

Achievement Motivation as a Function of Participation, Strive, Willingness to Work and Maintaining Work: Application of Structural Equation Modelling (SEM)

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Abstract Achievement Motivation is an interesting topic that should be carefully examined to find its core purpose. Self-report measures of achievement motivation are available, but are embodied in questionnaire measuring variety of personality traits. Researchers often require only the score on an achievement motivation scale, and a less time-consuming method of obtaining such scores is needed. Ellez (2004) proposed a 23-item scale instrument, named *Achievement Motive Scale (AMS)*, to examine and measure the construct of achievement motivation. The items are intended to measure the students' achievement motive in the size of *strive*, *participation*, *willingness to work* and *maintaining the working* on a five scores Likert scale. The aim of this article is to study the relationship, formulate a model and test the significance of the four dimensions of the AMS. The survey design was employed involving 295 first and second year senior high school students. Using Hu and Bentler (1999) suggested benchmarks for continuous data, the analysis reported a $RMSEA = 0.188 > 0.06$, $TFI = 0.395 < 0.95$, $CFI = 0.798 < 0.95$, giving an indication the model fit cannot be concluded to be good. The hypothesis that the model is correct was falsified by the application of SEM. Among the four dimensions, *participation* was statistically insignificant in measuring one's achievement motivation level. Although, the three other dimensions were identified as significant, the indicator items do not explain much of their variability. This suggests that more other items should be considered to bridge the huge gap of variability left to randomness.

Keywords Structural Equation Modelling, Achievement Motive Scale

1. Introduction

Achievement Motivation is an interesting topic that should be carefully examined to find its core purpose. It is first developed in an individual who has an extreme interest in accomplishing a task, therefore, is determined to put forth an effort in accomplishing the task. There are people who take on the role of achievement motivation in a different manner. Achievement motivation theorists' attempt to explain people's choice of achievement tasks, persistence on those tasks, vigor in carrying them out, and performance on them have lead to the development of variety of constructs to explain how motivation influences choice, persistence, and performance. Researchers have attributed the main factor bringing achievement motivation into existence as the need for achievement (Erdogan *et al.*, 2011). The need for achievement shows itself as a desire to complete a task or behaviour according to perfection criteria or even better than these criteria. For instance, doing something much

more than the rivals, reaching or obtaining a difficult goal, solving a complex problem, improving skills, and completing homework successfully show the need for achievement. Individuals with high achievement need to take reasonable risks prefer activities that can be achieved easily, reach inner satisfaction stemming from their successes, and do not care for anything except their tasks. Low need for achievement is thought to be associated with a sense of low competence, low expectations, and orientation toward failure (Erdogan *et al.*, 2011).

The concept of achievement motivation is viewed as a complex human incentive to bring about results. It stimulates a systematic pattern of behaviours towards the desired ends, continuously urging them till results actually manifest. Elliot and McGregor's (2001) model of achievement motivation, discuss two broad classes of goals: mastery goals, that is, to "master" the task at hand and performance goals. Research indicates that when students adopt mastery goals, they tend to engage in more effective cognitive processing strategies (Noar, Anderman, Zimmerman & Cupp, 2005). Social goals are another important type of goals, although not examined at length as mastery and performance goals (Dowson & McInerney, 2001). In these goals, social reasons are the main concerns for trying to achieve in academics. According to

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Maehr (2008) achievement motivation is largely social psychological in nature. It often occurs within groups, where interpersonal interactions can undermine or facilitate engagement in the tasks to be done.

Achievement motivation research has historically been examined using either a classic or contemporary approach. The concept has often been measured through the scoring of fantasy elicited in story form by thematic apperception tests (TAT) and TAT-like stimuli. Self-report measures of achievement motivation are available, but are embodied in questionnaire measuring variety of personality traits. Since researchers often only require score on an achievement motivation scale, a less time-consuming method of obtaining such scores seemed to be needed. Ellez (2004) proposed an Achievement Motive Scale (AMS) with 23 items, to examine and measure the construct of achievement motivation. The items measure the students' achievement motive in the size of *strive*, *participation*, *willingness to work* and *maintaining the working* on a five scores Likert scale.

The instrument has been used quiet often by researchers in recent times (eg. Demirel & Arslan Turan, 2010; Aydin and Coskun, 2011; Demet, 2015). The scale is reported in literature to be reliability. Demirel & Arslan Turan (2010) in their study used the scale in the form of a field questionnaire and reported a reliability coefficient of 0.76. The KMO coefficient of 0.81 and Cronbach alpha reliability coefficient 0.70 was reported by Aydin and Coskun (2011) when the scale was employed to study secondary school students' achievement motivation towards Geography lessons in Turkey. Demet (2015) administered the scale on 250 university students to identify the correlation between the musical interests and achievement motives of prospective music teachers. The scale was subjected to a factor analysis to establish its construct validity. The analysis showed that item 5 did not belong with any of the other factors therefore it was excluded from the scale. A Cronbach's alpha reliability coefficient of 0.89 was reported. The reliability

coefficients for the sub-dimensions were as follows: 0.79 for willingness to work, 0.82 for maintenance of work, 0.72 for participation, and 0.80 for strive. The aim of this article is to study the relationship, formulate a model and test the significance of the four dimensions of the AMS using structural equation modelling (SEM). The hypothesis that the dimensions of the model adequately measure the construct of achievement motivation is tested using SEM.

Statistical modelling is crucial in understanding complex phenomena of life. In social and behavioural sciences, there is an increasing complexity and specificity of research questions (Hoyle, 1995), with most constructs being latent. As a result, latent variable modelling has become a popular research tool. A quite recent method often employed is the structural equation modelling (SEM). Accounts of the statistical theories underlying SEM appeared in the 1970s. The technique has grown in popularity as a result of the massive strides in its software development, notably LISREL, AMOS, Mplus and Mx. This has increased the accessibility of SEM to researchers. The application of SEM in psychological studies is viral. MacCallum and Austin (2000) reviewed approximately 500 published articles appearing in 16 psychological research journal dated 1993 to 1997. In a fuzzy, overlapping and non-exhaustive categorization, they explored the usage of SEM in substantive research in psychology. They reported that SEM was heavily used in observational studies than in experimental studies. It is mostly employed in cross-sectional and longitudinal studies. Steele et al (2008) reported that although SEM techniques were used in <4% of the empirical articles appearing in 7 paediatric psychology journals between 1997 and 2006, the results indicated a recent increase in studies employing SEM techniques.

2. Method and Materials

2.1. Structural Equation Model (SEM)

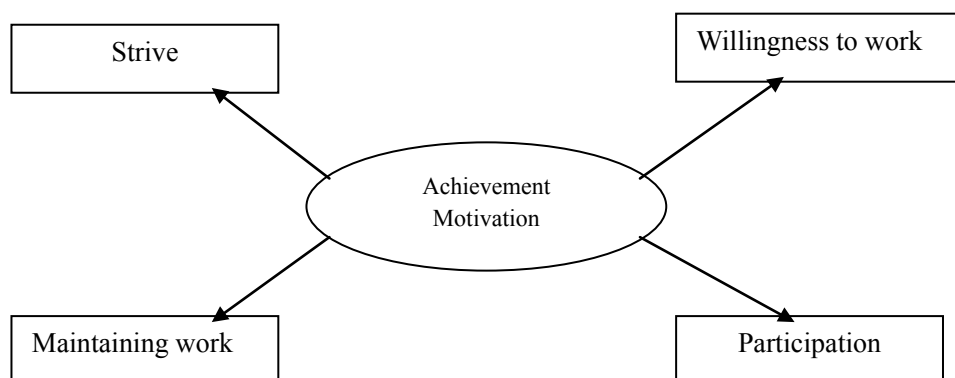


Figure 1. Ellez's Construct of Achievement Motivation

Structural equation modelling (SEM) is a series of statistical methods that allow complex relationships between one or more independent variables and one or more dependent variables. SEM provides a general and convenient framework for statistical analysis that includes several traditional multivariate procedures: factor analysis, regression analysis, discriminate analysis and canonical correlation. A structural equation model is a complex composite statistical hypothesis. It consists of 2 main parts: The measurement model represents a set of p observable variables as multiple indicators of a smaller set of m latent variables, which are usually common factors. The path model describes relations of dependency-usually accepted to be in some sense causal-between the latent variables. SEM is a hybrid between some form of analysis of variance (ANOVA)/regression and some form of factor analysis. SEM allows one to perform some type of multilevel regression/ANOVA on factors. The overall objective is to establish that a model derived from theory has a close fit to the sample data in terms of the difference between the sample and model-predicted covariance matrices.

The structural equation model,

$$\eta = \alpha + B\eta + \Gamma\xi + \zeta,$$

where η is a $m \times 1$ vector of endogenous latent variables and where it is assumed that the $n \times 1$ vector ξ of exogenous latent variables have mean κ and covariance matrix Φ , and that the $m \times 1$ vector ζ of error terms has zero mean and covariance matrix Ψ , and $Cov(\xi, \zeta) = 0$. If $|I - B| \neq 0$ and setting $A(I - B)^{-1}$, it follows that;

$$\mu_\eta = A(\alpha + \Gamma\kappa)$$

and

$$Cov(\eta) = A(\Gamma\Phi\Gamma' + \Psi)A'.$$

The measurement models for the p endogenous observed variables, represented by the vector y , and the q exogenous observed variables, contained in the vector X , relate the observed variables to the underlying factors and may be expressed as;

$$y = \tau_y + \Lambda_y\eta + \varepsilon, \quad E(\varepsilon) = 0, Cov(\varepsilon) = \Theta_\varepsilon.$$

$$x = \tau_x + \Lambda_x\xi + \delta, \quad E(\delta) = 0, Cov(\delta) = \Theta_\delta$$

respectively.

The mean vectors of the observed variables are;

$$\mu_y = \tau_y + \Lambda_y A(\alpha + \Gamma\kappa), \quad \mu_x = \tau_x + \Lambda_x \kappa$$

In general, in a single population, τ_y, τ_x, α and κ will not be identified without the imposition of further conditions. It further follows that;

$$\Sigma_y = \Lambda_y [A(\Gamma\Phi\Gamma' + \Psi)A'] \Lambda_y' + \Theta_\varepsilon$$

$$\Sigma_x = \Lambda_x \Phi \Lambda_x' + \Theta_\delta$$

and

$$\Sigma_{yx} = \Lambda_y A \Gamma \Phi \Lambda_x'$$

2.2. Sample and Data Collection

The total sample included 295 senior high school students recruited in Kwabre East district of Ghana in 2013/14

academic year. The sample was formed through simple random selection scheme. Recruitment and consenting procedures were adhered to. The survey research method was employed. The instrument consisted of paper and pencil questionnaire administered by the researcher. The questionnaire was segmented into three parts under the headings personal background, subject matter and matters arising. The personal information of the respondents is shown in Table 1.

Table 1. Personal information of respondents

		Frequency	Percentage (%)
Gender	Male	121	41
	Female	174	59
	Total	295	100
Age	Under 15	39	13
	15-19	188	64
	20 and above	68	23
	Total	295	100
Class level	Form 1	157	53.20
	Form 2	138	46.80
	Total	295	100
Guardians' educational background	No formal education	55	18.60
	Secondary education	173	58.60
	Diploma	19	6.40
	Bachelor	17	5.80
	Masters/PhD	31	10.50
	Total	295	100
Programme of study	General Arts	72	24.40
	Business	51	17.30
	General Science	22	7.50
	Home Economics	59	20.5
	Visual Arts	63	21.40
	Technical	28	9.50
	Total	295	100

2.3. Definition and Construction of Analytical Variables

Achievement Motivation is defined for this study as an extreme interest and a determination in accomplishing a task. It was measured by adapting 20 items of the "Achievement Motive Scale" (AMS) developed by Ellez (2004). The three items dropped were highly correlated with the others. This scale was chosen because it fits well into the definition of achievement motivation employed in this study. Students' achievement motivation is measured in the size of strive, participation, willingness to work and maintaining the working on a five scores likert scale. Items used to measure these four dimensions of achievement motivation are presented in Table 2. The scale was developed to measure students' achievement motivation levels on a scale of 1 to 5 defined as "most suitable (4.60-5.00)", "more suitable (4.00-4.59)", "suitable (3.00-3.99)", "not suitable (2.00-2.99)" and "not at all suitable (1.00-1.99)". The 20

items adopted from Achievement Motive Scale (AMS) shown in Table 2. A Cronbach alpha reliability coefficient of 0.79 was obtained and according to the results obtained, the scale can be expressed as a reliable instrument (Demirel & Arslan Turan, 2010).

Table 2. Items Used for Measuring the Four Dimensions of Achievement Motivation

Dimension	Items
Strive	1. I try persistently to solve questions in mathematics lessons even when I fail. 2. I try to do the best whatever I do 3. Being successful at easy tasks that anyone can do does not give me pleasure 4. I enjoy answering difficult questions in mathematics lessons. 5. To take low marks in mathematics lesson makes me sad. 6. I would like to get the highest mark in mathematics lesson
Participation	1. I revise my notes before mathematics lessons. 2. I only study mathematics lessons during test period. 3. I enjoy studying mathematics lessons. 4. I get bored when I start studying mathematics lessons. 5. I want easy topics to be taught instead of difficult topics in mathematics lessons.
Willingness to work	1. I like being successful at school. 2. I get disturbed when I cannot finish my mathematics homework. 3. I do not try to learn more than taught. 4. I start studying after mathematics lesson
Maintaining the working	1. I feel better when I am successful at school. 2. I review mathematics lessons even if I do not have exams. 3. I study more than what is taught in class. 4. I try to understand mathematics lessons. 5. I try my best to gain my mathematics teacher's approval.

3. Data Analysis and Results

The analysis was conducted in SPSS AMOS version 24. The maximum likelihood estimates were obtained to assess

the goodness of fit of the construct of achievement motivation as a function of the individual's strive, participation, willingness to work and maintaining the work using SEM.

3.1. Parameter Estimation and Model Fit

Table 3 presents an analysis on the significance or otherwise and the contribution of each item to the measurement of the dimensions of achievement motivation. On the dimension, *strive*, the most influential item is “*I try to do the best whatever I do*” explaining 23% of the variability in *strive*. All items but “*I enjoy answering difficult questions in mathematics lessons*” which explains only 3% of the variability in *strive*, were identified as significant predictors at 5% level of significance. For the dimension, *participation*, the item “*I enjoy studying mathematics lessons*” explained most of its variability, about 36%, with the item “*I want easy topics to be taught instead of difficult topics in mathematics lessons*” explaining 15% variability, which is the least among the items considered. All items predicting an individual's *participation* in Mathematics lessons were identified as significant 5% level of significant. Only two of the four items considered for measuring one's *willingness to work*, were identified at 5% significance level as statistically influential. The two significant predictors, “*I get disturbed when I cannot finish my mathematics homework*” and “*I like being successful at school*”, measured 30% and 15% respectively of the variability in the dimension, *willingness to work*. The dimension, *maintaining the work* had all its predictors identified as significant at 5% significance level. The most influential predictor “*I review mathematics lessons even if I do not have exams*” explained 26% of its variability.

3.2. Path Model

The four dimensions in relation to achievement motivation are at this point treated as the observed variables, because the scale is developed such that based on the indicator items, appropriate scores for the dimensions are assigned to obtain one's overall Achievement Motivation level. Figure 2 and Figure 3 depict the path output and the results of SEM respectively from the analysis.

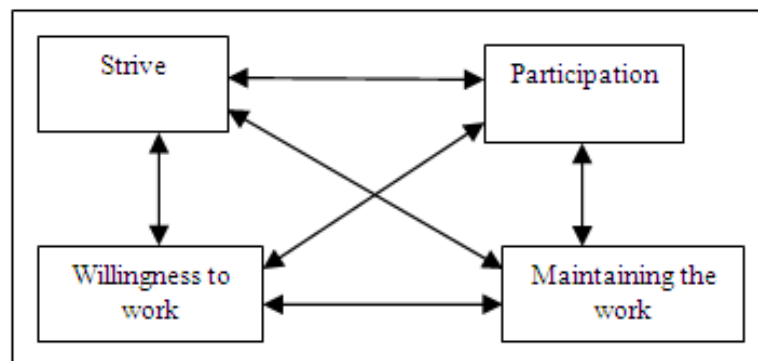


Figure 2. Path model of SEM

Table 3. Parameter estimation of the predictors for the measurement of the four dimensions of Achievement Motivation

Predictors (Items)	Dimension	Squared Multiple correlation	Standardized Regression Weights	Regression Weights	p-value
Persistently solving questions	Strive	0.20	0.45	0.554	***
Try to do my best		0.23	0.48	0.469	***
Success at easy task does not give me pleasure		0.04	-0.20	-0.281	**
Enjoy answering difficult questions		0.03	0.16	0.225	0.074
Low marks make me sad		0.17	0.41	0.547	***
Aim to get highest marks		0.28	0.52	0.461	***
Revise notes before lesson	Participation	0.20	-0.45	-0.460	***
Study only during test period		0.30	0.55	0.737	***
Enjoy studying		0.36	-0.60	-0.752	***
Get bored studying		0.18	0.42	0.591	***
Easy topics to be taught		0.15	0.38	0.581	***
Like to be successful at school	Willingness to work	0.15	0.38	0.312	**
Get disturbed when I cannot finish my work		0.30	0.55	0.698	**
Learn more than taught		0.03	0.18	0.252	0.070
Study after class		0.00	-0.03	-0.047	0.709
Feel better when successful at work	Maintaining the work	0.09	0.30	0.208	***
Review lessons all times		0.26	0.51	0.620	***
Study extra than required		0.03	0.18	0.215	**
Go extra miles to understand lessons		0.22	0.46	0.405	***
Try to gain my tutor's approval		0.19	0.42	0.425	***

*** - significant at 1%; ** - significant at 5%.

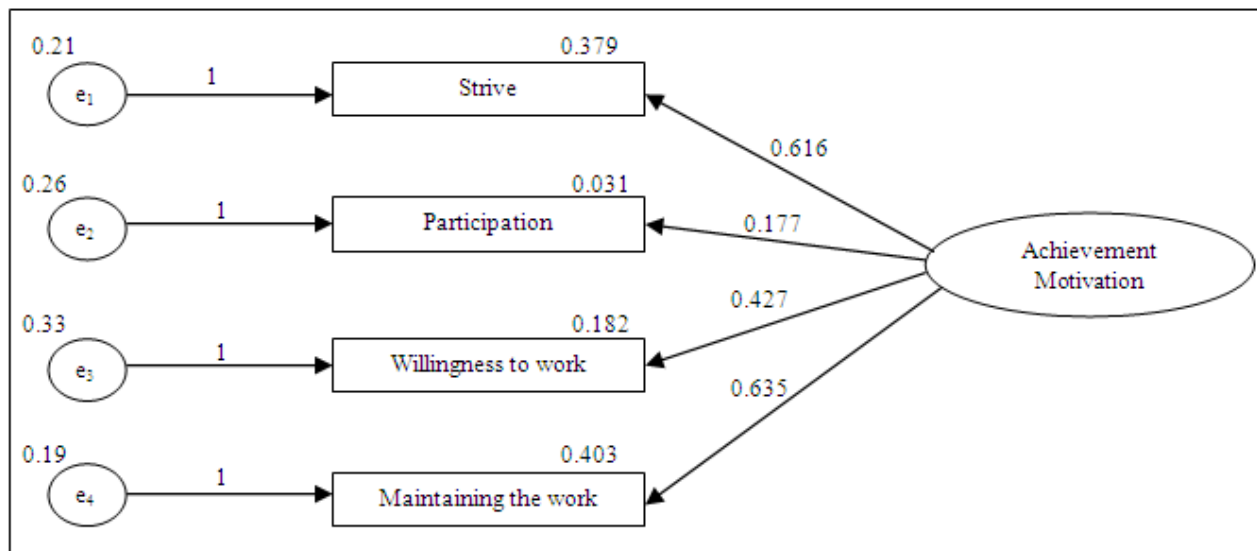


Figure 3. Results for the structure equation model. Non-Normal Fit Index (NNFI) = 0.791; Comparative Fit Index (CFI) = 0.798; Root mean square error of approximation (RMSEA) = 0.188; Tucker-Lewis Index (TLI) = 0.395; chi-square = 22.748; degree of freedom = 2; p-value = 0.000; e = error

Hu and Bentler (1999) suggested that for continuous data, when Root mean square error of approximation (RMSEA) < 0.06, Tucker-Lewis Index (TLI) ≥ 0.95 , Comparative Fit Index (CFI) > 0.95 and standard root mean square residual (SRMR) < 0.08, then a model is deemed fit. The current analysis reported a RMSEA = 0.188 > 0.06, TFI = 0.395 < 0.95, CFI = 0.798 < 0.95, giving an indication the model fit cannot be concluded to be good. Among the dimensions,

participation was identified as contributing insignificantly to the construct of achievement motivation. The sample size used in this study is appreciable large, because MacCallum et al (1996) provided a discussion on sample size requirement for the RMSEA goodness of fit using model degrees of freedom and effect size as reference points. For example, a sample size of 231 with 45 degrees of freedom would have a power of 0.80 (MacCallum et al, 1996).

Although, *willingness to work, maintaining the work* and *strive* were identified as significant contributors to the construct of achievement, their variability is minimally explained by their predictors. The squared multiple correlation coefficients of the dimensions suggest that greater amount of variability in them are not explained by their predictors. The most explained dimension is *maintaining the work*; the predictors explain 40.3 percent of its variance. For *strive*, the predictors explained 37.9 percent of its variability. The variance of *willingness to work* is 18.2 percent explained by the predictors. The variance in participation is just 3.9 percent explained by the predictors. In the construct of achievement motivation, *maintaining the work* is the most important dimension, followed by *strive* and then *willingness to work*. This is explained by the fact that when achievement motivation goes up by 1 standard deviation, the standard deviations of *maintain the work*, *strive* and *willingness to work* go up by 0.635, 0.616 and 0.427 respectively.

4. Conclusions

Based on the analysis, the Achievement Motive Scale does not adequately measure the construct of Achievement Motivation. The items categorised under the four dimensions, *strive, participation, willingness to work and maintaining the work* proposed by Ellez (2004) to measure one's achievement motivation do not adequately achieve the intended purpose. Among the four dimensions, *participation* was statistically insignificant in measuring one's achievement motivation level. Although, the three other dimensions were identified significant, the indicator items do not explain much of their variability. This suggests that more other items should be considered to bridge the huge gap of variability left to randomness.

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