A Review of Exploratory Factor Analysis (Efa) on the Motivation Instrument among Secondary School Students

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ABSTRACT

Motivation is a crucial psychological construct that influences students' engagement, persistence and academic achievement, particularly at the secondary school level. This study aims to validate the instrument of motivation among secondary school students. Exploratory Factor Analysis (EFA) for this study involved a total of 130 Form Four students who were selected using a random sampling technique. This study uses an instrument from the Work Preference Inventory (WPI) built by Amabile, T.M (1994). This instrument consists of 30 items involving two constructs, which is intrinsic motivation (challenge and enjoyment) and extrinsic motivation (external and reward). The data were analyzed descriptively by access Alpha Cronbach reliability and EFA analysis using SPSS software. The results of the analysis show that Alpha Cronbach value is 0.835 which is more than 0.60. Results from the exploration factor analysis show that nine factors with Eigen values is greater than 1.0. The KMO value (Kaiser-Meyer-Olkin) 0.735, Bartlett Test was significant p <0.05, variance value=67.725%, anti-image correlation value >0.5, communalities >0.5 and factor loading >0.5. However, there are six items that need to be removed because the values of factor loading obtained are less than 0.50, items M8, M10, M12, M19, M23 and M29. Thus, the overall findings show that the items for motivation can measure among secondary school students

Keywords: Exploratory Factor Analysis (EFA), Motivation, Secondary School Students.

INTRODUCTION

Motivation plays a very important role in life. It is closely related to an individual's behaviour, attitudes and norms. Motivation is an internal process that activates, guides and sustains behaviour over time. It is considered an essential element in encouraging students to actively engage in learning activities, sustaining their interest in lessons, and creating an enjoyable learning experience. Motivation can influence the outcomes of a task, whether good or otherwise. However, these outcomes depend on the individual themselves. In addition, motivation is also seen to have the ability to impact the learning process and students' academic achievement [1].

Motivation consists of two key components—intrinsic and extrinsic. Intrinsic motivation is driven by a student's internal desire to learn and explore knowledge [2]. Students with strong intrinsic motivation tend to be more careful in completing tasks, value quality, show greater energy, independence, competitiveness and genuine interest in learning. Extrinsic motivation on the other hand is influenced by external factors such as rewards, a conducive learning environment and engaging learning activities. It drives individuals to perform tasks due to external incentives like prizes, good grades or praise. These motivating factors come from outside the individual rather than from within.

LITERATURE REVIEW

Motivation is seen as having the ability to influence the learning process and academic achievement [1]. This

statement is supported by a study which showed a strong relationship between motivation and students' academic performance [3]. Similarly, other research also reported a high positive correlation between motivation and students' academic achievement [4]. In addition, motivation is one of the strongest contributing factors to academic performance [5]. This indicates that motivation helps students determine their direction and the effectiveness of the learning process, which in turn enhances their academic achievement.

Findings from these studies show a significant direct relationship between motivation and students' academic performance. This suggests that motivation is a crucial element in increasing students' commitment and academic success. Therefore, to improve academic performance, students need to be continuously motivated to maintain high levels of motivation. It is evident that positive attitudes, self-confidence and strong commitment toward learning can also lead to better academic outcomes.

Research Objectives

The purpose of this study is to use the Exploratory Factor Analysis (EFA) method to adapt the motivation instrument among secondary school students. The specific objectives are:

1. To determine the validity of the motivation instrument among secondary school students.

2. To determine the reliability of the motivation instrument among secondary school students.

METHODOLOGY

The study was conducted using a quantitative approach, with a pilot study carried out through a questionnaire. A total of 130 secondary school students from various schools in Perak, Malaysia, were randomly selected for this pilot study. This sample size is considered adequate, as recommend a minimum of 100 respondents for performing Exploratory Factor Analysis (EFA) [6]. The pilot study was conducted prior to the main survey to assess the reliability and validity of the research instrument, helping to prevent misunderstandings and identify any inherent flaws in the instrument [7]. This study utilized the Work Preference Inventory (WPI) developed by Amabile, T.M. (1994) [8]. The instrument consists of 30 items covering two constructs: intrinsic motivation (challenge and enjoyment) and extrinsic motivation (external and rewards). Each item is measured using a 4-point Likert scale. Each item is scored on a Likert scale ranging from one to four, with one indicating that the respondent never true of you with the statement and four indicating that the respondent almost true of you with the proposition as expressed in the questionnaire. Because researchers encourage respondents to commit to either positive or negative scales and avoid neutral, the Likert scale employs an equal number of points, such as four. In educational and social science research, the likert scale is one of the most basic and widely used psychometric tools [9]. The data obtained from the pilot study were analysed using SPSS and the researcher conducted the exploration factor analysis process.

FINDINGS

The total number of items before the Factor Exploration Analysis (EFA) was conducted was 30 items. After the EFA, a total of six items (M8, M10, M12, M19, M23, and M29) were removed because their factor loading values were below 0.5, while the remaining items were retained. This indicates that variables with factor loadings below 0.30 or above 0.90 are typically discarded [6]. In this study, a factor loading threshold of 0.5 was applied, as the questionnaire items were adapted from previous research.

Table 1: The Reason Item Was Dropped

Items	Reason
M8, M10, M12, M19, M23, M29	Loading factor less than 0.50

Table 2: KMO Schedule and the Bartlett Test

Kaiser-Meyer-Olkin	Measure of Sampling Adequacy	0.735
Bartlett's Test of Sphericity	Approx. Chi-Square Spherecitydf .000	845.550 276 Sig

Table 2 presents the results of the Exploratory Factor Analysis (EFA) for the motivation construct. The KMO value was 0.735, exceeding the minimum requirement of 0.6, and Bartlett's Test of Sphericity was significant (P-Value < 0.05) with a Chi-square value of 845.550 at 276 degrees of freedom. This indicates that factor analysis can be appropriately conducted.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	of Cumulative %	Total	% of Variance	of Cumulative %
1	5.322	22.174	22.174	5.322	22.174	22.174
2	1.983	8.262	30.435	1.983	8.262	30.435
3	1.647	6.863	37.298	1.647	6.863	37.298
4	1.531	6.380	43.678	1.531	6.380	43.678
5	1.282	5.343	49.021	1.282	5.343	49.021
6	1.221	5.087	54.108	1.221	5.087	54.108
7	1.151	4.796	58.904	1.151	4.796	58.904
8	1.102	4.590	63.494	1.102	4.590	63.494
9	1.015	4.230	67.725	1.015	4.230	67.725
.						
24	.215	.897	100.00			

Extraction Method: Principal Component Analysis.

Table 3 shows that nine factors emerged from the EFA procedure based on eigenvalues greater than 1. The total variance explained for this construct was 67.725%, which is adequate and acceptable as it exceeds the minimum threshold of 50% [10]. Meanwhile, the variance for Factor 1 was 22.174%, which is below 50%, indicating that the data do not exhibit common method bias [11].

Table 4: Component Matrix with Varimax Rotation

Item	Loading Factor	Communalities	Anti-image Correlation
M1	0.805	0.717	0.669
M2	0.728	0.645	0.653
M3	0.518	0.664	0.714
M4	0.660	0.710	0.591
M5	0.625	0.684	0.679
M6	0.709	0.587	0.752
M7	0.780	0.723	0.763
M9	0.840	0.770	0.626
M11	0.805	0.582	0.733
M13	0.599	0.686	0.802
M14	0.768	0.648	0.686
M15	0.631	0.697	0.721
M16	0.521	0.654	0.773
M17	0.527	0.594	0.828
M18	0.696	0.642	0.778
M20	0.602	0.715	0.750
M21	0.808	0.692	0.743
M22	0.702	0.730	0.748
M24	0.551	0.631	0.751
M25	0.623	0.648	0.801
M26	0.799	0.743	0.664
M27	0.623	0.666	0.833
M28	0.770	0.738	0.699
M30	0.526	0.687	0.722

Table 4 presents the component matrix with Varimax rotation for the 30 motivation items. Several items were removed because their factor loading values were below 0.5, specifically items M8, M10, M12, M19, M23, and M29, while the remaining items were retained.

Table 5: Reliability Analysis

Item	Corrected Item-Total Correlation	Cronbach Alpha if item deleted	Cronbach Alpha	Total Item
M1	0.257	0.837		
M2	0.371	0.830		
M3	0.342	0.831		
M4	0.372	0.831		
M5	0.433	0.828		
M6	0.304	0.832		
M7	0.374	0.830		
M9	0.295	0.833		
M11	0.432	0.827		
M13	0.525	0.823		
M14	0.231	0.834		
M15	0.431	0.827	0.835	24
M16	0.407	0.830		
M17	0.497	0.827		
M18	0.400	0.829		
M20	0.443	0.827		
M21	0.296	0.832		
M22	0.410	0.828		
M24	0.438	0.828		
M25	0.415	0.829		
M26	0.421	0.828		
M27	0.519	0.823		
M28	0.347	0.831		
M30	0.330	0.831		

Table 5 shows the Cronbach's Alpha (α) coefficient values, with each motivation item having a value around 0.835. These findings indicate that the questionnaire instrument has a high level of reliability [12] as the coefficient (α) exceeds 0.6. This is supported that alpha values ranging from 0.71 to 0.99 represent the best reliability level for instrument items [13]. This means that the items in this instrument are highly consistent and suitable for data collection.

CONCLUSION

The purpose of the Exploratory Factor Analysis (EFA) in this study was to enable more accurate and meaningful measurement of the motivation construct among secondary school students. Therefore, it was necessary to modify the existing instrument by conducting EFA to ensure that all items loaded appropriately onto the predetermined factors. The factor analysis showed that each motivation item had satisfactory factor loadings above 0.5. Likewise, the reliability analysis indicated that the questionnaire instrument had a high Cronbach's Alpha (α) coefficient, demonstrating its suitability for use in this study. In other words, this 24-item questionnaire instrument is reliable and valid for future research on motivation among secondary school students.

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