

**CONSTRUCTION OF AN INTELLIGENCE SCALE
FOR SECONDARY SCHOOL STUDENTS
IN SANA'A, YEMEN**

ADEL AHMED MOHAMMED AL-NAMRANI

UNIVERSITI SAINS MALAYSIA

2016

**CONSTRUCTION OF AN INTELLIGENCE SCALE
FOR SECONDARY SCHOOL STUDENTS
IN SANA'A, YEMEN**

by

ADEL AHMED MOHAMMED AL-NAMRANI

Thesis submitted in fulfillment of the requirements

for the degree of

Doctor of Philosophy of Social Science

DECEMBER 2016

ACKNOWLEDGEMENT

First and foremost I offer my thanks and praise to almighty ALLAH for his blessings upon me and for providing me with the sufficient strength and vision throughout the work to complete my research.

The study presented in this manuscript was accomplished under the inspiring guidance, generous assistance and enlightened supervision of Dr. Norzarina Mohd Zaharim and she deserves the most thanks after almighty god. I would like to express my deepest gratitude to her for her continues support, patience, caring and her excellent guidance throughout my thesis which without that great help of her, this thesis wouldn't have been completed and seen the light. One couldn't wish for a better supervisor.

I would also like to extend my deepest gratitude to my co supervisor, Dr. Mohammed Affandy for providing me with the necessary facilities that eased and helped me in completing my thesis.

I would also like to give my deepest thank to the experts in my thesis committee for their insightful suggestions and comments.

My thanks go to my friend Dr. Muhammad Hezam Alamari, Dean of the Faculty of Arts at Tamar University-Yemen for his support, encouragement and motivation and valuable advices throughout the work to complete my thesis.

My whole family, mother, brothers and sisters were constant source of encouragement and motivation. I would like to thank all of them.

Last but not the least, I find no words to express my gratitude and profound admiration to my wife, she was always there cheering me up and always by my side through the bad and good times.

ADEL AHMED AL-NAMRANI

TABLE OF CONTENTS

ACKNOWLEDGEMENT	ii
TABLE OF CONTENTS	iii
LIST OF TABLES	vii
LIST OF FIGURES	x
ABSTRAK	xi
ABSTRACT	xii
CHAPTER 1: INTRODUCTION	
1.0. Introduction	1
1.1. Overview	1
1.2 Intelligence Tests in Education	3
1.3 Intelligence Tests in Yemen and the Arab World	5
1.4 Problem Statement	7
1.5 Research Questions	11
1.6 Research Objectives	11
1.7 Research Scope	12
1.8 Significance of the Study	12
1.9 Definitions of Key Terms	14
1.9.1 Intelligence	14
1.9.2 Intelligence Test	14
1.9.3 Validity	15
1.9.4 Reliability	15
1.9.4 Norms	15
1.10 Structure of the Remaining Chapters	15
CHAPTER 2: LITERATURE REVIEW	
2.0 Introduction	16
2.1 Overview	16
2.2 Definitions of Intelligence	17
2.3 Theories of Intelligence	21

2.3.1	The Factorial Models of Intelligence	22
2.3.2	Contemporary Theories of Intelligence	35
2.3.3	Summary of Intelligence Theories	41
2.4	History and Development of Intelligence Tests	45
2.4.1	The Development of Mental Tests in Europe	48
2.4.2	The Development of Mental Tests during World Wars	52
2.4.3	The Development of Mental Tests in the United States	55
2.4.4	The Emergence of Collective Intelligence Tests	58
2.5	Intelligence Tests	60
2.5.1	Intelligence Measurement in the West	60
2.5.2	Intelligence Measurement in the Arab World	68
2.5.3	General Discussion of Intelligence Tests	73
2.6	Intelligence Quotient (IQ)	76
2.7	Concepts Related to Intelligence	79
2.7.1	Intelligence and Academic Performance	79
2.7.2	Intelligence and Socio-Cultural Context	81
2.8	Principles of Psychological Testing	83
2.8.1	Tese Conceptualization	83
2.8.2	Test Construction	84
2.8.3	Test Administration	96
2.8.4	Standardization of Psychological Test	97
2.8.5	Interpretation of Test Results	99
2.8.5	Summary of Principles of Psychological Testing	104
2.9	Theoretical / Conceptual Framework	105

CHAPTER 3: METHODOLOGY

3.0	Introduction	109
3.1	Research Design	109
3.2	Population of the Research	109
3.3	Participants	110
3.4	Instrument	111
3.4.1	Construction of the Instrument	111
3.4.2	Weighting of the Capabilities	113

3.4.3	Drafting of Items of the Intelligence Scale	114
3.4.4	Judgement on Items of Intelligence Scale (Opinions of Experts)	117
3.5	Test Administration	120
3.6	Data Analysis	121
3.7	Item Analysis	122
3.7.1	Calculating the Repeatability Distributions for the Total Scores	122
3.7.2	Coefficients of Difficulty and Discrimination for Items	123
3.7.3	Discriminatory Power for the Items	125
3.8	Validity	126
3.8.1	Content Validity	126
3.8.2	Concurrent Validity	126
3.8.3	Predictive Validity	127
3.8.4	Construct Validity	128
3.9	Reliability	128
3.9.1	Cronbach's Alpha	129
3.9.2	Test-Retest Method	129
3.9.3	Kuder-Richardson 20	129
3.9.4	Split Half Method	130
3.10	The Pilot Study	131
3.10.1	Sample of the Pilot Study	131
3.10.2	Procedure	131
3.10.3	Data Analysis	133
3.10.4	Validity	133
3.10.5	Reliability	134

CHAPTER 4: RESULTS

4.0	Introduction	137
4.1	The Frequency Distributions of the Intelligence Scale Scores	137
4.1.1	The Frequency Distributions of the Verbal Ability	142
4.1.2	The Frequency Distributions of the Numerical Ability	145
4.1.3	The Frequency Distributions of the Spatial Ability	147
4.2	Coefficients of Difficulty and Discrimination	149
4.3	The Discriminatory Power of Items	152

4.4	Validity of the Intelligence Scale	156
4.5	Reliability of the Intelligence Scale	171
4.6	Summary	173

CHAPTER 5: DISCUSSION

5.0	Introduction	174
5.1	Overview	174
5.2	Objective 1: To Norm the Intelligence Scale for Secondary School Students in Yemen	174
5.3	Objective 2: To Determine the Difficulty Level, Discrimination Index, and Discrimination Power of the Items in the Intelligence Scale	176
5.4	Objective 3: To Assess the Validity Coefficients of the Intelligence Scale for Secondary School Students in Yemen	178
5.5	Objective 4: To Assess the Reliability Coefficients of the Intelligence Scale for Secondary School Students in Yemen	183
5.6	Theoretical Implications	187
5.7	Practical Implications	190
5.8	Limitations of the Present Study	191
5.9	Recommendations for Future Research	192
5.10	Conclusion	193

REFERENCES	194
-------------------	-----

APPENDICES	217
-------------------	-----

A: Instructions to the Referee on the Items of the Intelligence Scale (First version)

B: English Version of the Intelligence Scale (Second version)

C: English Version of the Intelligence Scale (Third version)

D: English Version of the Intelligence Scale (Final version)

E: Arabic Version of the Intelligence Scale (Final version)

F: Permission Of Application

LIST OF TABLE

	Page
Table 2.1 A Qualitative Description of IQ	79
Table 3.1 Distribution of the Population of the Research, by Form, Specialization and Gender	110
Table 3.2 Distribution of the Participant of the Research, by Form, Specialization and Gender	110
Table 3.3 Matrix of Main Abilities Assessed by Various Intelligence Scale	111
Table 3.4 Theoretical and Procedural Definitions for the Main Abilities (Verbal, Numerical and Spatial)	113
Table 3.5 Weight Percentages for the Main Abilities in the Intelligence Scale	114
Table 3.6 Main Abilities, Subtests and the Number of Items for the Intelligence Scale (First Version)	116
Table 3.7 Main Abilities, Subtests and the Number of Items for the Intelligence Scale (Second Version)	119
Table 3.8 Sample of the Pilot Study by Form, Gender and Specialisation (N = 120)	131
Table 3.9 Time Required for Every Subtest and the Overall Test	132
Table 3.10 Correlation between Scores of Subtests and Abilities and the Score of the Scale	134
Table 3.11 Reliability Coefficients of the Subtests, Main Abilities, and Overall Scale	135
Table 4.1 The Frequency Distribution, the Mean, and the Standard Deviation of Intelligence Scores for Form One Students	137
Table 4.2 The Frequency Distribution, the Mean, and the Standard Deviation of Intelligence Scores for Form Two Students	138
Table 4.3 The Frequency Distribution, the Mean, and the Standard Deviation of Intelligence Scores for Form Three Students	139
Table 4.4 The Frequency Distribution, the Mean, and the Standard Deviation of Intelligence Scores for Male Students	140
Table 4.5 The Frequency Distribution, the Mean, and the Standard Deviation of Intelligence Scores for Female Students	141
Table 4.6 The Frequency Distribution, the Mean, and the Standard	

	Deviation of Verbal Ability Scores for Science Students	143
Table 4.7	The Frequency Distribution, the Mean, and the Standard Deviation of Verbal Ability Scores for Literature Students	144
Table 4.8	The frequency Distribution, the Mean, and the Standard Deviation of Numerical Ability Scores for Science Students	145
Table 4.9	The Frequency Distribution, the Mean, and the Standard Deviation of Numerical Ability Scores for Literature Students	146
Table 4.10	The Frequency Distribution, the Mean and the Standard Deviation of Spatial Ability Scores for Science Students	147
Table 4.11	The Frequency Distribution, the Mean, and the Standard Deviation of Spatial Ability Scores for Literature Students	148
Table 4.12	Coefficients of Difficulty and Discrimination for Subtests Items of Verbal Ability	149
Table 4.13	Coefficients of Difficulty and Discrimination for Subtests Items of Numerical Ability	150
Table 4.14	Coefficients of Difficulty and Discrimination for Subtests Items of Spatial Ability	151
Table 4.15	Discriminatory Power Coefficients for the Subtests Items of Verbal Ability	153
Table 4.16	Discriminatory Power Coefficients for the Subtests Items of Numerical Ability	154
Table 4.17	Discriminatory Power Coefficients for the Subtests Items of Spatial Ability	155
Table 4.18	Correlation between the Present Intelligence Scale and Wechsler Adult Intelligence Scale , Third Edition	157
Table 4.19	Correlation Coefficients for the General Information Subtest	158
Table 4.20	Correlation Coefficients for the Word Meaning Subtest	159
Table 4.21	Correlation Coefficients for the Opposite Words Subtest	160
Table 4.22	Correlation Coefficients for the Verbal Symmetry Subtest	161
Table 4.23	Correlation Coefficients for the Verbal Reasoning Subtest	162
Table 4.24	Correlation Coefficients for Numerical Memory Subtest	163
Table 4.25	Correlation Coefficients for the Digital Chains Subtest	164
Table 4.26	Correlation Coefficients for the Missing Number Subtest	165

Table 4.27	Correlation Coefficients for the Calculation Subtest	166
Table 4.28	Correlation Coefficients for Spatial Visualization Subtest	167
Table 4.29	Correlation Coefficients for Missing Shape Subtest	168
Table 4.30	Correlation Coefficients for Different Shape Subtest	169
Table 4.31	Correlation Coefficients for Spatial Symmetry Subtest	170
Table 4.32	Reliability Coefficients of the Subtests, Main Abilities, and Complete Test by Cronbach's Alpha and Test-Retest	171
Table 4.33	Reliability Coefficients, of the Subtests, Main Abilities, and Complete Test by Kuder-Richardson 20 & Split Half Method	172

LIST OF FIGURE

	Page
Figure 2.1	Distribution of Intelligence on the Equinoctial Curve 78
Figure 2.2	Theoretical Framework for the Present Study 107
Figure 2.3	Conceptual Framework for the Present Study 108
Figure 4.1	The Frequency Distribution of Intelligence Scores for Form One Students 138
Figure 4.2	The Frequency Distribution of Intelligence Scores for Form Two Students 139
Figure 4.3	The Frequency Distribution of Intelligence Scores for Form Three Students 140
Figure 4.4	The Frequency Distribution of Intelligence Scores for Male Students 141
Figure 4.5	The Frequency Distribution of Intelligence Scores for Female Students 142
Figure 4.6	The Frequency Distribution of Verbal Ability Scores for Science Students 143
Figure 4.7	The Frequency Distribution of Verbal Ability Scores for Literature Students 144
Figure 4.8	The Frequency Distribution of Numerical Ability Scores for Science Students 145
Figure 4.9	The Frequency Distribution of Numerical Ability Scores for Literature Students 146
Figure 4.10	The Frequency Distribution of Spatial Ability Scores for Science Students 147
Figure 4.11	The Frequency Distribution of Spatial Ability Scores for Literature Students 148

**PEMBINAAN SATU UJIAN KECERDASAN UNTUK PELAJAR SEKOLAH
MENENGAH DI SANA'A, YAMAN**

ABSTRAK

Minat tentang keupayaan mental telah meningkat kerana pembangunan negara. Setiap negara bersaing dalam menggalakkan bakat dan merangsang penduduk yang berbakat untuk bersaing di peringkat global. Objektif utama kajian ini adalah untuk membina skala kecerdasan untuk mengukur keupayaan mental pelajar sekolah menengah yang berumur 16-19 tahun di Yaman. Hal ini kerana dalam sejarah pendidikan Yaman, tiada sebarang usaha ke arah ini yang telah dilakukan. Skala versi pertama terdiri daripada 225 item yang terbahagi kepada tiga keupayaan utama iaitu 110 item verbal, 67 item numerikal dan 48 item keupayaan spatial. Berdasarkan cadangan pakar, sebanyak 40 item dan dua sub-ujian telah dikeluarkan daripada skala. Maka, skala versi kedua terdiri daripada 185 item dalam 13 sub-ujian, termasuk lima sub-ujian keupayaan lisan, empat sub-ujian keupayaan numerikal dan empat sub-ujian keupayaan spatial. Skala versi terakhir telah digunakan ke atas 500 orang pelajar dari bandar Sana'a, ibu negara Yaman. Tahap keupayaan, indeks diskriminasi dan kuasa diskriminasi telah digunakan untuk analisis item. Daripada hasil analisis, sebanyak 51 item yang mempunyai pekali keupayaan dan diskriminasi yang rendah telah dikeluarkan. Maka, skala versi terakhir terdiri daripada 134 item. Kesahan skala telah ditentukan oleh kesahan *content*, *concurrent*, *predictive* dan *construct* dengan pekali antara 0.69-0.91. Hasil keputusan ini menunjukkan bahawa skala ini adalah sah. Kebolehpercayaan skala telah ditentukan oleh Alpha Cronbach, kaedah *test-retest*, Kuder-Richardson 20, dan *split half* dengan pekali antara 0.73-0.92 untuk sub-ujian, 0.80-0.95 untuk keupayaan utama, dan 0.88-0.96 untuk skala

keseluruhan. Keputusan ini menunjukkan bahawa skala ini boleh dipercayai. Norma kumpulan juga telah ditentukan bagi populasi pelajar sekolah menengah di Sana'a. Oleh itu, skala ini sesuai digunakan dalam kajian tentang kecerdasan pada masa akan datang di Yaman.

CONSTRUCTION OF AN INTELLIGENCE SCALE FOR SECONDARY SCHOOL STUDENTS IN SANA'A, YEMEN

ABSTRACT

Interest in mental aptitude has increased because of national development. Nations compete in encouraging talent and stimulating their gifted population so as to be competitive globally. The main objective of the present study was to construct an intelligence scale to measure mental abilities of secondary school students ages 16-19 years in Yemen. This was because no attempts have been made in the past education history of Yemen. The first version of the scale consisted of 225 items falling into three main abilities: verbal 110 items, numerical 67 items, and spatial ability 48 items. Based on expert recommendations, 40 items and two subtests were removed. So, the second version of the scale consisted of 185 items distributed between the 13 subtests, including five subtests of verbal ability, four subtests of numerical ability, and four subtests of spatial ability. The final version for the scale was applied to a sample of 500 students drawn from Sana'a city, the capital of Yemen. Difficulty level, discrimination index, and item discrimination power were used for item analysis. The analysis resulted in 51 items having poor coefficients of difficulty and discrimination and were thus eliminated. So, the final version of the scale consisted of 134 items. The validity of the scale was determined by content, concurrent, predictive, construct validity with coefficients ranging from .69 to .91. These results indicated that the scale is valid. The reliability of the scale was determined by Cronbach's Alpha, test-retest, KR-20, and split-half methods with coefficients ranging from .73 to .92 for the subtests, .80-.95 for the main abilities, .88-.96 for the total scale. These results suggested the scale is reliable. The group norms were also determined for the

population of secondary school students in Sana'a. The scale can thus be used as a suitable instrument in future studies on intelligence in Yemen.

Chapter 1

Introduction

1.0 Introduction

This chapter introduces the role of intelligence tests in education and describes the problem statement, research questions, research objectives, significance of the study, and definitions of key terms for the present study. At the end of the chapter a structure of the thesis is outlined.

1.1 Overview

We are currently living in a world where the use of resources is of major concern. Resources are getting scarce and it is a major challenge to using them providently in order to ensure the survival of our race. Governments around the world are trying to ensure that there is a rational use of the resources so as to protect our future generations. Human beings are the most important capital of a nation. They are responsible for the ideas, creativity, innovations and inventions.

The importance and the implications of a society are not measured by its sheer number, equipment or monetary wealth, but by its talents and ability to use its human capital in order to augment the welfare of the community in general and to provide a better and healthy living for the society (Lynn & Vanhanen, 2002, 2012).

It is a difficult task to identify the true potential of the human capital through mental capability. Developed nations have long been trying to identify the mental ability of their citizens in order to put it to best use for the purpose of serving the society economically as well as socially (Boyle & Fisher, 2007; Furnham, 2008). However, identifying the true mental ability of an individual is a major challenge. Intelligence tests can help to distinguish individuals' mental ability based on their

performance in the tests. Hence, an individual's potential can be identified based on his/her scores in the test (Kazi et al., 2012; Steen, 2009).

With regards to the reality of the educational institutions in the Arab world in general, and in the Republic of Yemen in particular, there is a lack of the use of IQ tests and measurement tools. There is also a serious absence of a focused approach in the process of measurement and designing of intellectual tests and techniques consistent with the culture, customs, and traditions. This makes it inevitable for the interested parties like the researchers to direct their energy for the development of this vital aspect.

The present study is hence attempting to address this vital issue and thus construct intelligence test within the cultural context of Yemen, which could contribute to improving the overall educational process. This would hence largely benefit the society and provide the platform for the nation to leap towards a developed nation.

The present study's intelligence test focuses on assessing an individual's intellectual functioning and providing information about the individual's cognitive strengths and weaknesses by three main abilities: verbal, numerical, and spatial, evaluated through the application of 13 subtests. In order to construct the intelligence test, the views of different psychologists and experts in the field have been taken into consideration. In the review of the related literature, various constructs of intelligence are described. Some of the important research studies regarding intelligence are reviewed in the literature review in addition to some established tests and authoritative books on intelligence that have been utilized in construction of the current scale. Furthermore, the researcher used Arabic language, local currency, Arabic names; he also used a local sample to achieve the research

aims and draw the results. Culture in this context refers to the use of the local language and local sample (Ang et al., 2015; Cocodia, 2014). The researcher did not use the local dialect because the scale will be standardized on populations in other Arab countries in the future.

1.2 Intelligence Tests in Education

Scientists have made great efforts to study intelligence and to design intelligence scales (Jonsson et al, 2012; White, 2006). It has been one of the most challenging topics in the field of education as well as psychology. This is illustrated by the large number of mental scales which have been designed and constructed (Fletcher & Hattie, 2011).

Individual differences include an individual's physical, mental, and emotional properties, but intelligence is considered one of the most important areas of individual differences studied by scientists because of its significant and central role in directing efficiency of the individual's activity, and thus recognition of individual differences in intelligence has become essential and important to the decision-makers and tests designers, which leads to the movement of measuring intelligence activities and the production of large numbers of intelligence tests in the Western world (Sarouphim, 2010).

The intelligence tests have played an important role in modern education. They have had widespread usage in many countries where it has been used as the basis for admission to different universities. It has also been used in various schools in order to classify different groups of students based on their talents (Cocodia, 2014; Furnham, 2008). It also serves as a way to guide students in the selection of subjects where they might excel or show strong potential for the same. Thus, it serves as a

tool for vocational guidance or helping to mold the young minds in order for them to achieve an appropriate career path (Cohen & Swerdlik, 2010; Schaie, 2006).

In addition, intelligence better predicts the results of school examinations, and therefore IQ tests can be used reliably in making important decisions about how to teach students (Chamoro & Furnham, 2006; Gottfredson & Saklofske, 2009). Various schools use intelligence tests as a method to differentiate their students and success of the school is in evidently attached to it (Ilhan & Cetin, 2013; White, 2006).

In general, intelligence tests are designed to measure a wide variety of mental functions such as reasoning and comprehension and judgment. They help specialists to predict success in a variety of activities and to measure an individual's ability to perform socially ,scientifically excellence and compete economically. It reveals an individual's strengths and weaknesses and highlights on gifted's people do not know they have, improving educational, ability building and skills development. This type of testing provides a standardized method of comparing students' abilities and performance, accurately predicts academic achievement and identifies talents students. This allows parents, teachers, and professionals to tailor education to individual needs. Intelligence tests are also invaluable tools when used to detect whether pupils should be put into special education classes or accelerated learning programs (Kaya et al, 2015; Bücken, et al, 2015; Urbina, 2014).

Intelligence tests can be an accurate and valuable tool for assessing people's intelligence, but they also have some of defects and weaknesses. Despite the increased scientific evolution of intelligence tests, the tests still provide a very limited and incomplete picture of a person's intelligence. Some critics argue that characteristics that are important to achievement in the world that may not be directly

related to IQ scores. For example, the ability to interact well with others is an essential skill that many consider being a form of intelligence, but this is not measured by intelligence tests. Other significant personal characteristics such as motivation to succeed, disposition and self-discipline are also not measured by intelligence tests. The different elements of intelligence depend on the test taker's situation, and one intelligence test does not have the ability to cover every possible situation. One number assigned to a person's intelligence and grasp of traditional academic subjects is not an accurate way to measure intelligence quotient. What's more, a poor intelligence test can limit a child's aspirations due to the one score that he is labeled with. The results of intelligence tests can be used to estimate future performance of test takers, but these tests are limited in scope and therefore are not always accurate predictors of academic or job performance (Neisser et al., 1996; Nisbett et al., 2012).

1.3 Intelligence Tests in Yemen and the Arab World

The mental potential is of great importance in the developed industrial nations and they have managed to harness this potential in order to make great strides towards advancement. The developing nations need the same in order to ensure that they can grow and if they want to develop then they need to get the urgency of developing their people's mental potential. They need to employ all the energies available from the natural resources. The human potential need to be identified and channeled in the proper direction in order to lead to a higher standard of living and increase the productivity of the individual and society (Abuhatab, 1998; Allam, 2006).

Intelligence testing has helped great nations to effectively employ the minds of their citizens and trained it in order to achieve the optimal output. Hence these

countries tend to reconsider and change their testing methods in order to ensure that the services provided for their citizens are of sufficient standard. This will enable them to achieve a maximum level of mental capability and thus lead to more welfare for their societies. It is not only the desire of the developing nations to modernize but also to overcome the challenges and obstacles posed by the current conflicts in demand for education (Knapp, 2015; Urbina, 2014; Woolfolk, 2007).

Technological change has been rapidly taking place and the effects of the same can be felt by the Arab region. Globalization has been rapidly taking place and the nations are becoming independent on each other for resources as well as finished goods. There is no longer a single society which can truly isolate them from what is happening in the world around. We live in a world where competition is of the essence and there is specialization in everything in order to ensure that the best product/ service are provided at the most nominal rate. Hence the value of the mind and its accomplishments has stood out so prominently and arguably occupies the highest importance (Anastasi & Urbina, 1997, 2002; Erkus, 2012).

The differences in individual intelligence are still not taken into account in most of the schools in the Republic of Yemen and also in most Arab countries. All the students are treated equally and a fixed education regime is imposed on all the students. Thus, the potential for the creativity, innovation and development are hindered when the individual intelligence of the students is not taken into account. Hence the development of their creative capabilities and provision of the best conditions for this development should become the multiple primary duties of the school (Abuhatab, 1998; Allam, 2006).

The schools must thus use IQ tests for diagnosing, guiding, and identifying the gifted at an early stage. They should be developing programs which help in the

development of mental capabilities of the individuals. By designing special programs, they should ensure that each individual can improve on their self-efficiency thus making them contributing members of the society. They are the main contributors to a country's development and with their own self development a country can truly advance and compete with the developed nations (Baird et al, 2009; Knapp, 2015; Kyllonen et al, 2008; Stump et al, 2009; Sarouphim, 2010).

1.4 Problem Statement

Employing, developing, taking care of and guiding mental wealth (intelligence) is essential for both individuals and society, particularly the youth of both genders; developing their ability to the highest level ensures a generation of elite scientists and thinkers in the fields of science and knowledge (Erkus, 2012; Fletcher & Hattie, 2011).

Developed countries are among the first to use measures of intelligence in their educational systems for employing the mental capacities of their citizens, which accelerate their progress and civilisation (Al-Onizat, 2014; Kaplan & Saccuzzo, 2009). Furthermore, the use of intelligence tests as a measure of mental abilities has become widespread in schools, clinics, and industries, and they have been used for different purposes (Nanda et al, 2015). In the developed nations intelligence tests were developed as a result of the urgent need to the improvement of education as the best investment in comprehensive human development. This improvement begins with the investment of human capital that possesses capabilities, skills and competencies (Demetriou et al, 2011).

On the other hand, the educational systems of the developing world, including Yemen, are in dire need of investment and direction of the mental capacities of their

citizens for the benefit of their nation, because leaving these capacities without care hinders the growth of the state (Abu-Hilal et al, 2011).

Many Middle-Eastern researchers and experts in the field of psychology have always reiterated the urgency and importance need for increased research in the development, construction, and standardization of Arabic-based cognitive assessment measures such as the intelligence tests in order to expedite the progress and development of a nation (Hussain et al, 2012; Suwartono et al, 2014). However, the extant literature in the Arab world reveals that research on a construct or standardize measures of intelligence is almost nonexistent. Most work on the development of standardized intelligence tests in Arab society is outdated and has relied heavily on translated tests from Western societies (Al-Onizat, 2014; Soueif & Ahmed, 2001).

Arab nations tend to use intelligence tests developed in the West, which may not be suitable for the Arab and Yemeni people. Countries like Yemen have the resources needed to construct and develop intelligence tests but they have failed to account for the cultural factors, which is an important factor when distinguishing individuals and their capabilities. Failing to consider the cultural factor can lead to inaccurate and incorrect results when judging the level of intelligence among individuals. Hence, it is necessary to build measures of intelligence inspired by the environment. The culture of members of the community and its customs and traditions need to be taken into account in order to obtain precise instruments. These instruments will help to identify the real academic level of the students, strengths, and weaknesses, and consequently allow the educators to do their best to guide, serve and help them overcome their problems (Livermore & Van Dyne, 2015).

The people of Yemen are still not very familiar with the concept of intelligence tests; it could be due to many reasons such as the school curriculum does not include

intelligence tests and the lack of information provided by the media about these tests and their importance in the progress of the nation. In addition to education policy has not taken into account modern methods of teacher training, and measuring the cognitive abilities of the students, that even though the world has changed immensely, Arab schools including Yemen still use the same model and methods as 50 years ago, which affected negatively on society, education, investment, and economy (Al-Onizat, 2014; Khaleefa & Lynn, 2008; Taha, 2006).

‘Intelligence test’ is still a new terminology for the school teachers and students in this country. There is still no center for testing or test instruments of this kind in the state. This is partially due to the novelty of the Department of Psychology in Yemen, opened in 1989, which lacked research degree holders from the mentioned area of concentration. In fact, the lack of specialized research in Yemen is an old problem which is existent until now. In Yemen, there are some outdated intelligence scales, such as the Binet scale first edition (1916) and the Wechsler scale first edition (1939) which was constructed in foreign countries with the norms and culture of those people. Even though some Egyptian authors have translated and standardized these scales on the basis of their local norms and their local dialect, this does not fit with the people of Yemen. According to Serpell (1993) simply translating a Western test into the local language is not enough. Instead, it is critical to tailor each test to the needs and values of the culture in which it is to be used (cited in Benson, 2003). As no particular test is reliable and valid for all environments, the test constructed or standardized on other populations may not be suitable or relevant for the people of Yemen.

However, these scales are used only as a means to teach students in the laboratory of psychology at universities, and therefore it is not commonly utilized in

educational, or other, aspects. The schools and universities in Yemen and most Arab countries still do not take into account differences in individual intelligence. They instead treat all students equally and impose upon them only one fixed education programme. They are still dependent on achievement tests and estimates of teachers in judging the level of mental development of the students. There lies a serious problem with this, as it is not even remotely accurate. Thus, there are implications of serious mistakes in the educational decisions, which may negatively affect the future of the students (Hussain et al., 2012). Oftentimes, the teacher estimates are not based on facts or the actual performance, because it might be affected by the subjectivity of teachers, and thus may not be accurate way to identify the real mental abilities of students. As well as, achievement tests may not be an accurate enough to measure the full range of students' abilities (Khaleefa & Lynn, 2008; Suwartono et al., 2014).

The public often talks about the low standard of education in developing countries including Yemen and favors accountability in education. The low standard of education causes many problems such as low productivity, inefficient workforce, and wastage of resources and unemployment. The teaching–learning process has failed to produce quality, competency, creativity and excellence in students (Al-Onizat, 2014; Khaleefa & Lynn, 2008; Soueif & Ahmed, 2001). No doubt the officials in charge of the educational process in the Republic of Yemen seek to develop comprehensive solutions proposed to overcome these problems. However, these proposed solutions need to have accurate and appropriate scientific means to help in the diagnosis, selection, and classification. The most important of these means are the intelligence tests that will help solve this problem and assess each student based on their talents and capabilities.

There are many students who are naturally carrying traits of creativity and excellence. However, the education systems fail to identify or employ the students in order to guide them to their true potential causes by the lack of a suitable intelligence test. The society of Yemen and the Arab world is in desperate need of ambitious and accomplished citizens of both sexes. If there are any obstacles standing in the way to achieve this goal, they should be identified and appropriate solutions need to be found and addressed at the earliest by supporting their creative capacities and tendencies to achieve desired results.

In short, the problem was a lack of a suitable intelligence test to measure the mental ability of the secondary school students in Yemen. By construct of solid and integrated of measurement instruments, in a time when the mental ability is one of the priorities of the educational work to develop the modern society and push the wheel of advancement.

1.5 Research Questions

The research questions are as follows:

1. What is the norm of the constructed intelligence scale for secondary schools students in Yemen?
2. Do the intelligence scale items have good coefficients of difficulty level, discrimination index, and item discrimination power?
3. What is the validity of the intelligence scale for secondary schools students in Yemen?
4. What is the reliability of the intelligence scale for secondary schools students in Yemen?

1.6 Research Objectives

The main objective of this research is to construct an intelligence scale for secondary schools students in Yemen. To achieve this aim, the study outlines the following specific objectives :

1. To norm the intelligence scale for secondary schools students in Yemen.
2. To determine the difficulty level, discrimination index, and discrimination power coefficients of the items in the intelligence scale.
3. To assess the validity coefficients of the intelligence scale for secondary schools students in Yemen.
4. To assess the reliability of the intelligence scale for secondary school students in Yemen.

1.7 Research Scope

This study was restricted to the three widely included abilities, namely, verbal, numerical, and spatial, which measured the intelligence of high school students in Yemen. These three cognitive abilities are those skills that make up an individual's general intelligence (Kaya et al., 2015). Secondary school students have been recruited for this study. Students aged 16 to 19 years (first form 16-17, second form 17-18, and third form 18-19) were selected from the city of Sana'a the capital of Yemen. Because this city precisely has a very high percentage of people from different parts of Yemen.

1.8 Significance of the Study

The present study is important because it focuses on constructing an intelligence scale--High School Intelligence Scale (HSIS)--which can be used to measure individual differences in intelligence for high school students in Yemen. Intelligence plays a very important role in different areas of human activity. It helps

in the classification and categorization of individuals based on their merits and it helps the students select the appropriate career path for them (Carr & Dweck, 2011; Demetriou et al, 2013; Sarouphim, 2010).

Many of the intelligence tests around the world have been constructed for different purposes, which dictate rationale of the test being conducted. Perhaps intelligence testing is used to an assessment of neuropsychological status, to function as a benchmark, to measure progress, to ascertain potential, to identify strengths, weaknesses, to evaluate the intellectual abilities, to diagnosing a learning disability, to vocational guidance and selection, to ascertain intervention strategies and so on.

In this study, a rationale is that it is an attempt to meet the needs of educational institutions in Yemen to provide valid and reliable assessment tools that are suitable and useful for the education system in Yemen, as it focuses on different aspects like norms, culture, different background, educational level, and gender.

This study will provide standardized ways of comparing student performance with that of other students who are similar in age or grade level. It will also help the institutions in providing a means to judge and analyze talent as a very early stage. Furthermore, the test will contribute to predictors of scholastic achievement for students in the future, and it can help to accurately identify the real intelligence levels, strengths, and weaknesses of the local people. (Nanda et al, 2015; Gottfredson & Saklofske, 2009).

Moreover, constructing this measure will help researchers to use it in their educational and psychological studies, which aim at measuring the intelligence of the sample. This test will help to provide useful information on which teachers, school administrators, and policy makers can rely in order to assess and improve their classes or schools. It will provide a base for measurement and identification of

cognitive abilities at secondary school level. The quantitative measurement of these abilities will also help us in identifying the gaps between the current level of cognitive development and desired level of cognitive development, on a prescribed scale. It will also help in designing educational solutions that can elevate the cognitive ability of students to desired levels to drastically increase their learning process.

On a further note, the study will help in finding ways to improve these intelligence tests and identify new ways to further improve the education system through categorizing each student based on their specific abilities and helping educators to build special programs which identify students who must join ordinary schools and those who must join special classes. These are the significance of this study. There are many implications and benefits in conducting this study especially in Yemen and the Arab world as this discussed above in this section.

1.9 Definitions of Key Terms

The definitions of the key terms in the study are as follows:

1.9.1 Intelligence

Intelligence is an individual's ability to derive information, learn from experience, adapt to the environment, it's the capacity of the mind to think logically, solve problems in new situations and think abstractly. It is the ability to analyze novel problems, identify patterns and relationships that underpin these problems and the extrapolation of the relationship using logic (Bordens & Abbott, 2011; VandenBos, 2007).

1.9.2 Intelligence test

Intelligence test is a designed instrument to measure a variety of mental ability, such as verbal, numerical, and spatial ability. Intelligence test typically consists of a

set of problems, with a choice of answers provided. Many questions are used, in part, to derive a more accurate picture of the fine gradations of intelligence, and to test a person's ability to concentrate for long time intervals (Steen, 2009; Urbina, 2014).

1.9.3 Validity

Validity refers to a test's ability to measure what it is supposed to measure (Bhatt, 2014).

1.9.4 Reliability

Reliability refers to the consistency of a research study or measuring test. Would the measure give us the same result if we did it again numerous times? (Bonett & Wright, 2015).

1.9.4 Norms

Norms are the standards of a society or culture for the behaviors that are considered acceptable and expected (Bordens & Abbott , 2011).

1.10 Structure of the Remaining Chapters

This chapter has given an overview of the study along with its major contributions. The following chapters will be more in depth and it comprises the heart of the research. Chapter 2 presents the literature review which deals with the previous studies done in the field. It also concludes with the theoretical framework and the hypothesis development. Chapter 3 will comprise of the research methodology which was adopted in order to conduct this research. This includes the population and sample, the data collection and the instruments used for the survey. Chapter 4 will present the findings of the research along with the analysis of the study. It is concluded with the results for the questions testing in the study. Finally, the last chapter in this study, Chapter 5 discusses the study's implication, recommendation as well as the conclusion.

Chapter 2

Literature Review

2.0 Introduction

This chapter is constructed to review the basic concepts relevant to this research: intelligence and intelligence tests. It reviews intelligence, in terms of various definitions, theories, history, and evolution. In addition, it reviews the past studies that are related to the present research objectives.

2.1 Overview

The study of human intelligence is a provocative topic for psychologists. The search for how and why people differ in their mental abilities is a complex topic. Debates on the issues of intelligence and intelligence emphasizes on the subject of whether it is valuable or important to assess individuals based on their cognitive competence, and whether we can know this through an individual's intelligence or mental capabilities. Is there an existence of such a cognitive ability that we often call intelligence? (Geary, 2005; Gottfredson, 1998; Urbina, 2014).

Scores from standardized intelligence tests are often used to define one's intelligence level. But these kinds of tests do not reveal the complete picture and provide only part of a person's ability in the area under examination, so that, for example, someone who has scored high on a mathematical test can only be said to have a high numerical IQ and someone who has scored high on a verbal test can only be said to have a high verbal IQ. As a result, there have been differing views and beliefs that there are multiple kinds and levels of intelligence that exist among people. Each person has their own style in how they access knowledge and there are

also differences in their level of cognitive ability (Harrison et al, 2015; Hoerr, 2000; Knapp, 2015; Osho, 2004; Sternberg & Grigorenko, 2002).

What's more, there is presently another school of thought which accepts there are numerous more distinctive sorts of intelligence, some of which could be a consequence of our childhood and advancement and some of which could be the aftereffect of a characteristic ability with which we received at birth (Bartholomew, 2004; Carter, 2007).

Psychologists' opinions differ in relation to the subject of intelligence because of the extent of mental activity, which represents the overall capacity and diversity and its association with nervous system activity and functioning of the brain in particular. This makes the definitions of intelligence differ considerably (Johnson, 2007).

2.2 Definitions of Intelligence

The concept of intelligence has evolved over time, and intelligence tests have evolved along with it. Researchers continually seek the best ways to measure intelligence more accurately (Nanda et al., 2015). The assessment of intelligence has been a focus of research along with the conceptualization of intelligence for over a century. However, intelligence cannot be assessed without clarity about the definition of intelligence (Sternberg, 2003). Psychologists' definitions of intelligence often reflect intellectual goals, aspirations, or doubts rather than providing a clear definition of intelligence (Anastasi, 1986, cited in Kaya et al., 2015).

Defining mental factors is not an easy process because they are not things found in nature that could be isolated, observed and subjected to the measurements directly and determine its characteristics (Cocodia, 2014; Deary, 2001; Flanagan et al, 2013; Nanda et al, 2015). No surprisingly, there are different definitions of intelligence in

the literature of educational measurement and evaluation by various psychologists. Some of the definitions are given as follows

The word “intelligence” may refer to one’s acumen. An intelligent person is able to handle different challenges in life. His ability to understand problems makes him successful in problem-solving (Flynn, 2007). From the teacher’s perspective, however, an intelligent student is one who learns and solves problems with great ease, thus achieving excellent results in examinations. Conversely, a student who is slow at learning and consistently fails his examinations is regarded as stupid (Bartholomew, 2004; Sternberg, 2000). However, such viewpoints do not define intelligence accurately. A student who is regarded as stupid by one of his teachers because of his dismal performance in his test may be thought of highly by another teacher because of his ability to excel in a particular subject (Abad, et al, 2003).

Not only are the differences in attitudes normal, but the views of psychologists also differ on the subject of intelligence because of the breadth of this concept and its complexity (Benson, 2003; Geary, 2005). The word “intelligence” appears to have no formal definition. Nevertheless, scientists have proposed the following two major definitions for intelligence:

(i) Intelligence is General Capacity

In a report by fifty-two researchers intelligence is a general mental ability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience (Brown, 2006; Furnham, 2008; Gottfredson, 1998; Sternberg & Grigorenko, 2002).

(ii) Intelligence is Multiple Capacities

The Board of Scientific Affairs of the American Psychological Association published a report in (1995), about how people vary starting with one then onto the

next in their capacity to comprehend complex thoughts, to adjust successfully to nature, to gain as a matter of fact, to take part in different types of thinking, to overcome snags. In spite of the fact that these individual differences can be significant, they are never completely predictable: A given individual's scholarly execution will fluctuate on diverse events, in distinctive areas. For example, an individuals' performance may be high in mathematics, while his performance may be low in science. Ideas of intelligence are endeavors to clear up and sort out this unpredictable arrangement of marvels. Albeit significant clarity has been accomplished in a few territories, it has not answered all the important questions (Armstrong, 2009; Ccshau, 2008; Chan, 2003; Gardner, 1999; Neisser, et al, 1996; Perloff, et al, 1996).

There are also some physiological and psychological interpretations of intelligence as can be illustrated with the following definitions: Spearman (1904) defined intelligence as the general ability, which could be measured and numerically expressed (cited in Benson, 2008). According to Binet (1905), intelligence is a judgment, also known as a good sense, practical logic, inventiveness, the aptitude of familiarizing one's self to different settings (cited in Becker, 2003). Burt (1922) defines intelligence as an innate general cognitive ability (cited in Bartholomew, 2004). According to Gardner (1999), intelligence is the ability to solve problems, or to innovate products, that are valued within one or more cultural setting.

According to Gottfredson, (1998) intelligence is the ability to deal with cognitive complexity. According to Sternberg (2000), intelligence includes applying component processes to novel tasks to adjust, shape accordingly to a selection of surroundings. Is not a solitary, unitary capacity, but instead a composite of a few capacities. The term signifies that blend of capacities needed for survival and

headway inside of a specific society. As per Thorndike (1914), the definition of intelligence is the power of good responses from the point of view of truth or fact (cited in Wasserman & Tulsy, 2005). According to Cattell, Horn, and Carroll, intelligence is the general ability to perform complex nonverbal mental manipulations related to conceptualization, inductive reasoning, and visualization (cited in McGrew, 2005). According to Stoddard (1943) intelligence is the ability to undertake activities that are difficult, complex and abstract and which are adaptive to a goal, and are done quickly and which have social values and which lead to the creation of something new and different (Shergill, 2010).

Wechsler (1944) defines intelligence as the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment. It is global because it distinguishes the individual's behavior as a whole; it is an aggregate because it is composed of elements or abilities which, though not entirely independent, are qualitatively differentiable (Benson et al, 2010; Tulsy & Price, 2003).

The conceptualization of intelligence has received attention for over a century. Despite the researchers having tried to develop a unitary definition of intelligence, there are currently numerous definitions and explanations of intelligence. This lack of consensus on the definition of intelligence also contributes to disagreements about how to assess intelligence (Kaya et al., 2015). In short, differences in definitions of intelligence arise from different conceptualizations by researchers (Sternberg, 2003). Some researchers have suggested that intelligence is a single, general ability while others believe that intelligence encompasses a range of aptitudes, skills, and talents. Moreover, many researchers believe that conceptualizing intelligence as behavior includes the culture and environment of an individual. This suggests that intelligent