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Mathematics Education among Higher Education Students: Analysis using Structural Equation Modelling and Confirmatory Factor Analysis

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Abstract

Purpose: The objectives of the study were to study the 'student-related' dimensions impacting the students studying Basic Mathematics at the Colleges of Technology (COT) in Oman and to analyze and determine the intervention programs and strategies in reducing the student dismissal rate in all the Colleges of Technology in Oman.

Design/methodology/approach: The study was a diagnostic study, and the approach was a comparative analysis. Self-administered survey forms were used. The targeted populations of this study were the students of Colleges of Technology, who will fill out the survey forms for the quality audit. A systematic sampling of the students, males, and females, from different colleges, was carried out. To analyze data, the mean, standard deviations, and factor analysis were used.

Findings: The findings of this study show the significance of study habits which was one of the crucial criteria set for the educational purpose that should be developed from a younger age. The significance was established through the SEM and the goodness of fit indexes of CFA. Furthermore, of the four student-related dimensions, study habits have a strong influence on achievement in Basic Mathematics, and are followed by interest, language, and perception.

Research limitations/implications: The comparative study of the factors from the point of view of students, is reliable to show the significance of testing. This research was limited to the Omani population who were related to COT.

Social Implications: This study would help the authorities and stakeholders to facilitate new initiatives to achieve a higher rate of students moving into higher education in the Sultanate of Oman. The outcomes of this research would improve the new design of the education system to fulfil the visions of the nation.

Originality / Value: There was no such study that relates the academic performance of the students studying at the College of Technology in the Sultanate of Oman to the dismissal rate/ expulsion rate. This is the first-ever project which investigates the factors that affect the future education of Omani students from the student's point of view.

Keywords: Structural Equation Modelling; Confirmatory Factor Analysis; College of Technology in Oman, Study habits of the students, Interest and the language of the students.

Introduction

One of the fundamental disciplines that aid students in preparing for their future careers are Mathematics (Saffer, 1999). It is taught at all levels of education and is an important body of knowledge considering its applications in the real world. There are different branches of Mathematics. And these branches are then further academically sub-classified and appropriately introduced and taught at distinct educational levels.

Students must pass and acquire the Mathematical concepts and skills of the math subjects and/or courses at their level to further their studies in higher-level Mathematics and succeed in other disciplines that involve the application of Mathematics. However, not all Mathematics is created equal. There are some difficult concepts that students struggle to understand. If these issues are not addressed, they may result in failures and, in worst-case scenarios, may prevent students from moving forward with their studies and earning their degrees, which could then negatively impact their future. To understand better the external and internal factors affecting students' learning, performance, and achievement in Mathematics, numerous studies have been conducted to investigate these factors.

Mathematics Education in Oman

In the Sultanate of Oman, Mathematics is taught at different educational levels. One such level of education is a bridge program called the General Foundation Program (GFP). GFP is a program with no credits created and offered to support students who have met eligibility requirement leaving secondary education but not yet achieved the standards of higher education (Carroll et al., 2009). This program offers two Mathematics, four English, and one Information Technology/Computing Skills course. Prospective college students must take entry tests in English, Mathematics, and IT/Computing Skills and those who pass all three tests proceed directly to the tertiary/college level or the post-foundation level. Those students who did not meet all or have only met a certain test score, are then placed or enrolled in an appropriate GFP course level in English, Mathematics, and/or Computing Skills.

For Mathematics, students who got test scores less than 50% start with the Basic Mathematics course and move on to the Applied or Pure Mathematics course after successfully passing Basic Mathematics. While students who got marks from 50% to 79% on the Mathematics entry test are enrolled directly in Applied or Pure Mathematics. However, in recent years, in the Colleges of Technology (COT) in Oman, a public higher education institution, there have been cases of student dismissals in GFP for failing to meet the requirements in Basic Mathematics. Low grades or poor performance in Mathematics at the foundation level causes students to be dismissed early on before Omani students could even reach the post-foundation level. These dismissals raise a concern as it has a negative implication on Oman's objective of moving forward with its educational mission, and eventually, the student's future at landing better jobs.

Problem Statement

This study aims to understand and determine the possible underlying factors that could have an impact or influence on students' learning, performance, and achievement in Basic Mathematics and Mathematics in general. This study focuses on examining student-related factors and their sub-dimensions such as Interest, Perception of the Mathematics course, Study Habits, and Language. Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA) were used to determine the reliability of the survey instrument. According to (Schreiber et al., 2006), CFA and SEM are statistical techniques that use covariation to reduce the number of observed variables to a smaller number of latent or unobserved variables. This study used these techniques to measure and validate the internal consistency or inter-relatedness of the question items in the instrument that was floated. The results show that the student-related dimensions section of the survey instrument has an overall Cronbach's alpha of 0.907, which indicates a high reliability of the items in the instrument that was administered to students in the seven Colleges of Technology all over Oman who have studied Basic Mathematics. The findings of this empirical study contribute to the recommendation of appropriate interventions that focus on the key factors that have a significant impact on or influence the performance of Mathematics students in the COT and which would then mitigate if not solve the dismissal of GFP students due to foundation-level Mathematics failures.

Research Questions

1. What 'student-related' dimensions have an impact on students studying Basic Mathematics at the Colleges of Technology in Oman?
2. What are the intervention programs and strategies that can reduce the student dismissal rate in all the Colleges of Technology in Oman?

Research Objectives

The objectives of this study are to achieve the key points mentioned below:

1. To study the 'student-related' dimensions impacting the students studying Basic Mathematics at the Colleges of Technology in Oman.
2. To analyze and determine the intervention programs and strategies for reducing student dismissal rates in all the Colleges of Technology in Oman.

Review of Literature

Bryan & Bryan (1991) claimed that positive mood affects the Mathematics test performance of grade school, and junior and senior high school students compared to a no-treatment control group and the students conditioned in a positive mood before answering problems expressed greater self-efficacy. Self-efficacy is the conviction that one can take the actions required to accomplish objectives (Bandura et al., 1999). Students' positive attitudes toward Mathematics, have an impact on the student's achievement in Mathematics (Chen et al., 2018). Abu-Hilal & Al Abed's (2019) study with Omani students about engagement, self-efficacy, and anxiety in Mathematics, showed that self-efficacy predicted engagement. However, self-efficacy and engagement do not predict anxiety. On the other hand, Mathematics difficulties share common indicators with reading difficulties (Das & Janzen, 2004). In a study by (Al Jabri et al., 2022), the student's perception of Mathematics through teacher-related dimensions was examined through SEM analysis.

In teaching Mathematics, a study on the impact of Mathematics teacher quality on student achievement in eight-grade Mathematics performance in Oman and Taiwan showed that there exists a relationship between teacher quality indicators and student achievement and the effect on student achievement due to these, in both the countries differ on characteristics of students, and school factors (Ambussaidi & Yang, 2019). Baumert et al. (2010) demonstrated a significant positive influence of pedagogical topic knowledge on student learning gains, which was mediated by the provision of cognitive stimulation and individual learning assistance.

On the other hand, English proficiency appropriate for higher education studies could also be a factor in learning Mathematics and also other academic courses such as information & communication technology (Alami, 2016; Sergon, 2011). The anthology reviews the history, current status, plans for the development of Mathematics education in the Muslim States in Africa, the Middle East, and Asia (Vogeli & El Tom, 2020). Alquraan & Al-Shaqsi (2019) recommended that Mathematics and science teachers balance the use of assessment for learning and assessment of learning practices in Oman from teachers' points of view and as perceived by their educational supervisors. The evaluation of the efficiency of teaching methods like classroom supervision, instructional design, assessment practices, and teaching techniques, allowed the teachers to decide on the more appropriate practices to improve students' learning (Faragher et al., 2019; Marinho et al., 2017). Some Mathematics education analyses were declared regarding teachers' procedures for evaluating students' Mathematics understanding such as Richland & Begolli (2016) who studied the teachers' assessment methods targeted the students' high-level reasoning in Mathematics which could be used in improving teachers' execution by changing teaching techniques and the assignment's level of the students (Gill et al., 2013).

Research Methodology

A framework for understanding the student's interest, perception, study habits, and language in the study of Mathematics at the foundation level in the general foundation program of the education system in Oman demonstrates the decline in the movement of students to higher education. The research model consists of four latent variables namely interest, perception, study habits, and language which is a collaborative effort in identifying the indicators of the dismissal rate from education. This model involves the major factor (the students) to determine the factors leading to their dismissal from higher education in Oman.

The students' interest in Mathematics study is the most vital fact which causes a vital influence on their childhood. Perception is the next level factor which grows from the school level due to the influence of the teachers and parents. As the students reach the general foundation program at the graduate level the study habits which is developed from childhood through the influence of teachers and parents have a strong bonding in developing the skills needed for higher study. Language adds as an external factor to make themselves deeper in the world level to compete, among others. The items designed in the survey questionnaire are based on the four latent variables which are prepared after more understanding and deeper knowledge of student factors leading to dismissal from higher education in Oman.

To understand the relationship among the latent variables a hypothesis was established to fit the data collected through the questionnaire. The participants of the study include both male and female students from the seven campuses of the Colleges of Technology in Oman. A total of 1909 responses from students who had studied Basic Mathematics in the seven Colleges of Technology were collected. The self-administered questionnaire was hosted in Microsoft Forms. Each of the survey questions was written in English and Arabic. The provision of an Arabic translation was also given an equal opportunity for those students who were learning the English language to understand the survey questions clearly.

Table 1 shows the sequential form of the questionnaire which was circulated among the students. Also, it indicates the acronyms used in the other tables which were used in the discussion. As appeared in Table 2, the mean of the student interest (F1) bears the highest in the study-related dimensions whereas the student perception (F2) attains the least mean with the highest variance. This shows the significance of the student interest in the course which also embarks on the student perception in the study of Mathematics among the Omani student population.

To verify that the survey instrument used to measure the student's perception of student-related factors affecting Mathematics courses, the researchers employed Confirmatory Factor Analysis (CFA) as it is a popular tool among social sciences to show relationships among observed variables and latent variables. The study further shows the relationship of the different question items in the survey thru Structure Equation Modelling (SEM) and showed the path analysis of the relationships of the different questions that answer which ones have a larger effect on the students. The AMOS version 18 package is used to gather the results of the study.

Table 1. Student-Related factors dimensions

Items	Measurement	Item Name	Dimension
1	I make myself prepared for my Mathematics skills course	MTSSa1	Interest (F1)
2	I listen attentively to my lecturer	MTSSa2	
3	I enjoy doing activities/exercises given because they help me improve my skills	MTSSa3	
4	I actively participate and ask the teacher when I have doubts	MTSSa4	
5	I want to get good grades	MTSSa5	
6	I get frustrated when the discussion is interrupted, or the teacher is absent	MTSSa6	
7	I am interested in learning Mathematics skills because I find that the lessons/applications are important in my future career	MTSSa7	
8	I find Mathematics skills challenging	MTSSb1	Perception (F2)
9	I find the topics and lessons interesting	MTSSb2	
10	I find the course helpful to my career goal	MTSSb3	
11	I prefer a practical method of teaching to a theory	MTSSb4	

12	I do the activities and exercises promptly	MTSSc1	Study habits (F3)
13	I exert effort when I do difficult exercises	MTSSc2	
14	I spend my free time doing my assignments or studying my lessons	MTSSc3	
15	I study the lessons I missed	MTSSc4	
16	I study and prepare for quizzes and exams	MTSSc5	
17	I study harder to improve my performance whenever I get low marks	MTSSc6	
18	I spend less time with friends and concentrate more on my studies	MTSSc7	
19	I prefer finishing my course activities and exercises before doing other leisurely activities such as watching TV, playing computer/mobile games, or using social media	MTSSc8	
20	I understand the lesson better when I read the information or instruction	MTSSd1	Language (F4)
21	I understand the lesson very well when the instructions are spoken to me by my teacher	MTSSd2	
22	I understand clearly the lessons and instructions (whether spoken or written) in the English language	MTSSd3	

Findings

Table 2. Average and the Covariance for each Measurement and each Dimension

Dimension	Item Name	Mean	Variance	Mean per Dimension	Variance per Dimension
Interest (F1)	MTSSa1	3.98	0.70	4.07	0.76
	MTSSa2	4.06	0.69		
	MTSSa3	4.13	0.67		
	MTSSa4	3.99	0.76		
	MTSSa5	4.65	0.44		
	MTSSa6	3.67	1.08		
	MTSSa7	4.02	0.94		
Perception (F2)	MTSSb1	3.36	1.24	3.72	1.04
	MTSSb2	3.67	0.95		
	MTSSb3	3.82	0.99		
	MTSSb4	4.03	1.00		
Study Habits (F3)	MTSSc1	3.96	0.67	4.05	0.75
	MTSSc2	4.07	0.75		
	MTSSc3	3.67	0.92		
	MTSSc4	4.07	0.69		
	MTSSc5	4.33	0.60		
	MTSSc6	4.38	0.60		
	MTSSc7	3.83	0.95		
	MTSSc8	4.04	0.78		
Language (F4)	MTSSd1	4.04	0.69	3.97	0.78
	MTSSd2	4.14	0.71		
	MTSSd3	3.72	0.94		

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Table 3. Result of Reliability Analysis for Student-Related Factors Dimensions

Dimensions	Number of Attributes	Cronbach's Alpha
Interest	7	0.817
Perception	4	0.646
Study Habits	8	0.846
Language	3	0.726
Overall reliability analysis for STUDENT-RELATED dimensions	Cronbach's alpha	0.907
	No. of Items	22

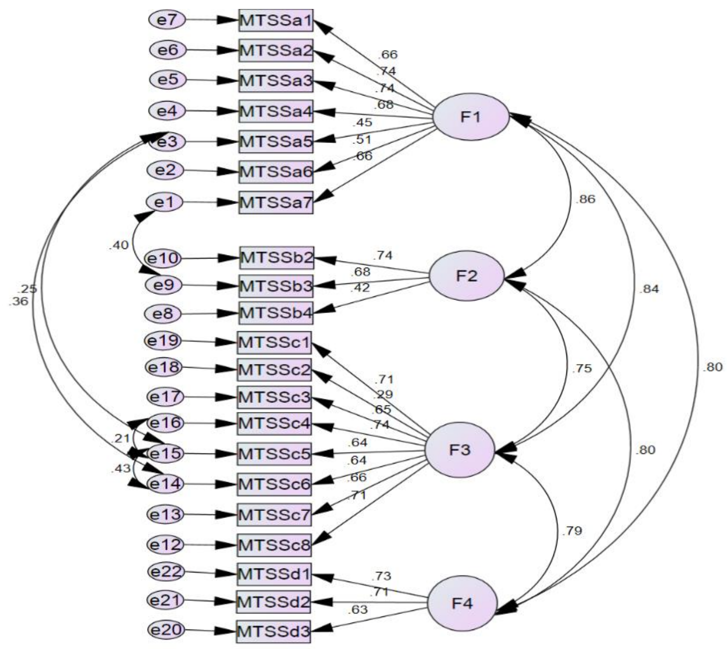

Fig 1. Confirmatory Factor Analysis for Student-Related Dimensions

Table 4. Chi-Square and Standardized RMR

Computation of degrees of freedom	
Number of distinct sample moments	231
Number of distinct parameters to be estimated	53
Degrees of freedom (231-53)	178
Chi-square and Standardized RMR	
Chi-square	1504.481
Degrees of freedom	178
Probability level	.000
Source: Primary data. Results computed by the package – AMOS	

Table 5. Fit Indices of Measurement Models

Measure	Estimate	Threshold	Interpretation
CMIN	1502.481	--	--
DF	178	--	--
CMIN/DF	8.441	--	Acceptable
CFI	0.922	>0.90 (Hu & Bentler, 1999)	GOOD FIT
GFI	0.924	>0.90 (Hair et al., 2006)	GOOD FIT
AGFI	0.901	>0.90 (Hooper et al., 2008)	GOOD FIT
NFI	0.913	>0.90 (Hu & Bentler, 1999)	GOOD FIT
IFI	0.922	>0.90 approaches 1	GOOD FIT
SRMR	0.035	<0.08 (Hair et al., 2006)	GOOD FIT
RMSEA	0.062	0.05 - 0.10 (Hair et al., 2006)	GOOD FIT
Results for default model compared with the standards.			
Source: Primary data. Results computed by the package – AMOS			

Table 6. Maximum Likelihood Estimates - Regression Weights

Variables/Indicators			Regression Weights				Standardized Regression Weights
			Estimate	S.E.	C.R.	P	Estimate
MTSSa7	<---	F1	1.000				.661
MTSSa6	<---	F1	.828	.041	20.084	***	.509
MTSSa5	<---	F1	.465	.026	18.008	***	.449
MTSSa4	<---	F1	.927	.036	25.963	***	.680
MTSSa3	<---	F1	.943	.034	27.748	***	.736
MTSSa2	<---	F1	.967	.035	27.990	***	.744
MTSSa1	<---	F1	.856	.034	25.237	***	.658
MTSSb4	<---	F2	1.000				.422
MTSSb3	<---	F2	1.589	.098	16.157	***	.680
MTSSb2	<---	F2	1.709	.103	16.544	***	.739
MTSSc8	<---	F3	1.000			***	.709
MTSSc7	<---	F3	1.015	.038	26.507		.655
MTSSc6	<---	F3	.780	.030	26.044	***	.640
MTSSc5	<---	F3	.784	.030	25.932	***	.643
MTSSc4	<---	F3	.978	.033	29.697	***	.739
MTSSc3	<---	F3	.994	.038	26.365	***	.651
MTSSc2	<---	F3	.399	.034	11.831	***	.289
MTSSc1	<---	F3	.922	.032	28.600	***	.709
MTSSd3	<---	F4	1.000			***	.633
MTSSd2	<---	F4	.977	.040	24.244		.713
MTSSd1	<---	F4	.991	.040	24.613	***	.730
Source: Primary data. Results calculated by the package – AMOS			*** - p-value less than 0.001				

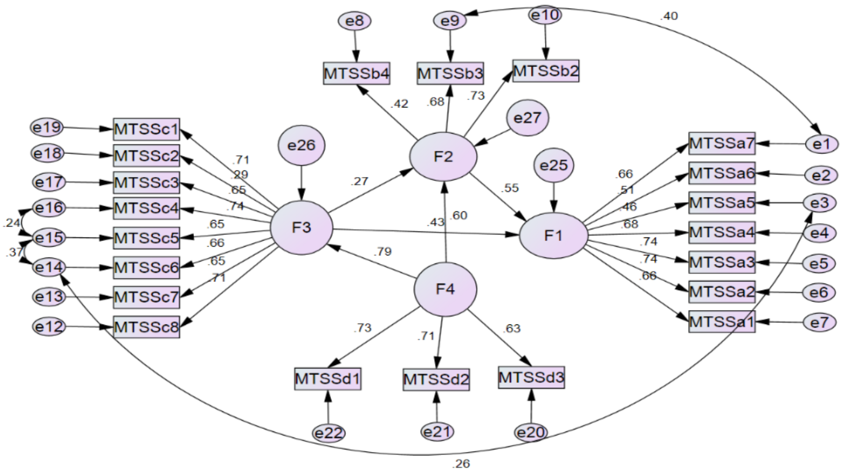

Fig 2. Path Diagram for Structural Model Showing Unstandardized Estimates of Factors Contributing to Mathematics Students' Student-Related Variables

Table 7. Path Coefficients in SEM

Variables/Indicators			Unstandardized co-efficient		C.R	P	Standardized Regression Weights
			Estimate	S.E.			
F3	<---	F4	.813	.038	21.167	***	.872
F2	<---	F3	.184	.036	5.156	***	.193
F2	<---	F4	.410	.044	9.365	***	.351
F1	<---	F3	.434	.038	11.552	***	.483
F1	<---	F2	.841	.075	11.147	***	.736
MTSSa7	<---	F1	1.000			***	.551
MTSSa6	<---	F1	.825	.041	20.045	***	.614
MTSSa5	<---	F1	.476	.026	18.316	***	.746
MTSSa4	<---	F1	.926	.036	25.978	***	.798
MTSSa3	<---	F1	.944	.034	27.796	***	.788
MTSSa2	<---	F1	.966	.035	27.993	***	.759
MTSSa1	<---	F1	.855	.034	25.233	***	.718
MTSSb4	<---	F2	1.000			***	.650
MTSSb3	<---	F2	1.576	.097	16.198	***	.760
MTSSb2	<---	F2	1.695	.102	16.605	***	.783
MTSSc8	<---	F3	1.000			***	.798
MTSSc7	<---	F3	1.011	.038	26.474	***	.700
MTSSc6	<---	F3	.790	.030	26.654	***	.686
MTSSc5	<---	F3	.797	.031	26.121	***	.729
MTSSc4	<---	F3	.979	.033	29.808	***	.667
MTSSc3	<---	F3	.987	.038	26.237	***	.783
MTSSc2	<---	F3	.405	.034	12.031	***	.775
MTSSc1	<---	F3	.919	.032	28.582	***	.481
MTSSd3	<---	F4	1.000			***	.818

Variables/Indicators			Unstandardized co-efficient		C.R	P	Standardized Regression Weights
			Estimate	S.E.			
MTSSd2	<---	F4	.977	.040	24.282	***	
MTSSd1	<---	F4	.988	.040	24.616	***	
Source: Primary data. Results calculated by the package – AMOS							

Table 8. Model Fit Indices

Measure	Estimate	Threshold	Interpretation
CMIN	1617.92	--	--
DF	180	--	--
CMIN/DF	8.988	Between 1 and 5	***
CFI	0.916	>0.90 (Hu & Bentler, 1999)	GOOD FIT
GFI	0.915	>0.90 (Hair et al., 2006)	ACCEPTABLE
AGFI	0.892	>0.90 (Hooper et al., 2008)	ACCEPTABLE
NFI	0.906	>0.90 (Hu & Bentler, 1999)	ACCEPTABLE
IFI	0.916	>0.90 Approaches 1	GOOD FIT
SRMR	0.036	<0.08 (Hair et al., 2006)	GOOD FIT
RMSEA	0.065	0.05 - 0.10 (Hair et al., 2006)	GOOD FIT
Results for default model compared with the standards.			
Source: Primary data. Results computed by the package – AMOS			

Discussion

This study employed SEM and measured the validity of the model using CFA. All 22 measurement items indicated in Table 1 were constructed based on the academe experience of the authors and guided by related studies on this topic (Islam, 2014; Mushtaq & Khan, 2012). Students who have studied Basic Mathematics in the COTs took part in answering the survey. The study undertook 1909 respondents as samples. In Table 2, the average and covariance for each measurement item, and each dimension are shown. Meanwhile, Table 3 indicates that overall, 0.907 is Cronbach's alpha score.

The SEM analysis modelled the complex relationship between the measured and latent variables. The CFA verifies the factor structure of the observed variables. The said score can be described as 'Excellent', which validates the model's reliability. Furthermore, Nunnally (1978) states that the minimum level of reliability is influenced by the usage of the model. While, according to (Beavers et al., 2019; Kaiser & Rice, 1974), the subscale's Cronbach's alpha values are labelled as follows: 'marvellous' for 0.9 to 1.0, 'meritorious' for 0.8 to 0.9, 'middling' for 0.7 to 0.8, 'mediocre' for 0.6 to 0.7, and 'miserable' for 0.5 to 0.6 alpha values. On the other hand, it was suggested by Lance et al. (2006) that requires a Cronbach's alpha value larger than 0.70 in the measurement scale is considered 'urban legend'. However, Cronbach's alpha values between 0.65 and 0.70 are still regarded by many researchers as acceptable. Based on the results shown in Table 3, further proves how the dimensions of the study are coherent and consistent.

Evaluation of the Model Fit

Prior to the interpretation of the causal paths of the structural model, a measurement model that is of good fit is necessary. The model's fit shows that it can replicate data, typically the matrix of the variance-covariance. When a model is of a good fit, it is said to be coherent with the data and it no longer must be respecified. Moreover, the researchers used fit indices to ascertain the fit of the model. In this research, fit indices (see Fig. 1 and Table 4) are generated from AMOS. Because SEM tests have multiple sets of relationships represented by multiple equations, the overall model's fit must be determined rather than each relationship.

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As shown in Table 4, the positive value for degrees of freedom which is 178 indicates that the model has been identified. Furthermore, the model is implicitly fit since the value of the chi-square has a p-value of 0.000, which is insignificant. Since the SRMR is less than 0.10, as indicated in Table 5, the model fit is adequate.

Table 5 displays the fit indices of different measurement models. Measurements indicated are as follows: the Chi-square value (CMIN), the Degree of Freedom (DF), the discrepancy divided by degrees of freedom (CMIN/DF), the Comparative Fit Index (CFI), the Goodness of Fit Index (GFI), the Adjusted Goodness of Fit Index (AGFI), the Normed Fit Index (NFI), the Incremental Fit Index (IFI), the Standardized Root Mean Square Residuals (SRMR), and the Root Mean Square Error of Approximation (RMSEA). As seen in Table 5, the comparison of the results of the default model in this study and the threshold or standard values based on various studies indicates that the model is of best fit.

Decomposition of Covariance and Correlations

In Table 6, the Standardized Regression Weights of each variable or indicator are shown. If the measured variables had first been converted to z scores - by subtracting the mean and dividing by the standard deviation - these regression weights would have appeared. Furthermore, the magnitude of standardized regression weights values can distinguish variables that are not related to the subsequent factors. A value below 0.5 for the variable's regression weights means that it is not particularly correlated with the factors. Table 6 shows that each measured variable is in line with its corresponding factor.

Additionally, the regression weight divided by this weight's standard error is equivalent to the Critical Ratio (CR). CR values greater than two (2) are considered significant at the level of 0.05 because the ratio's distribution seems like a Z distribution. As observed in Table 6, the value of all the latent variables is substantial because their CRs are larger than 2.

Path Analysis for Testing Structural Model

The next step in SEM is path analysis, which quantifies the relationships among several variables (Fan et al., 2016; Wright, 1918; Wright, 1921). As defined by Ullman & Bentler (2012), path analysis 'allows examination of a set of relationships between one or more independent variables, either continuous or discrete, and one or more dependent variables, either continuous or discrete'. SEM is concerned with both the measured or observed and latent or unobserved variables. A measured or observed variable can be seen or examined completely, while a latent or unobserved variable or factors (i.e., factor analysis) or constructs cannot be directly observed and should be implied from common factors of other observed variables (Fan et al., 2016; Schreiber et al., 2006). These latent variables could indicate the cause or effect of a model. Moreover, SEM is a combination of multiple regression and factor analysis (Ullman & Bentler, 2012). Performing path analysis reveals the structural relationships of the latent variables as seen in the CFA. The path analysis for the SEM model discussed in this article is shown in Fig. 2.

Decomposition of Correlations

Shown in Table 7 is the relationship among latent variables which is explained by the estimates of Unstandardized Coefficients.

Significance Tests of Individual Parameters

The unstandardized coefficients and test statistics are displayed in Table 7. The unstandardized regression coefficient shows how much the dependent or mediating variable has changed for each unit change in the predicting variable. In Table 7, the unstandardized estimate, its standard error (S.E.), and the estimate divided by the standard error - Critical Ratio (C.R.) are also shown. Moreover, column *p* is displayed in Table. 7 is the value of the probability associated with the null hypothesis that the test is zero.

Assessment of the Model Fit

The obtained sample data was examined using SEM for its fitness. Anderson & Gerbing (1988) and Gerbing & Anderson (1992) suggest the use of a measurement model first for the analysis of any survey instrument. This is performed to check the instrument's validity and reliability. This study used AMOS version 18 in the analysis of the model's structure. As mentioned by Tobbin & Kuwornu (2011), the SEM is most helpful in knowing the causal link among variables and in confirming that the model being utilized is compatible.

*** The results show that the chi-square statistics with a value of p = 0.000 does not show a good model fit. Furthermore, more than 200 sample sizes, as in this study with a sample size of 1909, may have an impact on the chi-square statistics to signify a substantial probability level (Schumacker & Lomax, 2004).

Subsequently, the current model is deemed for more interpretation specifically in the goodness of fit measures. SEM assesses how well the data conform to a theoretical model. The evaluation of the model emphasized the CFI, GFI, AGFI, IFI, and RMSEA as in Table 8. Common model-fit metrics like the CFI, RMSEA, NFI, and IFI were utilized to assess the model fit of the measurement.

Gerbing & Anderson (1992) listed the following as the acceptable model criteria: NFI of 0.90 or higher, the RMSEA of 0.08 or lower, and CFI of 0.90 or higher. According to Hu & Bentler (1999), a chi-square goodness-to-fit (GFI) test can be used to assess the fit between the data and the proposed measurement model. It specifies that a good fit has a probability value of more than or equal to 0.9. In Table 8, the results show that the GFI is 0.899 which is closer to 0.9. Moreover, the other measures fit satisfactorily such as AGFI=0.892, CFI=0.916, IFI=0.916, NFI=0.906, and RMSEA=0.065. These results show that the model has a good absolute fit (Bagozzi & Yi, 1988). The highlighted goodness-of-fit indices, support the model fit and demonstrate this structural model's suitability.

Conclusion

The statistical analysis shows the significance of the critical factors affecting the study. The results of SEM and CFA show that the model is a good fit for measuring student-related personal factors which are classified into four dimensions: Interest, Perception, Study Habits, and Language. This research is engaged in extracting and analysing the influential factors which should be adopted while constructing academic-related policies. The main results are generated through the AMOS package.

The dimensions set for the analysis show a positive impact on the purpose of the study. The identification of the significant student-related factors that influence student performance in Mathematics was done with structured equation modelling and confirmatory factor analysis. The results of SEM and CFA show that the model is a good fit for measuring student-related personal factors which are classified into four dimensions: Interest, Perception, Study Habits, and Language.

In the area of interest, descriptive data shows that 73% of the students strongly agree with the importance of getting good marks in Mathematics, which is the highest in the interest dimension. Additionally, the data suggest that Omani students enjoy participating in activities that help them develop their skills. In the dimension of Perception, 16% of the students are neutral about whether Basic Mathematics as challenging or not, while 48% of the students agree that Mathematics is challenging and a few of the students could be suggested to have self-efficacy (Abu-Hilal & Al Abed, 2019; Bandura et al., 1999). Consequently, it can also be shown that Omani students are inclined to a practical method of teaching more than theory. Furthermore, in the study habits dimension, half of the student-respondents are more extrinsically motivated (Lin et al., 2003) to study whenever they get low marks. 19% of the respondents were neutral about their spending free time on academic-related activities such as doing assignments and exercises. Surprisingly, students' achieving motive of getting good marks does not implicitly mean students study and prepare for their quizzes and exam, which is classified as an achieving strategy (Biggs, 1987) as seen in the CFA. In the dimension - language, 36% of the students agree that they understand the lesson very well when the instructions are spoken to them. And 20% are neutral about understanding the lessons and instructions clearly in the English language. Furthermore, of the four student-related personal dimensions, study habits have a strong influence on students' achievement in Basic Mathematics, and are followed by interest, language, and perception, respectively.

Recommendations

1. As the students feel the Basic Mathematics course is challenging at the college level, there should be modification of the mathematics courses at the school level.
2. More of student-centered learning techniques should be involved in the course instruction to improve the interest level in the course.
3. The self-efficacy of the students should be enhanced by providing additional references, videos, assignments, and projects.
4. The student should recognize the teacher as a facilitator who goes beyond the course outcome to enhance the interest in the course.
5. As study habit plays an important role in the course the responsibility of schoolteacher and parents has an important role in directing or building confidence in the students to prosper in the course.

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