

Structural Equation Modeling: Identifying key factors for Achievement of Students in Higher Education



Statistics

KEYWORDS : Achievement, Aspiration, Self Esteem, Structural Equation Modeling and Work Plan.

T Leo Alexander

Associate Professor, Department of Statistics, Loyola College, Chennai

S Xavier

Assistant Professor, Department of Statistics, Loyola College, Chennai

ABSTRACT

Evaluation is the formal determination of the quality or effectiveness of programme or curriculum. Evaluation of students' achievement is very essential since it serves as a basis on which education decisions concerning students are made. Achievement is one of the most important factors among the higher education students. In this study the relationship among self esteem, aspiration, work plan and achievement of higher education students is investigated. Totally 200 random samples were collected from four colleges in Chennai city and it is analyzed by using AMOS 16.0 software package. The importance of the self esteem, aspiration, work plan and achievement are discussed in this study.

1.0 Summary

There are many researchers conducted on the students' motivational level, their achievements, aspirations and the reward for working hard. It is true that the aspects chosen for research indicate the type of results the researcher is aspiring for. At the same time the level of students' aspirations and the road they have taken to achieve them varies. One cannot deny the fact that work plan is essential in this. So the study aims to study the relationship between students' self esteem, aspirations, motivations and work plan. The factors that enable individuals to achieve success in their career and life are studied in this study.

This paper aims at identifying the factors like self-esteem, aspirations, and work plan help to achieve the goals and to bring success. Success is what happens when preparation meets opportunity. The samples can enlighten the research for further development and also can bring to light the factors that enable to achieve the goals. The correlation between these factors is also studied. The review of literature supports the study as these factors are vital in the achievement of the students towards a successful future. The study conducted among the college students in Chennai city throws light on the theme proposed.

There are many researchers who have sought to discover factors that determine students' performance. Based on the findings of these researches and several lines of research pursued over the decades have accumulated evidence that numerous factors are associated with student achievement at all levels of education. Such factors could include: social behavior (Kathryn R. Wentzel, 1998), learning strategies (Paul R. Pintrich et al., 1990), academic engagement (Arthur N. Applebee et al., 2003), parenting styles (Baumrind, 1991) and academic motivation (Grolnick et al., 1991).

A study on "Structural Model of Self-concept, Autonomous Motivation and Academic Performance in Cross-cultural Perspective" was studied by Wondimu et al. (2006). Rugutt John K. et al. (2005) studied "Factors that Influence College Academic Achievement: A Structural Equation Modeling Approach".

Robert H. Stupnisky et al. (2007) has explained Comparing self-esteem and perceived control as predictors of first-year college students' academic achievement. The importance of setting up goals for behavior was first suggested and defined by Dembo (1931). Further Lewin et al. (1944) demonstrated that aspirations can be linked with the seeking of success and the avoidance of failure. Later research by Sewell et al. (1975) studied achievements among students. Quaglia et al. (1996) conceived of aspirations as the "student's ability to identify and set goals for the future.

2.0 Structural Equation Modeling

Structural equation modeling (SEM) is a statistical methodology that takes a confirmatory (hypothesis - testing) approach to the analysis of a structural theory bearing on some phenomenon. Typically, this theory represents "causal" processes that generate observations on multiple variables (Bentler, 1988). The term *structural equation modeling* conveys two important aspects of the procedure: (a) that the causal processes under study are represented by a series of structural (regression) equations, and (b) that these structural relations can be modeled pictorially to enable a clearer conceptualization of the theory under study. The hypothesized model can then be tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it is consistent with the data. If goodness-of-fit is adequate, the model argues for the plausibility of postulated relations among variables; if it is inadequate, the tenability of such relations is rejected.

Structural equation modeling is a collection of statistical techniques that allow a set of relationships between one or more independent variables and one or more dependent variables to be examined. Both independent and dependent variables can be either continuous or discrete and can be either factors or measured variables.

The general model is represented by the following equations consisting of measurement and structural models:

$$Y = v + \Lambda\eta + \varepsilon \quad (2.1) \text{ and}$$

$$\eta = \alpha + B\eta + \xi, \quad (2.2)$$

where Y the vector of p observed variables in a considered study ($p > 1$), v the $p \times 1$ vector of observed variable mean intercepts, Λ the $p \times q$ matrix of factor loadings, η that of q latent factors assumed in it ($q > 0$), ε the vector of p pertinent residuals (error terms), α the $q \times 1$ vector of latent variable intercepts, B a $q \times q$ matrix of latent regression coefficients and ξ the $q \times 1$ vector of corresponding latent disturbance terms.

3.0 Data Characteristics

This study is conducted in Chennai city colleges by distributing questionnaire to students. A total of 300 random samples are collected from four colleges in Chennai city of which 75 samples are from each college. That is Loyola College, Shankaral Sundarai Shasun Jain College, Madras Christian College and Justice Basheer Ahamed Sayeed College for Women. After screening the data, the valid 200 samples are decided for this study and rest of the data are eliminated due to extreme values and missing values. Out of 200 respondents, males and females were taken equally

that is 100 (50%) (Given in Appendix). Ages from 18 to 26 were collected and 74 (37 %) respondents are from arts background and rest of the respondents 126 (63 %) are science background. Out of 200, 44 (22 %) respondents are coming from rural and 156 (78 %) respondents are from urban.

We have considered four parameters such as Self esteem, Aspiration, Work plan and Achievement. Each parameter is having five questions with five point Likert scale measurement (1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree,

5 – Strongly agree) which are explained in the following Table 3.1.

Table 3.1

Latent Variables	Manifest Variables
SELF-ESTEEM (η_1)	On the whole, I am satisfied with myself (X1) I feel that I have a number of good qualities (X2) I am able to do things as well as most other people (X3) I wish ,I could have more respect for myself (X4) I take a positive attitude towards myself (X5)
ACHIEVEMENTS (η_4)	I am clear about my ambition (Y11) I am working for my ambition (Y12) I feel happy about my progress (Y13) I will achieve my goals within the scheduled time (Y14) I am in the right track (Y15)
ASPIRATION (η_2)	I have a desire to achieve my goal (Y1) My study performances show my aspiration (Y2) I prepare my lessons with achievements in mind (Y3) I read, my achievement related materials (Y4) My family and friends are supportive to my aspirations (Y5)
WORKPLAN (η_3)	I complete my assignments on time (Y6) I have no arrears in my academic performance (Y7) I feel happy about my academic progress (Y8) I make use of library to improve my knowledge on the subject (Y9) I am able to properly manage my time (Y10)

Totally 20 variables are measured from the respondents and classified into four constructs like Self-Esteem, Aspiration, Work plan and Achievements. Each construct is measured by five variables and their total variances are obtained by using SPSS, version 20. The total variance of Self esteem is 46%, Aspiration is 52%, Work plan is 51.7 % and Achievements is 51%.

3.1 Model Specification

There are many researchers who have sought to discover factors that determine students' performance. Based on the findings of these researches, several lines of research pursued over the decades have accumulated evidence that numerous factors are associated with student achievement at all levels of education. Thus we have proposed to test the following hypotheses:

H₀₁: Students Self-esteem will have positive effect on Student's Aspiration.

H₀₂: Students Self-esteem will have positive effect on Student's Achievements.

H₀₃: Students Aspiration will have positive effect on Student's Work Plan.

H₀₄: Students Aspiration will have positive effect on Student's Achievements.

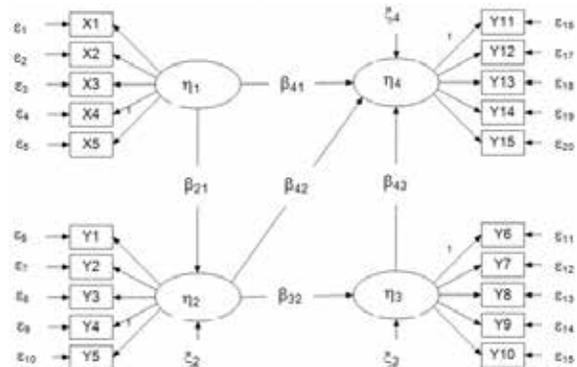
H₀₅: Students Work Plan will have positive effect on Student's Achievements.

Based on (2.2) and (3.1), we obtain the following structural model with three equations for the three endogenous variables namely Aspiration, Work plan and Achievement of the latent variables:

$$\begin{aligned} \eta_2 &= \beta_{21}\eta_1 + \xi_2 \\ \eta_3 &= \beta_{32}\eta_2 + \xi_3 \\ \text{and } \eta_4 &= \beta_{43}\eta_3 + \beta_{42}\eta_2 + \beta_{41}\eta_1 + \xi_4 \end{aligned} \tag{3.2}$$

The following structural model is constructed based on (3.2) using AMOS 16.0:

Diagram 3.1



From the above diagram, it is observed that Self esteem is considered as exogenous latent variable. Aspiration, Work Plan and Achievement are considered as endogenous latent variables. Now we shall study the direct effects of Self esteem, Aspiration and Work Plan on Achievement and the indirect effects of Self esteem and Aspiration on Achievement through Work Plan.

3.2 Construct's reliability and validity

Composite reliability (CR) is a measure of the overall reliability of a collection of heterogeneous but similar items. Average variance extracted (AVE) measures the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error. Each factor's loading, Composite Reliability and Average Variance Extracted are displayed in the following Table 3.2.

Table 3.2

Constructs	Total Items	Factors Loading	CR	AVE
Self esteem	5	0.686 to 0.723	0.7102154	0.500391019
Aspiration	5	0.630 to 0.769	0.7761456	0.524981693
Work Plan	5	0.603 to 0.772	0.7651344	0.5170344770
Achievement	5	0.687 to 0.750	0.7697382	0.5191154350

From the Table 3.2, Composite Reliability values are more than the recommended value 0.7 which explains the reliability of measurement models is adequate. Also the Composite Reliability values are more than the Average Variance Extracted values (CR > AVE) and also AVE is more than 0.5. Hence we conclude that the construct reliability and validity are satisfied for further study.

3.3 Evaluating Model Fit

The model (3.2) is constructed using AMOS 16.0 and it is exhib-

ited in Diagram 3.1. The model indices are displayed in the following Table 3.3.

Table 3.3

Model Fit Indices	Value	Recommended Guideline
χ^2/df	1.274	Less than 2 but could be between 2 & 5
Goodness of Fit Index (GFI)	0.906	>0.90
Adjusted Goodness of Fit Index (AGFI)	0.881	>0.90/0.80
Comparative Fit Index (CFI)	0.957	>0.90
Normed Fit Index (NFI)	0.930	>0.90
Relative Fit Index (RFI)	0.904	>0.90
Incremental Fit Index (IFI)	0.958	>0.90
Tucker Levis Index (TLI)	0.950	>0.90
Root Mean Square Error of Approximation (RMSEA)	0.037	<0.08

From the Table 3.3, we observed that the model fit indices chi-square / df, is less than the recommended guideline value 2. Goodness of Fit Index, Adjusted Goodness of Fit Index, Comparative Fit Index, Normed Fit Index, Relative Fit Index, Incremental Fit Index and Tucker Levis Index are perfectly satisfied the given recommended guideline values and also the Root Mean Square Error of Approximation (RMSEA) is less than 0.05. Hence it is concluded that the derived model has a high explanatory power in terms of describing the interrelationship among the latent exogenous and latent endogenous constructs.

Also each hypothesis (3.1) is tested with their coefficients and its p values. All the p values are highly significant which are displayed in the following Table 3.4.

Table 3.4

Hypothesis	Path	Coefficient	Result
H ₀₁	Self-esteem → Aspiration	0.67***	Significant
H ₀₂	Self-esteem → Achievements	0.37***	Significant
H ₀₃	Aspiration → Work Plan	0.25***	Significant
H ₀₄	Aspiration → Achievements	0.52***	Significant
H ₀₅	Work Plan → Achievements	0.23**	Significant

*** p < 0.001 , ** p < 0.01

Now the Standardized total effect of exogenous latent variable and endogenous latent variables on Student's Achievement are exhibited in Table 3.5.

Table 3.5

	Self Esteem	Aspiration	Work Plan
Aspiration	.669		
Work Plan	.168	.251	
Achievement	.751	.574	.226

From the above Table 3.5, we observed that the total effect of Self esteem on Achievement is 0.751 (75.1%), the total effect of Self Esteem on Work plan is 0.168 (16.8 %), the impact of Self Esteem on Aspiration is 66.9 %. Now the total effect of Aspiration on Achievement is 0.574 (57.4 %), the impact of Aspiration on Work plan is 25.1% and the impact of Work plan on Achievement is 22.6%

4.0 Modified Model

Since the "Work Plan" is important for any achievement and various studies established the contribution of Work Plan is vital for the achievement level among students in higher education.

In our study, we have proved that the "Work Plan" contributes less on achievement level of students. Therefore we dropped the role of Work Plan from our study in order to study the effects of other latent variables namely "Self Esteem" and "Aspiration" on "Achievement".

After removal of "Work Plan" from our study, the performance of the modified model is studied with the following hypotheses.

H₀₆: Students Self-esteem will have positive effect on Student's Aspiration. (3.1)

H₀₇: Students Self-esteem will have positive effect on Student's Achievements. (3.1)

H₀₈: Students Aspiration will have positive effect on Student's Achievements (4.1)

Based on (2.2) and (4.1), we obtain the following modified structural model with two equations for the two endogenous variables namely Aspiration and Achievement of the latent variables.

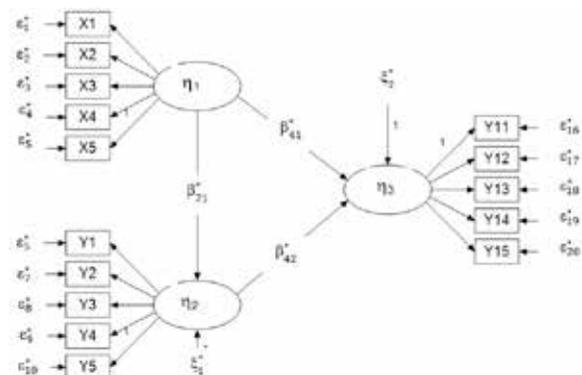
$$\begin{aligned} \eta_2 &= \beta_{21}\eta_1 + \xi_2 \\ \eta_3 &= \beta_{32}\eta_2 + \xi_3 \\ \eta_4 &= \beta_{43}\eta_3 + \beta_{42}\eta_2 + \beta_{41}\eta_1 + \xi_4 \end{aligned}$$

and

$$(4.2)$$

The following structural model is constructed based on (4.2) using AMOS 16.0:

Diagram 4.1



From the above Diagram 4.1, it is observed that Self esteem is considered as exogenous latent variable. Aspiration and Achievement are considered as endogenous latent variables. Now we shall study the direct effects of Self esteem and Aspiration on Achievement and the indirect effect of Self esteem on Achievement through Aspiration.

4.1 Evaluating Model Fit

The model (4.2) is constructed using AMOS 16.0 and it is exhibited in Diagram 4.1. The model indices are displayed in the following Table 4.1.

Table 4.1

Model Fit Indices	Value	Recommended Guideline
χ^2/df	1.340	Less than 2 but could be between 2 & 5
GFI	0.927	> 0.90
AGFI	0.899	> 0.90/0.80

CFI	0.963	> 0.90
NFI	0.911	> 0.90
RFI	0.944	> 0.90
IFI	0.964	> 0.90
TLI	0.955	> 0.90
RMSEA	0.041	< 0.08

From the Table 4.1, we observed that the model fit indices chi-square/df, is less than the recommended guideline value 2. Goodness of Fit Index, Adjusted Goodness of Fit Index, Comparative Fit Index, Normed Fit Index, Relative Fit Index, Incremental Fit Index and Tucker Lewis Index are perfectly satisfied the given recommended guideline values and also the Root Mean Square Error of Approximation (RMSEA) is less than 0.05. Hence it is concluded that the derived model has a high explanatory power in terms of describing the interrelationship among the latent exogenous and latent endogenous constructs.

Also each hypothesis (4.1) is tested with their coefficients and its p values. All the p values are highly significant which are displayed in the following Table 4.2.

Table 4.2

Hypothesis	Path	Coefficient	Result
H ₀₆	Self-esteem → Aspiration	0.68***	Significant
H ₀₇	Self-esteem → Achievements	0.32***	Significant
H ₀₈	Aspiration → Achievements	0.62***	Significant

*** p < 0.001

Now the Standardized total effects of exogenous latent variable and endogenous latent variable on Student's Achievement are exhibited in Table 4.3.

Table 4.3

	Self Esteem	Aspiration
Aspiration	.677	

	Self Esteem	Aspiration
Achievement	.734	.617

From the above Table 4.3, the total effect of Self Esteem on Achievement is 0.734 (73.4 %), the impact of Self Esteem on Aspiration is 68 % and the impact of Aspiration on Achievement is 62 %.

5.0 Conclusions

From Diagram 3.1, the relationships among Self esteem, Aspiration, Work Plan and Achievement of Higher Education Students are demonstrated and its parameter values were observed. Based on the parameters value, it is concluded that the higher education student's achievement is influenced by Self esteem, Aspiration and Work Plan. The contribution of Self Esteem and Aspiration are very high on Achievement but the contribution of Work Plan is less on Achievement.

From Diagram 4.1, Student's Achievement is studied without Work Plan. In this case, we observed that the effects of Self Esteem and Aspiration are highly significant on Achievement. The Achievement of the students can be accomplished in higher education even without proper Work Plan. Thus Work Plan plays a non vital role towards Student's Achievement in higher education.

REFERENCE

Arthur N. Applebee; Judith A. Langer; Martin Nystrand; Adam Gamoran (2003). Discussion-Based Approaches to Developing Understanding: Classroom Instruction and Student Performance in Middle and High School English, *American Educational Research Journal*, Vol. 40, No. 3. (Autumn, 2003), pp. 685-730. | | Baumrind (1991).The Influence of Parenting Style on Adolescent Competence and Substance Use, *The Journal of Early Adolescence* February 1991 11: 56-95. | | Dembo, T. (1931). Der arger als dynamisches problem. *Psychol. Forsch.*, 15, 1-144. | Kathryn R. Wentzel (1998). Social Relationships and Motivation in Middle School: The Role of Parents, Teachers, and Peers. *Journal of Educational Psychology* Vol. 90, No. 2, 202-209 0022-0663/98. | | Lewin, K., Dembo, T., Festinger, L., & Sears, P. (1944). Level of Aspiration. In J. M. Hunt (Ed.), *Personality and the behavior disorders* (pp. 333-378). Oxford: Ronald Press. | Paul R. Pintrich and Elisabeth V. De Groot (1990). Motivational and Self-Regulated Learning Components of Classroom Academic Performance. *Journal of Educational Psychology*, Vol. 82, No. 1,33-40. | | Quaglia, R. J., & Cobb, C. D. (1996). Toward a theory of student aspirations. *Journal of Research in Rural Education*, 12, 127-132. | | Robert H. Stupnisky, Robert D. Renaud, Raymond P. Perry, Joelle C. Ruthig Tara L. Haynes Rodney A. Clifton (2007). Comparing self-esteem and perceived control as predictors of first-year college students' academic achievement *Social Psychology of Education* 10(3):303-330. | | Rugutt, John K. ; Chemosit, Caroline C. (2005). Study of Factors that Influence College Academic Achievement: A Structural Equation Modeling Approach, *Journal of Educational Research & Policy Studies*, v5 n1 p66-90 Spr 2005. | | Sewell, W. H., & Hauser, R. M. (1975). *Education, occupation, and earnings: Achievement in the early career*. New York: Academic Press. | | Wendy S. Grolnick (1991). Inner Resources for School Achievement: Motivational Mediators of Children's Perceptions of Their Parents, *Journal of Educational Psychology*, Vol. 83, No. 4, 508-517 0022-0663/91. | | Wondimu Ahmed and Marjon Bruinsma (2006). A structural model of self-concept, autonomous motivation and academic performance in cross-cultural perspective, *Electronic Journal of Research in Educational Psychology* 4 (3), 551-576. |