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Developing a Scale for Assessing the Required Type of Intelligence Scale for Different Areas of Study

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ABSTRACT It is a known fact that in Turkey and in North Cyprus, most of the students register to universities after the University Entrance Examination which comprises a multiple choice test that assesses the quantitative and verbal abilities of the students. The students are placed to a department of a university if they obtain the necessary score. It is a known fact that in order to be successful each area of study requires certain skills or intelligence. There is always a possibility of a mismatch between students' dominant intelligence/s and the required intelligence/s for different fields of study. The current study aims to develop a Multiple Intelligences Scale which will be administered to academicians in a particular field of study for specifying the intelligence type required for that field of study.

INTRODUCTION

Schooling and the factors affecting the schooling process have always taken the attention of academic researchers (Alvarez and Frey 2012; Billig 2012; Purkey and Smith 1983; Wright 2015). As Armstrong (2000) specified, the idea of 'intelligence', which was thought to be among these factors, became more apparent in the twentieth century, when psychology was accepted as a respectable branch of science. With the efforts of French psychologist, Alfred Binet and a group of his colleagues, the first intelligence test was developed. With this test, intelligence was thought to be objectively measured and represented as a number or IQ score.

Almost eighty years after the first intelligence tests were developed, the traditional view of intelligence, which was limited to quantitative and linguistic abilities (verbal and computational intelligences), was abandoned with Howard Gardner's (1983) proposition of a new view of intelligence (Brualdi 1996). Gardner based his Multiple Intelligence (MI) theory on brain research, developmental work with young children, psychological testing, cross-cultural studies and the works of Dewey, Bruner, Piaget, and Eisner (Reiff 1997). As Derakhshan and Faribi (2015) state, with the proposition of MI, Gardner drew considerable attention from educational area for the reason that he expanded the concept of intelligence so that intelligence types included such areas as music, spatial relations, and interpersonal knowledge. Flouri et al. (2015) state that higher general intelligence was also related to fewer behavioural problems for children. According to Gardner (1999), intelligences are neural capacities that will be or will not be activated depending upon the society or opportunities available in that society, personal decisions made by individuals and/or their parents and teachers.

In his book, Intelligence Reframed, Gardner (1999) proposed that intelligence can represent itself in multiple ways as:

1) ***Verbal/Linguistic Intelligence:*** includes sensitivity to oral and written languages, and the capacity to use language to achieve certain aims (p .41).
2) ***Logical/Mathematical Intelligence:*** includes the ability to analyze problems logically, doing mathematical calculations, and investigate issues scientifically (p. 42).
3) ***Visual/Spatial Intelligence:*** includes the potential to recognize and manipulate patterns of wide space as well as patterns of more confined areas (p. 42).
4) ***Bodily/Kinesthetic Intelligence:*** the ability to use the body or parts of the body to express emotion, to play a game, to create a new product or solve problems (p. 42).
5) ***Musical Intelligence:*** capacities in the performance, composition and recognition

of rhythmic and tonal patterns, sensitivity to sounds from the environment, the human voice, and musical instruments (p. 42).

6) ***Interpersonal Intelligence:*** the ability to understand the intentions, motivations, and desires of other people and work cooperatively with others in a small group, as well as the ability to communicate verbally and non-verbally with other people (p. 43).
7) ***Intrapersonal Intelligence:*** the internal aspects of the self, such as knowledge of feelings, desires, fears, and range of emotional responses, and to use them effectively to regulate one's own life (p. 43).
8) ***Naturalistic Intelligence:*** the expertise in recognition of patterns in nature and the ability of classifying objects (p. 48).
9) ***Existential Intelligence:*** Spiritually reflects a desire to know about experiences and cosmic entities (p. 54).

Pedagogically, Gardner's theory has inspired diverse practices, including balanced programming, matching instruction to learning styles, and students' specialization (Klein 1997). This can be partly because of the shift from behaviorism to constructivism which emphasizes learners' internalizing knowledge and partly because practitioners' view intelligence as an important aspect of learning. Gardner's theory of MI has transformed some fundamental beliefs about teaching and learning. Enthusiasm for MI theory has grown and many educators have engrossed in the educational implications of it. There is quite a number of research done to reveal how activities developed based on MI theory facilitate students' learning in a variety of subjects. Today MI is seen as a valid and valuable tool for teaching children (Hoerr et al. 2010; Kezar 2001). There are also some studies on emotional intelligence as well which is the ability to be aware of your emotions and the emotions of others and then to use that knowledge to help manage the expression of emotions so that they foster success instead of causing roadblocks. (Prasad et al. 2015). Implications for school reform and classroom applications include expanded teaching strategies, curricular adaptations, and expanded school assessment (Stanford 2003). Furthermore, using MI theory makes it possible to teach large classes by increasing student motivation and inspiration (Chen 2004; Nicholson-Nelson 1998; Norel and Necsoi 2011).

Statement of the Problem

Recently, there has been an increase in the number of studies done on the effects of Multiple Intelligences in school settings all over the world. Despite the fact that there are some negative views regarding Gardner's MI theory (Ceci 1996; Kagan and Kagan 1998; Sternberg 1994; Willingham 2004), many researchers state the positive effects of applying Multiple Intelligence theory in school settings (Emig 1997; Giles et al. 1991; Hoerr et al. 2010; Shearer and Willingham 2005; Tai 2014). The environment that educators create should not be underestimated since it stimulates both intelligence development and learning and the components of intelligence identified by the theory can help curriculum guidance and planning as well as classroom strategy (Jordan et al. 2008).

Since the emergence of Gardner's theory, the implications have been significant for elementary and secondary schools and many schools have moved from teacher-centered curriculum to learner-centered because there is an appreciation of the uniqueness of the intelligence of individual students (Kezar 2001). Although there is an appreciation of the MI theory in elementary and secondary schools in the USA and in many parts of the world, little attention is paid to the practical use of MI theory in higher education (Barrington 2004; Kezar 2001; Sherarer and Luzzo 2009).

Parallel to the world, recently there has been a considerable number of studies conducted on the MI theory in Turkey and in North Cyprus. A content analysis of the studies done on MI in Turkey (master's and doctoral dissertations indexed by Higher Education Council's national Thesis Center and research articles published in journals indexed by ULAKBIM Social Sciences Database) revealed that most of the MI studies were conducted in elementary schools (Saban 2009). According to Hürsen and Özçinar (2008), the number of the MI studies done at higher education is not sufficient. Although there are some studies done in higher education settings (Abaci and Baran 2007; Akpinar and Dogan 2012; Durmaz and Yildirim 2005; Hamurcu et al. 2002; Saban et al. 2012), little attention has been given to the practical usage of the MI theory in higher education. Furthermore, because there is no known empirical study done to reveal the necessary intelligence profiles for different fields of

study, students do not have the opportunity to be guided in terms of their multiple intelligence profiles. We should therefore consider the fact that students who are undecided regarding their career choices are likely to display low self-esteem and inadequate educational self-efficacy and are likely to drop out schools (Shearer and Luzzo 2009).

Purpose of the Study

It is a known fact that in Turkey and in North Cyprus, most of the students register to universities after the University Entrance Examination which comprises a multiple choice test that assesses the mathematical and verbal abilities of the students. For students to be successful in a particular department certain skills and intelligences are required. Because the students taking the University Entrance Examination are not tested and placed to different departments according to their skills or Multiple Intelligence profiles, there is a possibility of finding themselves studying in departments which require different types of intelligences then their own (Sözüdogru 2009).

After a thorough search of the related literature, empirical studies specifying required intelligence types for different fields of study could not be found. Considering the possibility of a mismatch between students' dominant intelligence/s and the required intelligence/s for different fields of study at university level, career counsellors need a list of fields of study with the corresponding required intelligence types. By using this list counselors will be able to advice their students to apply to departments suitable to their intelligence profiles. For this reason the current study aims to develop a Multiple Intelligences Scale (MIS) which will be used to identify the intelligence profile required for success in any field of study

Sampling

The population of the study was all the university lecturers in Turkey and North Cyprus For the purpose of data collection convenient sampling method has been employed. Participants of this study were 234 university instructors from Turkey and North Cyprus who were contacted through an online survey tool, SurveyMonkey. The participants were from different fields of study such as Education (56), Engineering (34), Health Sciences (11), Pharmacy (16), Architecture (4), Medicine (14), Law (9), Arts and Sciences (16), Business and Economics (8), Dentistry (7), Veterinary (16), Agriculture (23), Modern Languages (10), and History (10). There were 111 females and 123 males. The participants' experiences in their profession were 1-5 years (6), 6-10 years (27), 11-15 years (53), 16-20 years (45), and 21-above years (103). All the participants were PhD holders.

Developing the Instrument

A cross-sectional survey method was employed to develop the Multiple Intelligence Scale (MIS) and after gathering the data, quantitative data analyses were employed. In order to develop the MIS, lecturers were asked to respond to the items in MIS so that the data would be available for exploratory and confirmatory analyses. The MIS consisted of two parts. The first part aimed to collect demographic data about the instructor participants and included items about their major field of study, area of specialization, faculty/department they were currently teaching, gender, age, year of employment as a lecturer, nationality, and academic rank.

For the second part of the scale the multiple intelligences scale which was originally prepared by McKenzie (2005) was adapted and instructors were asked to respond to the items in the developed scale for the purpose of finding out the required intelligence types of students for different fields of study. The original scale had 10 items for each intelligence (a total 90 items) and the original language was English. Since, it was going to be used in a Turkish setting, it was first translated into Turkish and as it was not going to be used as a Multiple Intelligence Scale, the items in the original scale were adapted to serve for the research purpose. For example, the items in McKenzie's original scale 'I enjoy working in a garden' and 'I can complete calculations quickly in my head' were adapted for the MIS as 'In order to be successful at your area of teaching, your students should find working in the garden enjoyable' and 'In order to be successful at your area of study your students should be able to complete calculations quickly in their head'.

For the content related validity, the items in the scale was checked by three experts and ac-

cording to their feedback some modifications were made of the items which seemed not suitable for the purpose of the research. Then the revised scale was checked by two measurement and evaluation experts and further modifications were made. The final version of the Multiple Intelligence Scale consisted of ten items for each intelligence area with a total of 90 items. The items in the scale were presented with a 5 point Likert scale ranging from 'a' to 'e' where (a) absolutely necessary, (b) necessary, (c) not sure, (d) unnecessary, and (e) absolutely unnecessary.

In the current study Statistical Package for Social Sciences (SPSS) software was used for exploratory factor analyses to find out how and to what extent the observed variables are connected to their underlying factors. The relationship between the observed and latent variables (factors) is represented by factor loadings (Byrne 2001; Harriggton 2009). In other words, all observed variables are related to every latent variable by a factor loading estimate (Hair et al. 2009). In this current study the 9 kinds of intelligence proposed by Howard Gardner were the underlying factors and the MIS items were the observed variables.

Before taking into consideration the exploratory factor analysis results, Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Barlett's Test of Sphericity was checked to see whether or not the data were appropriate for factor analysis. The lowest value of KMO should be .70 and the Barlett's test of Sphericity should be significant for the data to be adequate for exploratory factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) for Verbal/Linguistic, Naturalistic, and Bodily/Kinesthetic intelligences was found to be .731 which is above the commonly recommended value of .70 and the Barlett's Test of Sphericity was also found significant, $\chi^2(120) = 778.88$, $p = .000 < .01$. Hence factor analysis for these three latent variables was appropriate.

For the Logical/Mathematical, Existential, and Musical Intelligences KMO was found to be .781 which is above the required value, and Barlett's Test of Sphericity was significant, $\chi^2(325) = 1464.01$, $p = .000 < .01$. Hence factor analysis for these three latent variables was also appropriate.

KMO for Interpersonal, Intrapersonal, and Visual/Spatial Intelligences was found to be .786 which is above the limits and the Barlett's Test of Sphericity was also found significant, $\chi^2(171) = 879.63$, $p = .000 < .01$. Hence, factor analysis for this third set of three latent variables was also appropriate.

RESULTS AND DISCUSSION

After checking the KMO and Barlett's Test of Sphericity values, factor loadings were computed by using principal components analysis with Varimax rotation to check whether or not the scale items (variables) were loaded on the relevant factors. As three factors were aimed for each factor analysis, the number of factors was fixed to three at the beginning of each analysis. In the literature there are different views about the lower limit of the factor loadings. According to Ho (2006), cut-off value .33 was considered to show practical significance but on the other hand the cut-off value .30 for factor loadings was considered significant by Hair et al. (2009). According to Furr (2011), when interpreting the magnitudes of factor loadings, many researchers consider loadings above .30 or .40 as reasonably strong, with loadings of .70 or .80 being very strong.

Table 1: Factor loadings of verbal/linguistic, naturalistic, and bodily/kinesthetic intelligences

Rotated Component Matrix[a]	*1*	*2*	*3*
Nat7	.743		
Nat5	.708		
Nat8	.646		
Nat2	.640		
Nat9	.618		
Nat4	.507		
Verb/Ling6		.809	
Verb/Ling7		.808	
Verb/Ling8		.779	
Verb/Ling 5		.576	
Verb/Ling 1		.359	
Bod/Kinest 6			.719
Bod/Kinest 5			.693
Bod/Kinest 10			.637
Bod/Kinest2			.531
Bod/Kinest 4			.525

Extraction Method:
Principal Component Analysis.
Rotation Method: Varimax with
Kaiser Normalization.

a. Rotation converged in 5 iterations.
Factor loadings for V

Factor loadings for Verbal/Linguistic, Naturalistic, and Bodily/Kinesthetic Intelligences are

displayed in Table 1. The factor analysis was conducted with 30 items at the beginning and 14 items were eliminated because of low factor loadings on any of the factors. Of the remaining sixteen items six of them loaded on Naturalistic Intelligence, five on Verbal/Linguistic Intelligence, and the remaining five on Bodily/kinesthetic Intelligence.

Factor analysis of the Logical/Mathematical, Existential, and Musical Intelligences in Table 2 reveals that after omitting 2 items from both Existential and Musical Intelligences, most factor loading show reasonably strong and four loadings show very strong factorability.

Table 2: Factor loadings of logical/mathematical, existential, and musical intelligences

Rotated Component Matrix[a]	*1*	*2*	*3*
Math4	.720		
Math2	.707		
Math1	.634		
Math8	.615		
Math7	.585		
Math5	.559		
Math3	.522		
Math9	.507		
Math10	.496		
Math6	.376		
Existent8		.742	
Existent10		.704	
Existent9		.689	
Existent4		.632	
Existent		.516	
Existent6		.509	
Existent1		.479	
Existent2		.464	
Musical4			.699
Musical3			.644
Musical8			.634
Musical5			.603
Musical9			.598
Musical10			.557
Musical2			.472
Musical1			.393

Extraction Method:
Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

Factor loadings for Interpersonal, Intrapersonal, and Visual/Spatial Intelligences are displayed below in Table 3. Because of low factor loadings, four items from Interpersonal Intelligences, four items Visual/Spatial, and three items from Intrapersonal Intelligences are removed. The remaining factor loadings are either suggesting reasonable or strong factorability.

Table 3: Factor loadings of interpersonal, intrapersonal, and visual/spatial intelligences

Rotated Component Matrix[a]	*1*	*2*	*3*
Interpersonal6	.707		
Interpersonal5	.703		
Interpersonal3	.697		
Interpersonal7	.626		
Interpersonal2	.592		
Interpersonal9	.424		
Intrapersonal3		.675	
Intrapersonal7		.655	
Intrapersonal9		.653	
Intrapersonal1		.650	
Intrapersonal8		.614	
Intrapersonal10		.469	
Intrapersonal4		.458	
Visual/Spatial7			.663
Visual/Spatial6			.656
Visual/Spatial2			.577
Visual/Spatial10			.576
Visual/Spatial9			.566
Visual/Spatial4			.322

Extraction Method:
Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

In this current study almost all of the factor loadings for Multiple Intelligence Scale were found to be higher than the desired levels showing a good representation of the relevant factors.

Reliability of Multiple Intelligence Scale

According to Ho (2006), reliability is a prerequisite for the validity test and when a new instrument is developed one of the first things that should be considered is to be sure whether the instrument is sufficiently reliable to measure what it intends to measure (Aiken1999). In other words, the researcher should be sure about the consistency of the instrument (Bouma and Ling 2006). Internal consistency is considered as the most common method of estimating reliability (Furr 2011). Hence, in the present study the alpha coefficient which is popular among researchers (Furr 2011) was used to check the reliability of the Multiple Intelligence Scale. The Cronbach's alpha values for intelligence areas are displayed in Table 4.

According to Furr (2011) the cut-off values of good and poor reliability are not clear but Cohen et al. (2007) suggests 0.60 as the lower limit and 0.70 and above as reasonably reliable. As can be seen in Table 4 all the alpha levels for intelligence areas are at the required level.

Table 4: Cronbach's alpha values of intelligence areas

Intelligence areas	*Cronbach's Alpha*	*N of items*
Verbal/Ling	.731	5
Bodily/Kinesthetic	.650	5
Naturalistic	.725	6
Logic/Maths	.777	10
Existential	.765	8
Musical	.730	8
Interpersonal	.736	6
Intrapersonal	.725	7
Visual/Spatial	.608	6

Confirmatory Factor Analysis of Multiple Intelligence Scale

To assess the model fit of MIS, confirmatory factor analysis was done by using AMOS. For this purpose goodness-of-fit measures were taken into consideration by the researchers. The goodness-of-fit measures can be classified into three sub-titles (Gallagher et al. 2008; Ho 2006):

1) Absolute Fit Measures:

By examining the absolute fit measures the researcher can determine how well the proposed model fits the collected data. There are several fit measures like Chi-square statistics (χ^2), the Goodness-of-fit statistics (GFI), and Root Mean Square Error of Approximation (RMSEA) among the absolute fit measures (Gallagher et al. 2008; Ho 2006).

2) Incremental (Comparative) Fit Measures:

By examining the incremental fit measures the researcher can compare the proposed model and the null (independence) model where in the null model the observed variables are assumed to be uncorrelated with each other. There a five fit measures for the incremental fit measures and they are Tucker-Lewis Index (TLI), Normed Fit Index (NFI), Relative Fit Index (RFI), Incremental Fit Index (IFI), and Comparative Fit Index (CFI). The values of the incremental fit measures range from 0 showing poor fit of the model to 1 showing a perfect fit of the model (Ho 2006).

3) Parsimonious Fit Measures:

By examining the parsimonious fit measures the researcher can make sure if the model fit has been achieved. Parsimonious Normed Fit Index (PNFI), Parsimony Goodness-of-fit Index (PGFI), Consistent Akaike Information Criterion (CACI), Expected Cross Validitation Index (ECVI), and Akaike Information Criterion (AIC) are among the fit indices of this measure (Gallagher et al. 2008; Ho 2006).

As reported above there are many goodness-of-fit measures to assess the Model Fit and it is a matter of personal preference which fit indices are to be used. However, often multiple indices are reported (Tabachnick and Fidell 2007). In this current study the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Goodness-of-fit statistics (GFI), and Incremental Fit Index (IFI) have been used to assess the model fit.

The Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) are perhaps the most frequently reported fit indices (Hu and Bentler 1999; Tabachnick and Fidell 2007). For RMSEA values from 0.05 to 0.08 are considered acceptable and values from 0.08 to 0.10 indicate mediocre fit. If the value is greater than 0.10 it indicates a poor fit (Ho 2006). For the CFI, NFI, and IFI values can range from 0 (very poor fit) to 1, where large values show a good fit (Ho, 2006). However, Byrne (2001) suggests 0.90 to be the minimum value for CFI, NIF, and IFI. Similar to CFI, NIF, and IFI, for the GFI any value greater than 0.90 is considered to prove a good fit (Kelloway 1998).

When the goodness of fit values for Verbal/Linguistic, Naturalistic, and Bodily/Kinesthetic Intelligences are considered, the GFI was found to be 0.939, CFI to be 0.947, RAMSEA to be 0.045, NFI to be 0.854, and IFI to be 0.949. These values confirm that the items in each factor are at acceptable fit level. For the fit values to be at acceptable levels one item from the Naturalistic and one item from the Verbal/Linguistic Intelligences were deleted. Figure 1 represents the model fit.

When the goodness-of-fit measures were assessed for the model fit of Logical/Mathematical, Existential, and Musical Intelligences, GIF was found to be 0.910, CFI to be 0.918, RAMSEA to be 0.045, NFI to be 0.787, and IFI to be 0.920 proving that the items in each factor to be a good fit. For the fit values to be at acceptable levels six

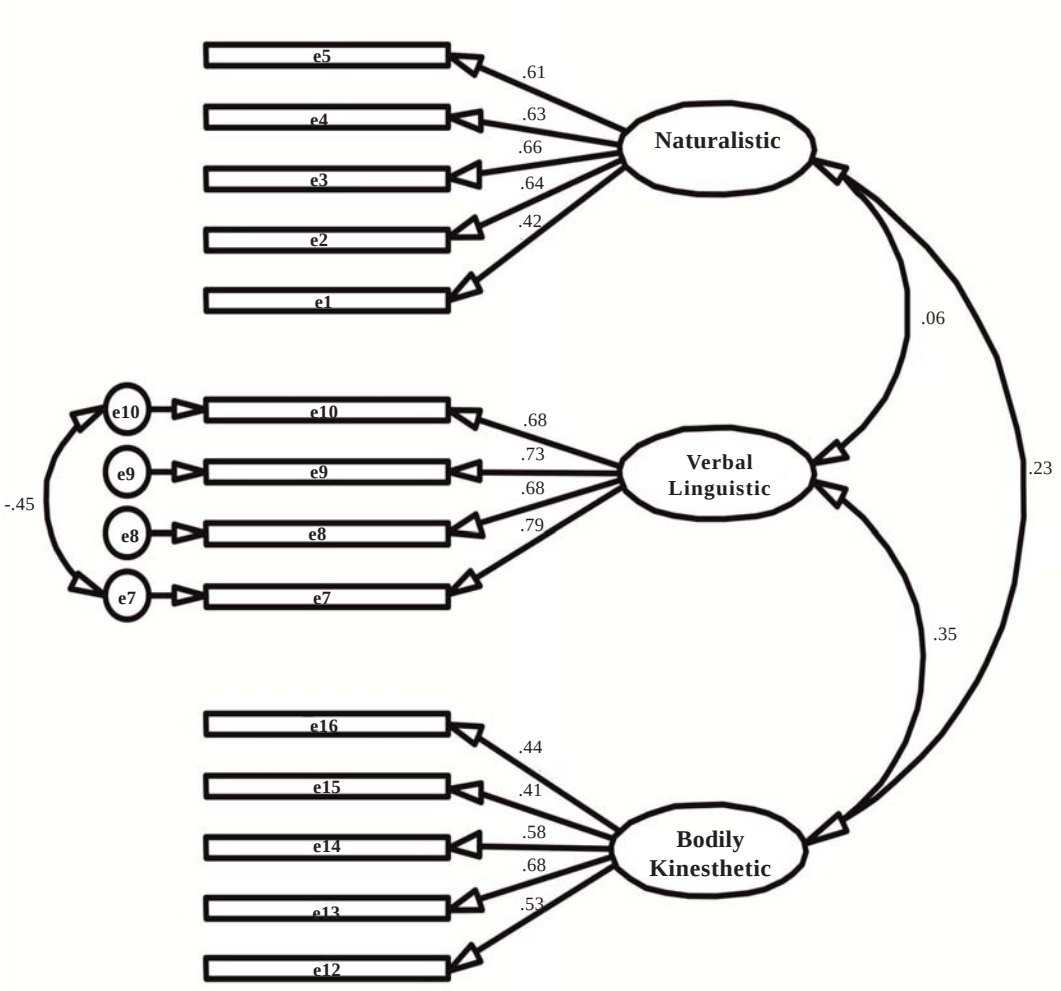

Fig 1. Model fit of verbal/linguistic, naturalistic, and bodily/kinesthetic intelligences

items from the Logical/Mathematical, one item from the Existential, and one item from the Musical Intelligences were deleted. Figure 2 represents the model fit.

For the Interpersonal, Intrapersonal, and Visual/Spatial Intelligences when the values of goodness-of-fit measures were analyzed , GIF was found to be 0.926, CFI to be 0.932, RAMSEA to be 0.039, NFI to be 0.790, and IFI to be 0.934 proving that the items in each factor to be a good fit. For the fit values to be at acceptable levels one item from the Visual/Spatial Intelligence was deleted. Figure 3 represents the model fit.

The final version of the MIS with the remaining items is given in the appendix.

Howard Gardner's Multiple Intelligences Theory was accepted by educators all over the world and the rationale behind his theory has contributed for expanded teaching strategies, curricular adaptations, and expanded school assessment. However, limited research was done at higher education level using Gardner's theory. Therefore, this study aims to make a contribution in the implementation of Multiple Intelligences for higher education purposes.

For students to be successful in a particular department certain skills and intelligences are required and these are not revealed by the University Entrance Examination. As a result stu-

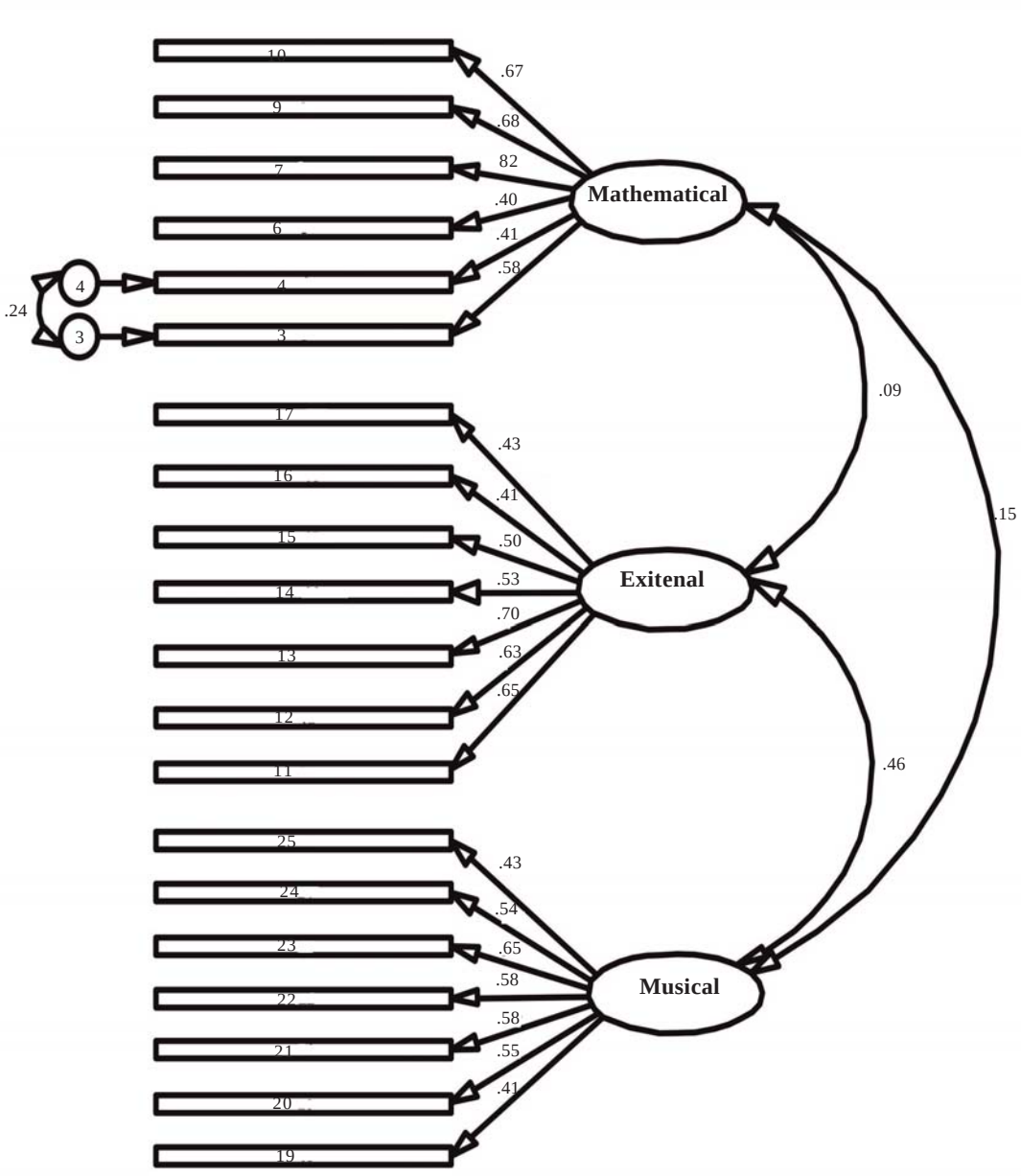

Fig. 2. Model fit of logical/mathematical, existential, and musical intelligences

dents may find themselves studying in departments which require different types of intelligences then their own. To this aim the researchers developed a valid and reliable Multiple Intelligence Scale which can be used for finding the required intelligence type/s for different fields of study. The first version of the Scale had 90 items and after Exploratory and Confirmatory factor analysis some of the items with low factor loadings were deleted. The final version of the MIS has 52 items.

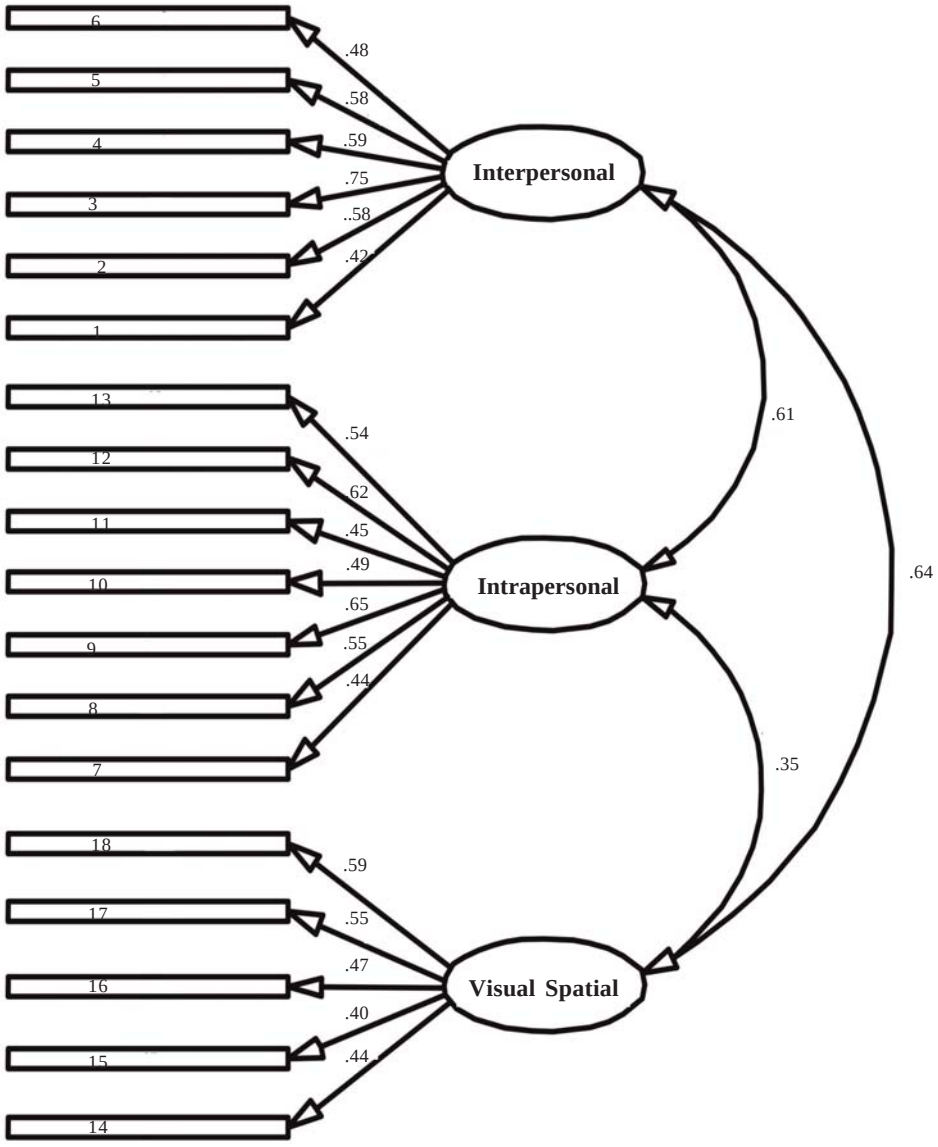

Fig. 3. Model fit of interpersonal, intrapersonal, and visual/spatial intelligences

CONCLUSION

There is a couple of limitations of the study. As the survey was done online the researchers could not answer possible questions of the participants. Although, some participants expressed their interest in the results of the study by sending e-mails encouraging the researchers there might be some participants who would like to make their comments about the Scale face to face and of course this was not possible.

Another limitation of the study was related to the nature of the study which employed only a quantitative design. Therefore, the study could be repeated employing a mixed method approach using both quantitative and qualitative approaches. This procedure will assure the triangulation of the study.

Finally, it can be concluded that the MIS will help career counselors guide their students for better career choices by providing the students with a list of intelligences required for different areas of study. If students are guided with the results of the MIS, it is assumed that their academic success will be better, they will be motivated, and they will not quit school because of academic failure. To prove this assumption, further longitudinal research academic success of students placed in departments according to the results of MIS throughout their higher education is required.

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