



# Stimulant Engagement in Higher Education: An Empirical SEM Approach among Undergraduates

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## Abstract

Stimulant utilization is increasing among university students globally due to pressure to improve their academic performance. The current work looks at the link between stimulant knowledge, attitudes toward use and academic pressure among undergraduates at the University of Energy and Natural Resources (UENR). The study adopted two psychological theories, Planned Behaviour and Strain, and employed the cross-sectional questionnaire for data collection. Data were obtained from 234 undergraduates and analysed using Structural Equation Modeling (SEM) in IBM SPSS Amos version 26. Findings revealed that stimulant knowledge positively predicts attitudes toward intension to use, while academic pressure enhances motivation to use stimulants. Additionally, results indicate that attitudes toward stimulant use significantly influence students' motivation to use stimulants at the University. It is recommended that the university management provide academic support services, as well as workload management strategies, to help reduce students' motivation to use stimulants.

## Subject Areas

Higher Education, Psychology

## Keywords

Reliability, Convergent Validity, Composite Reliability

## 1. Introduction

The use of stimulants to improve students' cognition in academics is a growing

phenomenon among undergraduates worldwide. Globally, some students take these stimulants without a prescription to enhance energy, concentration, alertness and academic performance [1]. While students use these stimulants to cope with academic pressure, misuse is associated with health issues such as heart problems, sleeping disorders, anxiety, and potential addiction, raising concerns about students' future health in higher education institutions [2]. Locally, existing studies in Ghana and other African settings indicate that stimulant use among undergraduates in higher education institution is alarming but remains understudied, with most focusing on prevalence rather than the causes of behaviour [3]. Other research reveals that attitudes toward and knowledge about these stimulants are key indicators of their use. [4] argue that students experiencing higher academic stress are more likely to use illicit stimulants. Several limitations exist in previous research. Studies often focused on single determinants, such as knowledge, stress, and attitude, in isolation rather than integrating multiple variables into a comprehensive behavioral model [5]. Additionally, most studies have focused primarily on North America and Europe, resulting in limited data from higher education institutions in Africa. These drawbacks hinder a refined understanding of how situational factors influencing stimulant use interact to shape undergraduates in higher education institutions.

To address these challenges in the Ghanaian context, we developed an assessment model to examine the interactions between knowledge of stimulants, attitudes toward their use, academic pressure, and motivation to use them among undergraduates at the University of Energy and Natural Resources (UENR). The model was evaluated using Structural Equation Modeling (SEM), allowing for the simultaneous assessment of the constructs and their relationships. By incorporating various constructs and employing SEM, this paper provides strong evidence on the relationships between these constructs and the use of stimulants among undergraduates in Ghana, enabling policymakers to develop effective measures and strategies.

## 2. Conceptual Foundations

The study was underpinned by Theory of Planned Behaviour developed by [6]. The theory posits that an individual's intention to perform an action is largely determined by their attitudes toward the action. From this perspective, undergraduates' acceptable and unacceptable attitudes toward the use of stimulants are likely to directly influence their motivation to use them. Our main objective was to gain an understanding of the indicators influencing stimulant use.

The model further draws on Strain Theory, postulated by [7], which suggests that burdens such as academic pressure may trigger strain that leads individuals to engage in stress-management behaviours, including high-risk behaviours such as stimulant use. Academic pressure is thus identified as a direct determinant of students' motivation to use stimulants.

Based on these theories, this study emphasizes four constructs: stimulant

knowledge, academic pressure, attitudes toward stimulant use, and motivation to use stimulants, to evaluate the direct relationships among these constructs and to better understand how stress-induced and cognitive factors guide students' behavioral intentions.

### 3. Research Methodology

Our study is rooted in the positivist research paradigm, which is based on the idea that reality is objective, observable, and measurable. Accordingly, researchers can discover relationships among variables through systematic measurement and quantitative analysis [8]. The population of the study was made up of 564 undergraduates from the School of Geosciences at the UENR, classified by year of study as follows: Level 100 (186), Level 200 (136), Level 300 (140), and Level 400 (102). Two hundred and thirty-four (234) undergraduates were selected as the sample from the population, using a 5% margin of error based on [9] formula. A stratified random sampling technique was applied to ensure proportionate representation across all levels in forming the sample. The final sample from each level of the school was: Level 100 (77), Level 200 (56), Level 300 (58), and Level 400 (43). Simple random sampling was used to select respondents within each level to ensure equal probability of selection [10].

Responses were gathered using a self-administered questionnaire consisting of 21 items, completed by 234 participants. The four measured constructs are Stimulant Knowledge (5 items), Academic Pressure (5 items), Attitudes toward Stimulant Use (6 items), and Motivation to Use Stimulants (5 items). Expert knowledge was solicited to review the items for their content validity and alignment with existing literature. Reverse-coded items for the Attitude towards Usage scale were scored by inverting the original response values so that higher scores consistently reflected a more positive attitude. This ensures that all items contribute in the same direction when computing the latent construct score. The questionnaire items use in assessing the construct for the study are presented in **Table A1 (Appendix)**. The reliability of the measurement items was assessed through a pilot study involving 30 students from Saint Ambrose College of Education. Structural Equation Modeling (SEM) was employed to assess the relationships among the latent constructs and to validate the proposed model. **Table 1** presents the initials of the latent constructs for the purposes of SEM.

**Table 1.** Construct abbreviations.

Construct	Meanings
SK	Stimulant Knowledge
ATSU	Attitude of Stimulant Usage
AP	Academic Pressure
MTUS	Motivation to Use Stimulant

## 4. Findings and Results

The subsequent sections of this study present the insights and outcomes that validate the assessment model, thereby facilitating the development of the structural model. The three hypotheses, assessing the significant linkages among the constructs and their measurement items, along with the discussion and conclusions, were presented. SEM was conducted using IBM SPSS AMOS version 26 to evaluate how the underlying constructs relate to their measurement items [11].

## 5. Assessment Model

The quality of the model was tested, as shown in **Table 2**, which presents construct and composite reliability. The internal consistency, as measured by Cronbach's alpha values for all items, ranged from 0.804 to 0.858 ( $\alpha > 0.7$ ), indicating good reliability across all constructs. According to [12] the recommended threshold for composite reliability is greater than 0.6, and the results fall within the acceptable range, confirming internal consistency. Additionally, the suggested benchmark for Average Variance Extracted (AVE) is greater than 0.5 [13], and the AVE values presented in **Table 2** are within the criterion, confirming the convergent validity of the constructs' items.

Discriminant validity was assessed to ensure that all constructs are distinct. Despite some conceptual overlap between items, validity was confirmed: the constructs were modeled as separate latent variables, correlations remained below multicollinearity thresholds, and items loaded more strongly on their intended constructs, demonstrating that attitude toward usage and motivation of usage are distinct. The square root of each construct's AVE indicates that a construct shares more variance with its own items than with other constructs. This demonstrates that, even though the constructs are correlated, each one measures a unique aspect of the model. Overall, the assessment model is consistent and credible, supporting further analysis.

**Table 2.** Summary statistics and pairwise correlations.

	Summary Statistics			Pairwise Correlations			
	AVE	Composite Reliability	Cronbach's Alpha	SK	ATSU	AP	MTUS
<b>SK</b>	0.525	0.846	0.858	<b>0.725</b>			
<b>ATSU</b>	0.532	0.871	0.804	0.284	<b>0.729</b>		
<b>AP</b>	0.536	0.852	0.807	0.391	0.403	<b>0.732</b>	
<b>MTUS</b>	0.543	0.855	0.820	0.260	0.554	0.362	<b>0.737</b>

**Table 2** presents the model assessment, with Columns 1 - 3 showing reliability and convergent validity indices. Discriminant validity is indicated by the off-diagonal correlations, whereas the diagonal entries display the square roots of the AVE for each latent construct indicating their distinctiveness.

## 6. The Structural Model

SEM was conducted using Robust Maximum Likelihood estimation to assess the relationships among the constructs, and their path coefficients were estimated. Missing data were handled using Full Information Maximum Likelihood, which estimates model parameters using all available data, producing more efficient and less biased estimates. All participants were included in the analysis. Normality was assessed using visual inspection of histograms and Q-Q plots, and univariate outliers were identified as values exceeding  $\pm 3$  standard deviations from the mean; no cases were removed, ensuring robust path estimates. Model fit was evaluated using RMR (Root Mean Square Residual), GFI (Goodness of Fit Index), CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), and RMSEA (Root Mean Square Error of Approximation). The following hypothesis were tested: **H1**: Stimulant-related knowledge positively and significantly influences attitudes toward usage.

**H2**: Academic pressure meaningfully enhances usage motivation. **H3**: Attitude toward usage significantly improve usage motivation. The results of the model fit indices, path estimates and structural model diagram are presented in **Table 3**, **Table 4** and **Figure 1** respectively.

**Table 3.** Fit indices assessing reliability and convergent validity of scale items.

Model/Indices	RMR	GFI	CFI	TLI	RMSEA
Model [ <b>Figure 1</b> ]	0.069	0.964	0.957	0.964	0.058

The model fit results indicate that the measurement model demonstrates a good fit to the data (RMR = 0.069, GFI = 0.964, CFI = 0.957, TLI = 0.964, RMSEA = 0.058). All fit indices meet the recommended thresholds, confirming the reliability and convergent validity of the scale items.

**Table 4.** Path estimates.

Path	B (SE)	$\beta$	CR	p-value
Stimulant Knowledge → Attitude of Usage	0.309 (0.089)	0.279	3.466	<0.001
Attitude of Usage → Motivation of Usage	0.541 (0.073)	0.698	7.414	<0.001
Academic Pressure → Motivation of Usage	0.060 (0.013)	0.059	4.782	<0.001

**Note.** B = Unstandardized regression coefficient; SE = Standard Error;  $\beta$  = Standardized coefficient; CR = Critical Ratio.

**Table 4** presents the path estimates of the model, showing that stimulant knowledge significantly and positively predicted attitude toward usage (B = 0.309,  $\beta$  = 0.279,  $p < 0.001$ ), indicating that increased stimulant knowledge leads to a more favorable increase in attitude of usage. Academic pressure also had a significant positive effect on motivation of usage (B = 0.060,  $\beta$  = 0.059,  $p < 0.001$ ), sug-

gesting that higher academic pressure boosts motivation to use stimulants. Furthermore, attitude toward usage significantly predicted motivation ( $B = 0.541$ ,  $\beta = 0.698$ ,  $p < 0.001$ ), reflecting that a more positive attitude is associated with greater motivation to use stimulants.

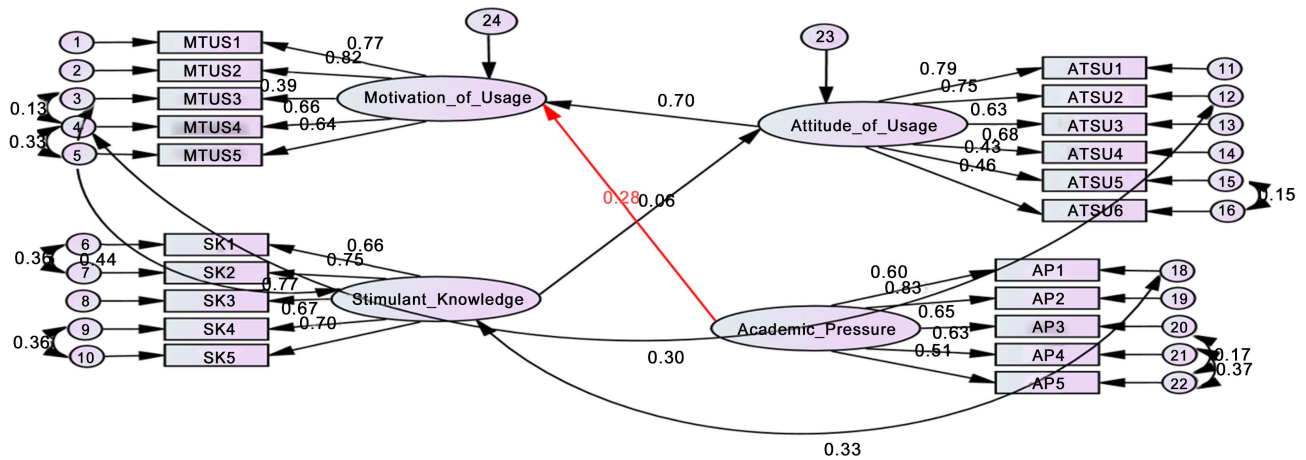


Figure 1. SEM of stimulant knowledge, academic pressure, attitude, and motivation of usage.

Figure 1 presents the structural model diagram, showing strong measurement validity with all observed items loading well on their respective constructs. The model highlights that stimulant knowledge significantly influences attitude toward usage, which in turn strongly predicts motivation. Academic pressure also has a smaller but meaningful effect on motivation. Overall, attitude toward usage is the strongest predictor of motivation.

### 7. Discussions

Previous research underscores that latent constructs should demonstrate appropriate reliability, composite reliability, and average variance extracted above recommended cutoffs prior to hypothesis testing [14]. These findings indicate that the latent constructs are measured reliably, allowing for unbiased estimations of structural relationships in SEM [14]. The derived models aligned with established SEM practices, due to their reliability and convergent validity.

The observed positive links between the constructs are consistent with previous studies aligning them and achievement requirements to stimulant use among undergraduates. Researchers have routinely identified significant positive relationship between stimulant knowledge and attitude toward usage, as corroborated by our findings. Also, in line with existing literature, our study found that academic pressure and attitudes are significant predictors of motivations for stimulant use [15]. Undergraduates exposed to intense academic pressure may be more inclined to consume stimulants, particularly when they perceive such stimulants as tools for increasing concentration. Again, abuse of stimulant drugs for the purposes of academic enhancement has been widely reported in student articles, often associated with pressure to improve attentiveness [16]. Collectively our findings support

the earlier opinions that academic pressure is a key factor driving motivation towards stimulant use. Similarly, the significant positive estimate between attitudes and motivation of stimulant use observed in our study aligns with findings across many domains, like education, health, psychology and others, which consistently show that attitudes toward a behavior increase the likelihood of engagement [17].

In summary, our study revealed that constructs were assessed accurately, supporting valid SEM. Consistent with earlier investigations academic pressure and attitude were significant predictors of stimulant use among undergraduates in UENR, often linked to performance and concentration enhancement, stimulant knowledge significantly predicts attitude. Our findings align with broader evidence across wider settings, highlighting that attitudes and academic pressure strongly influence engagement in such behaviour.

## 8. Conclusion

This study examined the drivers of undergraduate students at UENR to stimulant use, giving special attention to stimulant knowledge, attitudes, academic pressure and motivation of usage. Using SEM underpinned in the theories of Planned Behavior and Strain, the results showed that knowledge positively predicts attitudes, while academic pressure and attitude drive intention to use stimulant. We recommend helping students to handle academic pressure, learn more stimulant/substance effect, and develop healthier attitudes, to support undergraduates in African universities. Future research could examine mediation and moderation effects of the constructs for robust generalization.

## Conflicts of Interest

The authors declare no conflicts of interest.

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## Appendix

**Table A1.** Provides a detailed list of the questions administered to students.

S/N	Stimulant Knowledge (SK)	1	2	3	4	5
SK1	I understand how stimulants affect concentration and memory.					
SK2	I am aware of the side effects of using stimulants.					
SK3	I know the legal consequences of using non-prescribed stimulants.					
SK4	I can recognize the signs of stimulant addiction.					
SK5	I understand the difference between medical and nonmedical stimulant use.					
Academic Pressure/Stress (AP)		1	2	3	4	5
AP1	I feel overwhelmed by academic demands.					
AP2	I feel constant pressure to achieve high grades.					
AP3	My academic responsibilities interfere with my well-being.					
AP4	I worry excessively about upcoming exams or deadlines.					
AP5	Academic expectations from others add to my stress.					
Attitude toward Stimulant Use (ATSU)		1	2	3	4	5
ATSU1	Using stimulants can be helpful during exams.					
ATSU2	Stimulant use is acceptable if it helps improve academic performance.					
ATSU3	I believe using stimulants without a prescription is risky. ( <i>reverse-coded</i> )					
ATSU4	I support using prescription stimulants for academic success.					
ATSU5	I think using stimulants gives students an unfair advantage. ( <i>reverse-coded</i> )					
ATSU6	I would consider using stimulants if I felt academically pressured.					
Motivation to Use Stimulants (MTUS)		1	2	3	4	5
MTUS1	I feel tempted to use stimulants when I'm academically overloaded.					
MTUS2	I would consider using stimulants to improve my academic performance.					
MTUS3	I am curious about the effects of stimulants on study habits.					
MTUS4	If I believed stimulants would help me focus, I would use them.					
MTUS5	I have thought about using stimulants to stay awake while studying.					