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Determination of Huffaz Academic Achievement Using Binary Logistic Regression Model

Nurul Anasuhah Zakaria[1],Tahir Ahmad[1*], Siti Rahmah Awang[2] and Ajmain Safar[3]

[1] Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia.
[1*] Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia.
[2] Azman Hashim International Business School, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia
[3] Faculty of Social Sciences and Humanities, Universiti TeknologMalaysia, 81310 Johor Bahru, Johor, Malaysia

Email: tahir@utm.my

Abstract. There have been increasing awareness among parents to send their children to dual-system tahfiz schools. However, mode of teaching in these schools may pose shortcomings to their students' (huffaz) academic performances. Therefore, identification of huffaz' intelligences, needs, curriculums, and learning styles offer in these schools are worthwhile to be investigated. The aims of this study are to identify dominant intelligence among huffaz that is based on Gardner's multiple intelligence theory and to describe the relationship between academic achievement and Quran memorization performances of the huffaz. A number of 130 tahfiz students (79 male and 51 female) from four different tahfiz schools are the subjects in this study. Binomial logistic model is used to determine factors that influence huffazs' academic performances. Results show huffazs' Quranic performances (memorization) do influence their academic performances. Furthermore, naturalist intelligence is determined as the dominant intelligence among huffaz.

1.   Introduction

Academic excellence among huffaz is paramount since it reflects the quality of education they go through in a tahfiz Quran institution. Excellence in academic achievement and memorizing Quran are closely related. Several studies have proved that memorizing Kitabullah influence huffaz to obtain excellent academic results [1]. However, there is a perception of certain quarters that the curriculum of Quran memorization is academically burdensome [2]. This study was therefore undertaken to investigate the relationship between academic performance and Quran memorization performance among huffaz that are presented in the following sections.

2.   Literature Review

Lately, there have been many researchers who relate the level of intelligence (IQ) with academic performance [3], emotional intelligence (EQ) with academic performance [4] and spitual intelligence (SQ) with academic performance [5]. Moreover, roles and characteristics of teachers that prompt students' interest, experience and teaching style also affect students' academic performance [6]. The effectiveness of learning process that optimize students' learning style also greatly affect performance of students. However, the implementation of tahfiz learning style still has shortcomings and weakness that will directly affect the huffaz academic performance [7]. According to [8], poor academic performance among students are not caused by their curriculum instead they can do well in any subject if their learning styles are tailored to their intelligences. Students' learning style are different

according to their dominant intelligence, so do teachers' teaching styles. Due to the differences between teachers' teaching and students' learning styles, the later become demotivated, bored and paid less attention in classrooms [9].

There are differences between individuals in thinking and multiple intelligence areas [10]. Identifying multiple intelligence trends, meeting the needs of students, preparing a curriculum suitable for learning styles, and knowing and implementing teaching strategies to enrich the learning experience of individuals are useful educational tools for both students and teachers [11, 10,12]. Therefore, intelligence is a reflection of the structure of the brain, which consists of different parts [13]. Gardner developed the theory of Multiple Intelligences (MI) that explains the presence of nine different intelligences of which include kinesthetic, spiritual, interpersonal, intrapersonal, logical/mathematical, musical, naturalistic, linguistic and visual.
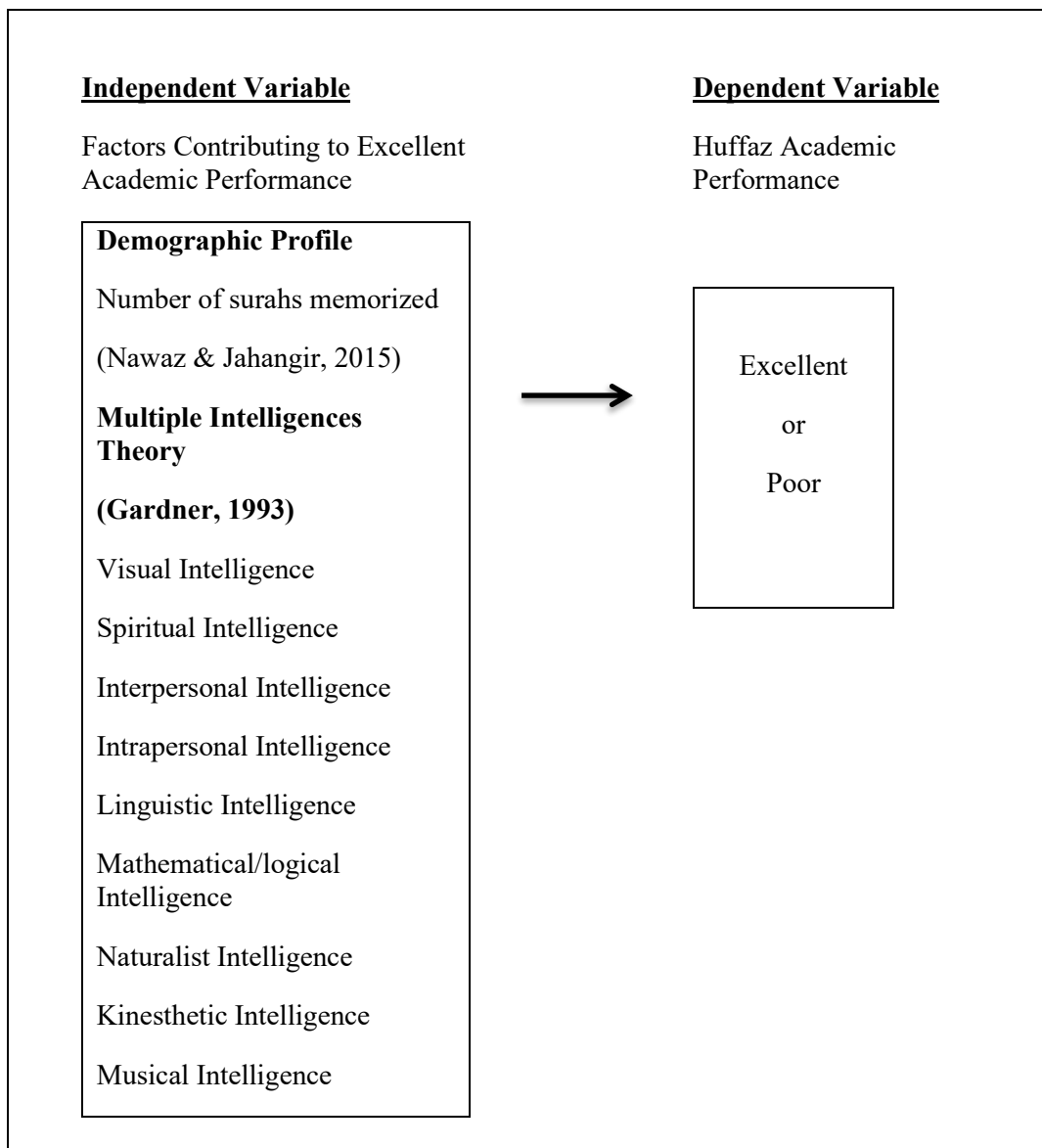
In 2001, the Ministry of Education of Malaysia introduced MI in the nation's education system through the Curriculum Development Centre which is now known as Curriculum Development Division. There are three stages in implementing MI in teaching and learning: (1) First stage; matching, (2) Second stage; experimenting (3) Third stage; planning. In the first stage, awareness on the importance of teaching and learning processes with students' multiple intelligences is established. At this stage, teachers must identify the dominant intelligence among students. By doing this, teachers are able to select the apt teaching methods and strategies that complement students' intelligence. Therefore, this factor expresses importance of the research. Huffaz' dominant intelligence will be identified based on the theory of MI in enhancing their academic performance by using binary logistics regression analysis.

In the context of education and students' achievement, the knowledge of multiple intelligences is crucial to help teachers' view on education holistically [14]. According to [13], MI assists teachers to understand students' motivation and it also creates awareness among teachers on the importance of employing various methods so that students can learn and demonstrate their understanding. As a result, when this awareness is realized, students then become more motivated to learn through the method employed by their teachers.

Some researchers have found in their studies, intelligence leads to academic performance. Consequently, many researchers such as [14] stress the importance of identifying students' individual differences, individual learning styles and the multiple intelligence profiles of the learners and empowering intelligences in their learning process. Hence, MI should therefore, be combined in tahfiz education to ensure students' success in achieving outstanding academic and memorization performances.

3.   Research Method

There are many factors that affect student performance. Several factors have been identified to be significant effects to huffaz academic performances and incorporated into a binary logistic regression model. The independent variables that are considered to be significant factors in affecting huffaz' academic performance divided into two sections. The first section is the demographic profile of huffaz consisting of one item which are number of surahs that they memorized. The next nine parts are the huffaz' intelligence profiles are considered and elaborated in the second section. The status of huffaz' academic performances whether excellent or poor is the dependent variables. In total there are ten variables identified in this study and summarized in figure below:

Independent Variable

Factors Contributing to Excellent
Academic Performance

Demographic Profile

Number of surahs memorized

(Nawaz & Jahangir, 2015)

**Multiple Intelligences
Theory**

(Gardner, 1993)

Visual Intelligence

Spiritual Intelligence

Interpersonal Intelligence

Intrapersonal Intelligence

Linguistic Intelligence

Mathematical/logical
Intelligence

Naturalist Intelligence

Kinesthetic Intelligence

Musical Intelligence

Dependent Variable

Huffaz Academic
Performance

Excellent

or

Poor

3.1   Subjects

This study involved 130 students of tahfiz schools, 79 male (60.8%) and 51 females (39.2 %) from four tahfiz schools that coded as A, B, C and D School. These codes are assigned due to ethical and confidentiality considerations. The highest level of education among these respondents are PT3 and continue their studies to form four. They are majoring in Religion Sciences (0.8 %), Social Sciences (14 %), Pure Science (66.2%) and Pure Religion Science (19.3 %). The respondents' age group are between 15 and 19 years old. However, majority of the them are 16 years old.

3.2   Instrument

The instrument employed in this study is a psychometric test that is known as Huffaz Intelligence Test (HIT©2017). The HIT was introduced by [15]. It was developed based on the theory of MI. Each item in HIT is supported by arguments and statements taken from the Quran, hadiths, Prophet Muhammad (pbuh)'s teachings and words of the main ulama' in Islam. The purpose of developing HIT is to measure huffaz' intelligences.

The HIT is divided into ten sections. The first section seeks the demography information of respondents. The next sections measure the intelligences of huffaz based on MI theory. These sections measure nine intelligences, namely, musical, linguistic, kinesthetic, mathematical/logical, visual, interpersonal, intrapersonal, naturalist and spiritual. Each section has five or six indicators. Each respondent is asked to assess him or herself based on a Likert Scale of between 1 (not me) and 5 (me) that is set by the researcher.

The Reflective Model was employed to obtain the values of loading, indicator's reliability, composite reliability, Average Variance Expected (AVE), alpha cronbach and discriminant validity in measuring the reliability and validity of HIT [15] and is used to measure huffaz' multiple intelligences.

3.3   Binary Logistic Regression

Currently, there is a tendency to acknowledge the limitations of linear regression to explain the relations between categorical dependent variables of interest (success/failure, excellent/poor. dropping out/remaining) and a series of continuous and categorical predictors [16]. Among the problems that linear regression may present are the assumptions on which the model is based: normality of the dependent variable, normal distribution and homoscedasticity of the residuals. Such assumptions are difficult to fulfill for variables that are typical of the field of education or psychology [17] and they are definitely not met when the dependent variable is binary.

However, the statistical model of logistic regression is more flexible than linear regression because it does not require the variables to meet the aforementioned assumptions of normality and homoscedasticity. It allows the dependent variable to be dichotomic or polyatomic [18]. Binary Logistic Regression model describes the relationship between a dichotomous dependent variable and a set of predictor variables. This model is used for the prediction of the probability of the occurrence of an event by fitting data to a logistic curve.

In this study, the event is the probability of huffaz to gain poor and excellent academic performance. Huffaz who are excellent in academic performances are coded in SPSS as one (1), while huffaz who are poor in academic performances are coded as zero (0).

4.   Result and Analysis

4.1   Model Fit Test

4.1.1   Classification Table

The percentage of 61.5 in Table 1 represents the percentage of respondents in the dependent variable that is correctly predicted, in which 80 respondents had excellent academic performance and 50 respondents possessed poor memorization performance. The above-mentioned percentage was obtained based on this calculation:

$$\frac{80}{(80+50)} \times 100 = 61.5\%$$

Table 1. Classification Table Step 0

Observation		Projection		
(Step 0)		Academic Performance Status		Percentage Correct
		Excellent	Poor	
Academic Performance Status	Excellent	80	0	100.0
	Poor	50	0	0
Overall Percentage				61.5

Table 2 depicts the predictive value for the dependent variable in the logistic regression model after the predictive variable is inserted into the model for analysis (82.3%). The projection value is bigger compared to the prediction value before the independent variables are used for the analysis (61.5%) (refer to Table 1). This means the insertion of respective values into the logistic regression model has enhanced the correctness of the projections.

Table 2. Classification Table Step 1

Observation		Prediction		
(Step 1)		Academic Performance Status		Percentage Correct
		Excellent	Poor	
Academic Performance Status	Excellent	71	9	72.0
	Poor	14	36	88.8
Overall Percentage				82.3

4.1.2   Omnibus Test of Model Coefficient
Table 3 shows significant results ($\chi^2 = 63.047$, df = 10, p < 0.05) for logistic regression model in Step 1 after predictive variable is added to the model for the analysis. The value of $\chi^2 = 63.047$ shows the contribution of the projective variable to the dependent variables in the model. The *p* value for all tests is *p* = 0.0001 in which *p* < 0.05. This demonstrates that generally all projective variables that were inserted into the model are expected to be significantly influence changes in the dependent variable.

Table 3. Omnibus Test of Model Coefficient

Test		chi- square	df	*p* value
Step 1	Step	63.047	10	0.0001
	Block	63.047	10	0.0001
	Model	63.047	10	0.0001

4.1.3   Hosmer and Lemeshow Test

Hosmer and Lemeshow Test is a test that most reliable conducted onto models that is interpreted differently from omnibus. To support the developed model for this study, the value of *p* must be more than 0.05. The value of *p* that is depicted in Table 4 is 0.083 ($p > 0.05$) which indicates that it is a good model.

Table 4. Hosmer and Lemeshow Test

chi- square	df	*p* value
13.940	8	0.083

4.1.4   Cox and Snell R^2 & Nagelkerke R^2

The value of R^2 Cox and Snell and the value of R^2 Nagelkerke predict the change in the dependent variable explained by a given model. The value of R^2 Cox and Snell shows the estimation value of R^2 in logistic regression model is based on the likelihood ratio. Since the maximum value of R^2 is usually less than 1, and to make comparison easier, this value is recalculated to obtain the standard R^2 Nagelkerke that has the range of between 0 and 1. In this study, 52.2% (Nagelkerke $R^2 = 0.522$) change in the dependent variable was predicted by a significant reliable predictive variable.

Table 5. Cox and Snell R^2 and Nagelkerke R^2

Cox dan Snell R^2	Nagelkerke R^2
0.384	0.522

4.2   Model Formulation

Based on the results of the Wald test, huffaz academic performance model is developed. This model consists of only significant factors that enhance the probability of excellent academic performance among huffaz. There are four identified significant factors, namely, demographic naturalist intelligence, interpersonal intelligence and kinesthetic intelligence. The output of the model can be written as follows:

Let,

x_j= Huffaz who memorized between 16 and 30 surahs

x_n= Naturalist intelligence

x_{ie}= Interpersonal intelligence

x_k= Kinesthetic intelligence

$$z = 2.505 * x_j + 0.147 * x_n - 0.301 * x_{ie} - 0.171 * x_k$$

such that z is the probability of huffaz to gain excellent academic performance.

4.3   Huffaz Academic Performance Model Interpretation

Ten projective variables are identified in this study. However, number of surahs memorized by huffaz, naturalist intelligence, kinesthetic intelligence and interpersonal intelligence contribute most to huffaz academic performance. Furthermore, the more surahs they have memorized, the higher chance of huffaz to excel academically. Besides, the academic performance excellence among huffaz can be enhanced if their teachers can tap on their most dominant intelligence, namely, naturalist intelligence

in their teaching and learning process. This study has found that kinesthetic and interpersonal intelligences are the least dominate intelligence among huffaz and did not contribute to the boost of academic performance among them.

This model can be interpreted by the odds ratio of each significant independent variable. The value of Wald, df and odds ratio for the four significant variables are summarized in Table 6.

Table 6. Value of Wald, df and odds ratio

		Odds Ratio
Huffaz who memorized between 16 and 30 surahs	Wald value: $\chi^2 = 16.878$, df = 1, p < 0.05	12.243
Naturalist intelligence	Wald value: $\chi^2 = 4.509$, df = 1, p < 0.05	1.159
Kinesthetic Intelligence	Wald value: $\chi^2 = 8.396$, df = 1, p < 0.05	0.843
Interpersonal Intelligence	Wald value: $\chi^2 = 6.266$, df = 1, p < 0.05	0.740

The odd ratio for huffaz who memorized between 16 and 30 surahs is Exp (B) or $e^{2.505} = 12.243$. This entails huffaz who memorized between 16 and 30 surahs have had the chance of 12.243 times higher to achieve excellent academic performance. In other words, the more surahs they memorized, the higher the chance for them to achieve excellent academic performance.

The odd ratio for naturalist intelligence is Exp (B) or $e^{0.147} = 1.159$. This discloses that if teachers integrate naturalist intelligence in the teaching and learning process, it increases the chance of 1.159 times for huffaz to accomplish excellent academic performance.

5.   Conclusion

Excellence in huffaz' memorization performance is the main factor that drives the success of their academic success. The findings of this study reveal that students who are excellent in memorization performance are more likely to achieve excellent academic performance up to 12.243 times higher. This rejects certain quarters' assumption that the curriculum of Quran memorization is academically burdensome, instead this study has proven it is otherwise. Integrating naturalist intelligence in teaching and learning helps in enhancing the academic performance of huffaz. It is discovered that the most dominant intelligence among huffaz is naturalist intelligence and response to naturalist stimulation would increase the potential of achieving academic excellence up to 1.159 times higher. Students who are dominant in naturalist intelligence are able to recognize flora and fauna plus other consequential distinction in the natural world and use this ability productively. Howard Gardner defines understanding as a capacity to apply knowledge in new situations, while providing for the naturalist intelligence is one way to encourage true understanding [19]. Besides that, showing the phenomenon would encourage students to observe in detail, to make categorization, and to see how nature works in a system. This understanding is one of the methods to develop students' problem-solving skills in the cognitive aspect [20]. Muslims scholar in the Golden Age of Islam such as Ibnu Sina, al-Khawarizwi and al-Biruni studied nature in the context of the Quran. The Quran depicts the relationship between nature and man. Mankind has a duty to study nature in order to discover God and to use nature for the benefit of mankind, and these have inspired the Muslim scholars to study natural phenomena in the context of the Quran in order to understand God's command clearly. Thus, proper handling of one's naturalist intelligence would increase one potential of acquiring scientific knowledge and technology development.

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