Creating and Testing of Multiple Intelligences Scale for College Students

Tianran Yu[a] and Xiaodong Li[b] [*]

Laboratory of Smart Health Promotion, Huaihua University, Huaihua, Hunan, China

[a]79680567@qq.com, [b]802618@qq.com

[*]corresponding author

Keywords: Multiple Intelligences; College Student; Structural Equation Model; Confirmatory Factor Analysis

Abstract: Purpose: develop a scale for measuring Chinese college students' multiple intelligences. Method: the entries were envisaged theoretically on the basis of literature retrieval and interviews. The objects of study are the students from 8 universities in Beijing. There are two rounds of tests, an initial test (n=1091) and a proving test (n=1250) in which large sample questionnaire were sent out and collected. Then use the content validity and confirmatory factor analysis to evaluate the validity of the scale and Cronbach's α coefficient to examine the reliability. Results: The content validities were evaluated on the basis of content validity ratios (I-CVI=0.792~1.000, S-CVI/UA=0.917, S-CVI/Ave=0.946). The structure validity was evaluated by confirmatory factor analysis (NNFI=5.50, CFI=0.93, IFI=0.93, RMSEA=0.064), the revised scale contains 86 entries in 8 factors, and the evaluation of proving test was steady. Reliability: the Cronbach's α coefficient of the whole scale is 0.949; the Cronbach's α coefficient of each sub-scale is 0.809~0.924, and the reliability evaluation of proving test was steady. Conclusion: The multiple intelligences scale for university students has good reliability and validity, there are eight kinds of factors including verbal-linguistic, logical-mathematical, visual-spatial, bodily-kinesthetic, musical-rhythmic, interpersonal, intrapersonal and naturalist, and this scale can be used as a measuring tool for research in the field of psychology and pedagogy.

1. Introduction

Humans have the passion in seeking the theory of intelligence for a long time. The people come from diverse social background have great differences in the concept of intelligence. In modern society, people pay attention to the existence and value of individual and emphasize the diversity of culture and knowledge. Howard Gardner (1993) thought that persons' intelligences are multiple in his theory of multiple intelligences (This study assumes that intelligence and mentality are the same concept). There are eight kinds of factors in this theory including verbal-linguistic, logical-mathematical, visual-spatial, bodily-kinesthetic, musical-rhythmic, interpersonal, intrapersonal and naturalist. This multiplicity could be found in all aspects of social life. Each intelligence has the equally important role, so that successes in one area does not mean that the people have higher relative intelligence in this field. The theory of multiple intelligences challenges the traditional definition of intelligence and its measurement methods. It keeps the scalability of traditional intelligence theories, also reflects that the trend of contemporary intelligence theories are more comprehensive. This theory has been widely applied in the reform and innovation of education and provides a new reliable basis in understanding and evaluating students comprehensively (McKenzie W, 2012).

There are many new achievements in creating of multiple intelligences scale. Shearer (1994) firstly compiled the self-evaluation scale of multiple intelligences and got numerous international academic attentions. Then he employed large samples (n = 23000) that were repeated revisions. Based on the exploratory and confirmatory factors analysis, he found the two secondary intelligences scale which included nine intellectual factors and space factors. The reliability coefficient of each sub-scale was 0.79~0.89. Which had big differences with the initial scale.

Shearer (2007) gave a proving testing with the revised scale, the measuring range of correlation coefficient was 0.77 ~ 0.92 and the scope of the internal consistency was 0.4 ~ 0.8. The results of effectiveness study on the multiple intelligences scale proved that the multiple intelligences scale could provide a reasonable estimate of the candidates' intellectual preponderance.

The Chinese domestic study such as Zhang Guoxiang (2008) based on the research results of 111 middle school and 190 high school students in a China and Portugal vocational and technical school, developed the middle and high school students' multiple intelligences scale which had intuitive, insight questions and considered the differences between Chinese and western students. The deficiency is that: the sample size was too small, confined to only a school; the factor analysis part did not use to modern statistics which contained the popular use of structural equation model. Zhang Jianhua (2012) employed the multiple intelligences scale composing large sample size which consisted of 1250 students from Beijing Normal University to developed 64 entries in 8 factors. This scale was given twice confirmatory factor analyses and gained relatively good structure validity of fitting index. The deficiency is that: the internal consistency reliability of the verbal-linguistic intelligence was low and it could be further improved.

There are differences education ideas between the east and west in view of their diverse social systems and cultural background, so that foreign existing multiple intelligences scales are difficult to directly to suit Chinese college students and adults. The multiple intelligence scale studies in China are still at the beginning.

The proving test study on Shearer's multiple intelligences scale of college students and adults outside the United States (Indonesia, Malaysia, Chile and Spain) did not get the breakthrough because the versions are not unified, reliability and validity tests of the data are not complete, and the contents of the entries and 7- grade measurement methods are too complicated (Yoong S, 2001; Pizarro SR, 2003)

The purpose of this study was that to develop a scale for measuring Chinese college students' multiple intelligences, in order that it can be used as a measuring tool to provide objective basis and standards for college students' self-evaluation, personal development and career choice.

2. Preliminary Research before Developing the Scale

2.1. Theoretical Foundation of the Scale

According to the definition of each intelligence factor of the theory of multiple intelligences and the existing scales, this study arranged the potential quality under the eight dimensions of multiple intelligences and constructed the primary index to describe the eight kinds of intelligence factors. Based on the primary index, the researchers reorganized the potential conducts of the intelligence factors in life, then developed the corresponding measuring entries that is the secondary index system. Each dimension of intelligence contains 2~5 primary indexes and 13~14 secondary indexes.

Listing primary indexes is not to further analyze the intelligence factors, but in order to descript a kind of intelligence comprehensively and objectively, make the questions' contents could reflect the behaviors what each kind of intelligence controlled more accurately. Because each kind of intelligence factors in theory is an independent whole, In later scale revise, if need to cut questions, cannot simply use statistical data as a reference, but to ensure the integrity of the first indicators to complete the whole intelligence factors.

According to some of the multiple intelligence scales abroad, this study commonly found the topics of their design are too complex so that it often need to be thought carefully, even it is difficult to get a clear answer after thinking.

Due to the scale of this study has substantial topics and the sample size is larger, objectively the questions require to be intuitive and concise as possible. The researcher conducted intelligence behavior or characteristics in common life as a reference to guarantee the quality of recovery of the large sample. At the same time, this article tried to verify the traditional multiple intelligences scale from different way of thinking that is as far as possible conducting intelligence behavior or characteristics in common life as a reference. From the results of research, this attempt is feasible.

Although the theory of multiple intelligences stated that the intellectual factors are independent, people often need to mobilize their multiple intellectual factors to cooperate to complete the task for intelligent behaviors sometimes in life. It had brought many difficulties and troubles to measure the independence of the intelligence. The items which compiled by various factors in the research need to avoid overlapping of intellectual factors, so as to ensure the purity of intellectual factors as possible, also prepare for later researches on correlation among various factors of multiple intelligences. At the same time, this study need to estimate the differences that existed in a large number of respondents in the act of a single intellectual factor. If it was expected that an intelligent behavior in different people did not have obvious differences, it is still unpredictable.

Table1. Multiple intelligences' two-level index structure (110 items)

Intellectual factors	Primary indexes	Secondary index numbers
Verbal-linguistic	Verbal comprehension	7
	Verbal expression	7
Logical-mathematical	Computing capability	4
	Logical organization ability	5
	Analysis ability	5
Bodily-kinesthetic	Body perception & expression	5
	Overall athletic ability	6
	fine motor ability	3
Visual-spatial	Space Identity	7
	Space using	7
Musical-rhythmic	Rhythm awareness	2
	Pitch perception	3
	Music appreciation	5
	Music spiritual	2
	Musical performance	2
Interpersonal	Interpersonal awareness	6
	Interpersonal coordination	8
Intrapersonal	Self-perception	7
	Self-control	7
Naturalist	Natural identification	6
	Natural interaction	8

2.2. Interview with Experts and Students

The research group invited 15 experts from related fields, covering psychology, sports science, arts, literature, pedagogy, etc. to evaluate the omission or repetition in the index system, the clearness of expression and the applicableness of the items of multiple intelligence scale, and propose revision recommendations. Combined with the recommendations put forward by experts, the research group revised and perfected the multiple intelligences index system and preliminarily formulated the questionnaire.

The research group invited 11 Ph.D. students from related departments (School of Chinese Language and Literature, School of Science of Mathematics, College of P.E. and Sports, School of Arts and Media, School of Philosophy and Sociology, School of Business and Economics and College of Life Science) in Beijing Normal University and 39 undergraduates from Beijing universities to fill in and discuss the preliminarily formed questionnaire and propose revision recommendations for doubtful items. The principle should be followed in the revision process: Inspect the semantic accordance with the corresponding research contents; ambiguity of the verbal expression, terseness of the language and fitness of the presentation. The preliminary questionnaire would be formulated after such revision.

2.3. Preliminary Survey Version of Multiple Intelligences Scale:

A scale in the questionnaire was developed by adopting the Five-Level Likert Scale, including strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree, respectively. The question uses serpent arrangement, namely each item is selected from each dimension for orderly arrangement and eight for a group. In this way, it could both prevent subjects from the thinking set and look up in later research by classification. For purpose of screening valid questionnaires, the researcher designed two reverse items with correspondence to the original ones for lie detection (Lazear DG,1994). After the above revision, a preliminary survey version of multiple intelligences scale would be determined, as shown in Table 1.

3. Initial Test and Result Analysis with Scale

3.1. Respondents in Initial Test

The respondents in initial test are the Beijing normal university undergraduate students. The freshman and sophomore students are the main body. The study based on the teaching plan of the institute of physical education and sports to choose classes samples, accorded to the class time to get in touch with the teachers, and adopted the method of sending out questionnaires then collecting them during a lesson. In most cases the respondents filled in the questionnaires before class and were illustrated by the research team members who contain 15 teachers that teach the lessons of public physical education. In the process of filling out, they implemented the whole process supervision to ensure that the questionnaires were real and effective. 1226 students participated in the survey and 1091 valid cases were collected. The sample effective rate was 89.0%.

The Questionnaires distributed in 45 teaching classes, and 1091 valid samples were collected. Sample distribution was as follow: 449 boys (41.2%) and 642 girls (58.8%); 334 freshmen (30.6%), 359 sophomores (32.9%), 398 juniors and seniors (36.5%); specialty coverage: liberal arts (31.4%), science and engineering (42.3%), business (12.6%), arts and sports (13.6%).

3.2. Reliability and Validity Analyses in Initial Test

3.2.1 Content Validity of Initial Test

Content validity (CVI)) refers to the extent to which a measure represents all facets of a given construct. The most widely used in the quantitative analysis of content validity is content validity index including I-CVI and S-CVI. According to the different calculation methods, S-CVI contains S-CVI(S-CVI/UA) and S-CVI(S-CVI/Ave)If　I-CVI ≥0.78, S-CVI/UA≥0.8 and S-CVI/Ave≥ 0.9, the measure would have good content validity (Shi Jingjing et al.,2012)

The research group invited 24 experts again from related fields, covering psychology, sports science, arts, literature, pedagogy, etc.to evaluate the second round of the multiple intelligences scale; and distributed to each expert the "Expert questionnaire evaluation form of college students' multiple intelligences" The evaluation contents was the applicableness of the items of multiple intelligences scale and used the four points grade evaluation method to calculate the CVI of the scale: 4 is "strongly correlation", 3 is "correlation" ,2 is "weak correlation" ,and 1 is "uncorrelated". The content validities were evaluated on the basis of content validity ratios that is the number of the experts who gave "3" or "4" divided by the total number of experts (24). The value is corresponding item's CVI. For this study, I-CVI = 0.792~1.000, S-CVI/UA = 0.917, and S-CVI/Ave =0.946. These values conform to the requirements of the statistics, so that the CVI of the total questionnaire and each item are better.

3.2.2 Structure Validity of Initial Test

The structure validity analyses include the Exploratory Factor Analysis (EFA) and the Factor Analysis (CFA). Generally speaking, when the observed variables and latent variables have unknown or uncertain relationship, the EFA will be used. At this point the researcher's interest is the number of key factors of observation variables. When based on the prior theory or the number of the setting factors of the previous researches and their relationships, the EFA will be used (Byrne BM, 1994). Its aim is to test the relationship between the observation variables and their internal

latent variables (Zhao Bihua & Gu Haigen, 2010). Looked from the direction of researches, the former is data-driven, the latter is theory guidance. The process of creating the scale in this study followed the concept and contents of the theory of multiple intelligences and the theory basis is fully, so that using CFA conformed to the requirements.

Factor analysis was made by using the LISREL8.80 data; a first-order eight-factor structure equation model was established. As for the figure 1, the fitting indexes included χ^2/ df, NNFI, CFI, IFI and RMSEA. If RMSEA is below 0.05, the fitting extent of structure model would be ideal. If RMSEA is 0.05-0.08, the structure model would be accepted. The value of NNFI, CFI and IFI need to attain 0.9 and more than 0.9 are optimal. If χ^2/ df is 2-5, the structure model would be accepted. Because it is easy to be influenced by the sample size, it has little significance for evaluation of a single model (Hou Jietai et al., 2004).

Given in this paper, we mentioned before each kind of intellectual factors should, in theory, is an independent group, so using intelligence factor and the item is the secondary indicators to construct structural equation model.

As already stated, the intellectual factors are independent in theory, so this study used intellectual factors and the items that is secondary indexes to construct the structural equation model. Through fitting the first-order eight-factor structure equation model, the initial model fitting indexes were relative ideal (Table 2), but there was still a further optimization of space.

Table 2. The fitting indexes of the eight-factor structure equation model of multiple intelligence(n=1091,Items=110)

Fitting indexes	χ^2	df	χ^2/ df	NNFI	CFI	IFI	MSEA
Value	37117.53	5857	6.34	0.91	0.91	0.91	.070

In the process of optimization, the load quantity and modified index were the references. When an item removed, the structure of the system of the multiple intelligences theory would not be affected at the same time, so as to ensure the completeness of the primary indexes and intellectual factors. When the two items' modified indexes are different, the principle of revision is to keep the value of larger load quantity, more purely representing a single intelligence factor. The items which are more intuitive and concise, the behaviors which are more diversity will be persisted.

Table 3. The adjusted fitting indexes of the eight-factor structure equation model of multiple intelligences

Fitting indexes	χ^2	df	χ^2/ df	NNFI	CFI	IFI	RMSEA
Value	19460.01	3541	5.50	0.93	0.93	0.93	0.064

After 17th adjustments of the preliminary test and 18th confirmatory factor analysis, the results showed that the fitting indexes of the structural equation model are favorable and stable, the load quantity of each item is above 0.4, an 86-questions multiple intelligences scale was ultimately determined then.

3.2.3 Examining the Reliability of Initial Test

This study used the SPSS 18.0 to calculate the Cronbach's α coefficient to examine the reliability of initial test. The greater the Cronbach's α coefficient show that the greater reliability of measurement.

The standard is often thought to be that 0.60~0.65 is unacceptable value, 0.65~0.70 is the minimum acceptable value, 0.70~0.80 is fairly good value and 0.80~0.90 is ideal value. Thus, a scale or questionnaire with good reliability, the Cronbach's α coefficient would be above 0.80. If Cronbach's α coefficient of sub-scale is below 0.60 or the whole scale is below 0.80, the researchers should consider revising the scale again or emending the items. In this study the Cronbach's α coefficient of the whole scale is 0.949; the Cronbach's α coefficient of each sub-scale is above 0.80, so the reliability evaluation of initial test was ideal.
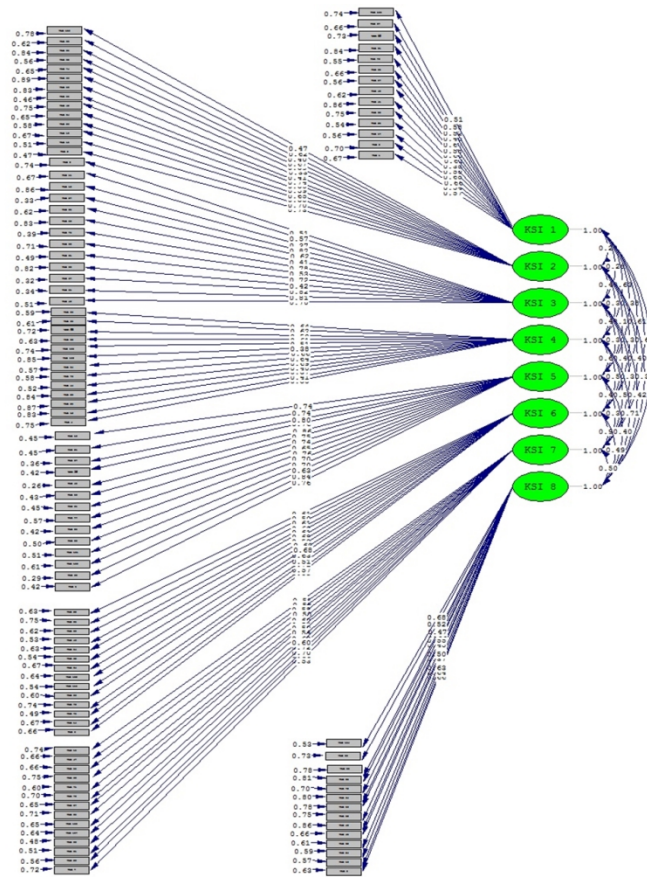
Figure1. The eight-factor structure equation model of multiple intelligence (110 items)

3.3. The Revised Multiple Intelligences Scale

According to the results of the reliability and validity analyses, the revised scale contains 86 items in 8 factors as the secondary indexes structure. It would be used as the basis of the proving test in the next step.

Table 4. The internal consistency of multiple intelligences factors of initial test (n=1091)

Intellectual factors	Cronbach's α coefficient	Items
Verbal-linguistic	0.839	11
Logical-mathematical	0.837	10
Bodily-kinesthetic	0.876	12
Visual-spatial	0.808	8
Musical-rhythmic	0.924	12
Interpersonal	0.857	11
Intrapersonal	0.835	12
Naturalist	0.809	10
Total reliability	0.949	86

Table5. The revised multiple intelligences scale (86 items)

Intellectual factors	Title number	Secondary indexes
Verbal-linguistic(11)	1	I can easily understand classical essays.
	9	Reading is a relaxed and happy thing for me.
	17	I can quickly grasp the ideas which the author want to convey.
	25	I can feel the artistic conception of poetry.
	33	I seldom meet rarely used words.
	49	I can easily remember the catchphrase.

	57	I can write good essays.
	65	I can write fluently.
	73	I am good at quoting.
	89	I am very comfortable in discussion and debate.
	97	I am good at telling stories.
Logical-mathematical(10)	2	In peers, mathematics is my strong suit.
	10	I can keep clear thinking when calculating.
	18	I have accurate estimated arithmetic ability.
	26	I have strong mental arithmetic ability.
	34	I like puzzles or logical game.
	42	I am speaking and doing things with logical thinking.
	50	I am good at science.
	74	I am interested in the principle of scientific discoveries.
	82	I am used to quantitative analyses of the problems solving.
	106	I am interested in the internal operation procedure of the computer.
Bodily-kinesthetic(11)	3	I can get inspiration through physical activities.
	11	I am good at imitating others' body movements.
	27	I can easily learn a new sport skills.
	35	I can always effectively avoid injuries when the body out of balance.
	43	I am and good at many sports and love them.
	51	I am moving fast.
	59	I have a good flexibility.
	67	I am athletic.
	75	I have good body balance ability.
	83	I have strong throwing ability.
	91	My limbs coordinate.
Visual-spatial(8)	4	I am able to distinguish all sorts of color.
	36	I can understand the thought of paintings or sculptures.
	44	I can judge photography products.
	60	I am good at match colors.
	76	I am good at photography.
	84	I know how to use images to express ideas.
	92	I am good at painting.
	100	I often help thinking through drawing.
Musical-rhythmic(12)	5	I can command with the musical-rhythm.
	21	I can clearly find others out of tune.
	29	I am able to quickly and accurately sing or hum a song when it plays 1 or 2 times.
	37	I am able to discern the treble and bass part of music works.
	45	I have strong music appreciation ability.
	53	I can distinguish the voice of the common instruments.
	61	I can feel the emotion that be conveyed by music.
	69	I like to talk about music.
	77	I like to collect audio and video products about music.
	85	I can find study or work's inspiration from the music.
	101	Classmates and friends often praise my songs.
	109	I am good at one or more instruments.
Interpersonal(11)	14	I can often transpose thinking.
	22	I am good at sense motive.

	38	I can hear the implication of others.
	46	I know my relationship status.
	54	The classmates and friends around me often ask me for help.
	62	I can effectively communicate coordinate with others, when we have disagreements.
	70	I can help others to resolve contradictions.
	78	I can always find someone can help me.
	86	I have a number of friends.
	94	My classmates and friends think that I have charisma and leadership.
	110	I can always win everyone's love and respect.
Intrapersonal(12)	7	I know my own personality.
	23	I know my position and role in groups.
	39	I clearly know my strengths.
	47	I will think about my own life.
	55	I can anticipate what the result of doing things.
	63	In the face of setbacks, I can keep optimistic mood.
	71	I can be based on reality life to set goals for myself.
	79	After the conflict, I will be calm and critical thinking.
	87	I am able to overcome my shortcomings.
	95	I can easily focus attention.
	103	I am strong.
	111	I can always find a good way to relieve pressure.
Naturalist(11)	8	I can observe the subtle changes of plants growing.
	16	I can tell the difference between a variety of trees and flowers.
	24	I am familiar with the taste of a variety of flowers.
	32	I would be able to recognize a variety of animals.
	40	I am very familiar with famous mountains, the mountains, etc.
	56	I like the outdoor activities such as hiking, camping, rafting and so on.
	64	I like to appreciate the natural landscape.
	72	I care about the environment change and actively participates in the natural environment protection.
	96	I like the movies, music, photography, art or literature about nature.
	104	I am good at planting trees and flowers.
	112	I'm good at to collocation vegetables on cooking.
	16	I can tell the difference between a variety of trees and flowers.

4. Scale Validation Test and Result Analysis

The proving test questionnaire was also developed by adopting the Five-Level Likert Scale, including strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree, respectively. The inappropriate questions were deleted from the preliminary questionnaire, and the question order remained unchanged. For purpose of screening valid questionnaires, the researcher also designed two reverse items with correspondence to the original ones for lie detection. The two polygraph questions are "I have few friends" and "I lack athleticism" vs. "I have a lot of friends" and "I am athletic".

4.1. Respondents in Proving Test

In order to prove the reliability and validity of the questionnaire, researchers issued the proving test questionnaire in 8 universities (Tsinghua University, Peking University, Renmin University of

China, Beijing Normal University, Beijing Institute of Graphic Communication, Central University for Nationalities, Beijing University of Civil Engineering and Architecture and Beijing Foreign Studies University). The reasons of university selection is that firstly, for the consideration of the distribution of samples in common and key universities, four key and four common universities in Beijing were selected; secondly, for the reasonable distribution of samples of different majors, two liberal arts and two science and engineering universities, which offer the specialties of arts and business, were selected.

These questionnaires were issued and received in these universities by the physical education teachers in or after class. A faculty meeting was held before the questionnaires were issued to explain and emphasize the principles of questionnaire: it is a secret questionnaire; ask students not to be backward about filling out it and ask faculty to supervise students to complete the questionnaire. There were 1250 available cases.

Sample distribution was as follow: 631 boys (50.5%) and 619 girls (49.5%); 487 freshmen (39%), 633 sophomores (50.6%), 130 juniors and seniors (10.4%); specialty coverage: liberal arts (380, 30.4%), science (260, 20.8%), engineering (272, 21.8%), business (200, 16.0%), arts and sports (90, 7.2%) and other specialties (48, 4.8%).

4.2. Structural Validity of Proving Test

4.2.1. Analysis of the Reliability and Validity of Proving Test

Factor analysis was made by using the LISREL8.80 data; a first-order eight-factor structure equation model was established again, and the comparison with the initial results shows that the major fitting indexes of the first-order eight-factor intelligence structure model are ideal, indicating that the 86-question first-order eight-factor intelligence structure model has a favorable structural validity and stability. It should be noted that chi-square values are sensitive to sample size; due to the larger sample size in the second test, the freedom degree of chi-square is higher compared with the initial test.

Table 6. The major fitting indexes of the first-order eight-factor intelligence structure model

(n= 1250, items=86)

Fitting indexes	χ^2	df	χ^2/ df	NNFI	CFI	IFI	RMSEA
Value	25021.42	3541	7.07	0.92	0.93	0.93	0.070

4.2.2. Examining the Reliability of Proving Test

This study used the SPSS 18.0 to calculate again the Cronbach's α coefficient. The internal consistency reliability of various intelligence factors and the summative scale reliability of the multiple intelligence scale were analyzed in the verification test, and the two measurements did not differ significantly, indicating again that the internal consistency coefficients of the multiple intelligence scale are stable and can be applied to actual measurement and practical study.

5. Analysis and Discussion

5.1. The Reliability and Validity of Multiple Intelligences Scale

The questionnaires adopted Cronbach's α coefficient to examine the reliability. The Cronbach's α coefficient of the whole scale is above 0.9 and the Cronbach's α coefficient of each sub-scale is above 0.8; so that the reliability evaluation of proving test was steady. As for the content validity, if I-CVI ≥ 0.78, S-CVI/UA≥ 0.8 and S-CVI/Ave≥ 0.9, the measure would have good content validity. For this study, I-CVI = 0.792~1.000, S-CVI/UA = 0.917, and S-CVI/Ave =0.946. These values conform to the requirements of the statistics, so that the CVI of the total questionnaire and each item are better. As for the structure validity, the scale in this study strictly followed the concepts and contents of the multiple intelligences theories during preparation and was based on the factor number and relationship setting in priori theories or previous research; as a theory orientation

study, confirmatory factor analysis was used in this study to test whether there is a relationship between observable variables and their inner latent variables. The method of confirmatory factor analysis is to establish a first order structural equation model; after 17 adjustments and the preliminary test and verification test of a total of 2,341 valid samples, the results showed that the fitting indexes of the structural equation model are favorable and stable, then an 86-questions multiple intelligence scale was ultimately determined.

As already stated, any intelligence theory is subject to its limitations. The multiple intelligence scale is much more connected to the display of the tendencies and features of the students in different factor intelligence development. These tendencies and features, which may be different from the intelligence contents that are stressed by many other intelligence theories, can represent the capacity to solve various problems in a diversified social, which is stressed by the multiple intelligence theory.

5.2. Cultural Differences in Multiple Intelligence Scale

Different cultural backgrounds may lead to different insights into intelligence; the multiple intelligence theories in the contemporary society with the contention of various schools are partly derived from cultural diversity. Under this premise, people will reflect on how to share the same intelligence in different cultures and how the sharing results will be. For example: Western intelligence research emphasizes cognitive processing speed, while Oriental researchers will doubt the quality of quick action, and stress the importance of processing depth (Lockhart RS & Craik FI,1990); Australian college students attach importance to their learning ability while Malaysia college students to their practical abilities, language skills and creativity(Gill R & Keats DM,1980); the understanding of the importance of various intelligence factors varies in different parts of the Chinese world. As noted earlier, no breakthrough has been made in cross-cultural trials of multiple intelligence scale. Even a multiple intelligence scale shows favorable reliability and validity in the confirmatory study in a country or a region, it appears controversial when it is tried in another region with different cultural backgrounds (Cai Xiaoyue &Xiang Zuqiang, 2001; Zhou Zhuying &Zhang Yamei 2001).

Table7. The Cronbach's α coefficient of the whole scale and each sub-scale(n=1250, Items=86)

Intellectual factors	Cronbach's α coefficient	Items
Verbal-linguistic	0.832	11
Logical-mathematical	0.840	10
Bodily-kinesthetic	0.879	12
Visual-spatial	0.833	8
Musical-rhythmic	0.925	12
Interpersonal	0.859	11
Intrapersonal	0.847	12
Naturalist	0.809	10
Total reliability	0.954	86

The exam-oriented education in China does not allow the sound development of comprehensive qualities and abilities of most students before they go to the university, and students prematurely put labels of liberal arts or science on themselves to classify their knowledge system. It is particularized as follows: the differences in language and mathematics are polarized by arts or science; students of arts and sports are classified prematurely; there is a widespread lack of emotional education. As students enter the university, their existing knowledge system will change greatly. There are many sources of these changes, such as the urban environment, family background, school atmosphere, their majors and social groups. Chinese students will go through a knowledge deconstruction soon after they go to university, which is revolutionary for their multiple intelligence development. Specifically, it is reflected on all aspects of their college life, such as the advanced study and selective abandoning of their existing mathematical knowledge, rethinking and selective acceptance of Marxism, the application and selective expansion of the composition writing

methods in high school and reorientation and selective reinforcement of foreign language studying.

This study attempted to find the contents for measurement from the cultural life of China's college students to change the multiple intelligence so as to fit the cultural environment in China. Researchers failed to express how to display the cultural differences via the scale. However, through the interviews and extensive communication and interaction between experts and students, the common cognitive background and cultural identity of researchers and respondents can avoid, to the greatest degree, the limitations of intelligence theories themselves and the bias in Western studies on intelligence against Chinese students. The question expressions draw upon the successes of various versions of foreign multiple intelligence scales and more fully take into account China's basic national conditions and the differences in cultural background and educational system to facilitate respondent students' understanding and truthful answer of the scale.

6. Conclusion

The multiple intelligences scale for university students in this research has good reliability and validity, and it can be used as a measuring tool for researches in the field of psychology, pedagogy, etc. The intellectual factors have the relative independence in the theory of multiple intelligences. Logical-mathematical, bodily-kinesthetic and musical-rhythmic are the highest in independence.

Reference

[1]. Byrne BM (1994) Structural equation modeling with EQS and EQS / Windows: Basic concepts, application, and programming London: Sage Publications.

[2]. Cai Xiaoyue and Xiang Zuqiang (2001) Intellectual development and education of Chinese southwest minority youth. Chinese southwest normal university press, Chongqing.

[3]. Gardner, H (1993) Multiple intelligences: The theory in practice. New York: Basic Books.

[4]. Gill R and Keats DM (1980) Elements of intellectual competence. Journal of Cross-Cultural Psychology, 11(2):233-243.

[5]. Hou Jietai et al. (2004) Structural Equation Model and Its Application. Educational Science Press, Beijing.

[6]. Lazear DG (1994) Multiple intelligence approaches to assessment: solving the assessment conundrum. Tucson: Zephyr Press.

[7]. Lockhart RS and Craik FI (1990) Levels of processing: a retrospective commentary on a framework for memory research. Canadian Journal of Psychology, 44(1): 87-113.

[8]. McKenzie W (2012) Intelligence Quest: Project-based Learning and Multiple Intelligences. Eugene: International Society for Technology in Education.

[9]. Pizarro SR (2003) Psychometric analyses of the Multiple Intelligences Developmental Assessment Scales. Annual meeting of the American Educational Research Association, Chicago.

[10]. Shearer CB (1999) The MIDAS challenge! A guide to career success. Kent: MI Research and Consulting Inc.

[11]. Shearer CB (2005) Large scale factor analysis of the Multiple Intelligences Developmental Assessment Scales. Annual meeting of the American Educational Research Association, Montreal.

[12]. Shearer CB (2007) The MIDAS: professional manual (Rev. ed.). Kent: MI Research and Consulting Inc.

[13]. Shearer CB, Luzzo DA (2009) Exploring the application of multiple intelligences theory to career counseling. Career Development Quarterly, 58(1): 3-13.

[14]. Shi Jingcheng et al. (2012) Content validity index in scale development. Journal of central south university (medical edition) Changsha, 37(2): 152-155.

[15]. Yoong S (2001) Multiple intelligences: A construct validation of the MIDAS scale in Malaysia. International Conference on Measurement and Evaluation in Education, Penang.

[16]. Zhang Guoxiang (2007) Two School-based Multiple Intelligences Learning Evaluation Experiment Research. Educational Science Press, Beijing.

[17]. Zhang Jianhua (2012) The theory of sport knowledge. Beijing sports university press, Beijing.

[18]. Zhao Bihua and Gu haigen (2010) Some Problems and Their Solutions in the Development of Mental Scales. Psychological Science, Shanghai, 33(6): 1467- 1469.

[19]. Zhou Zhuying and Zhang Yamei (2001) The theory of multiple Intelligences experiment in Taiwan elementary schools. Global education outlook, Shanghai, 30(12): 23-30.