Modelling" is used to assess the quality of the instrument while "Confirmatory Factor Analysis" is used to assess construct validity of the items. The CFA shows that all 81 construct of the instrument fits the empirical data based on the "Comparative Fit Index" of 0.9 and the "Tucker Lewis Index" of 0.9. The results of the analysis indicate that the instrument is deemed acceptable according to Arbuckle and Wothke (1999). The application of SEM over CFA helps to assess the validity of the main structural factors. Further all the goodness of fit indices, for each of the types of intelligence, indicates that all the values are above the threshold hold value so this indicates that the scale possess construct validity. Hence, when the validity and reliability of the instrument has been proved high, it can be concluded that the tool is valid and reliable.

Conclusion

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The present study was aimed at the construction and validation of a scale on multiple intelligences in the light of "Gardner's theory of Multiple Intelligence. A scale (comprising of items on 9 types of intelligence) consisted of 81 items in total. Each type of intelligence namely, "verbal intelligence", "logical intelligence", "spatial intelligence", "musical intelligence", "bodily- kinaesthetic intelligence", "interpersonal intelligence", "naturalistic intelligence" consisted of 9 items each, while intrapersonal intelligence", consists of 10 items and "existential intelligence" consists of 8 items was developed to measure the multiple intelligence of secondary school students. The scale demonstrated acceptable psychometric properties. The present scale will be of great help in the education sector and it will help in the identification and classification of students as per their natural abilities and inclinations and will thereby help them to make right career decisions. The scale can help students realize their unique talents and will boost up their confidence. Further the scale can be used as a diagnostic test to measure the multiple intelligences of students, and based on the high multiple intelligences, students can undertake that stream of study which will later help to create a career on the strength of one's multiple intelligences. Further, the scale will be of great help to teachers, parents and stakeholder and it will enable them to identify natural inclinations and abilities of students and thus avoid making wrong choices and there by leading to optimum development and utilization of human resources and can be extremely helpful to the teaching community to enhance and enrich the teaching learning process in order to achieve maximum results of learning outcomes.

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