Original Article

An Investigation of the correlation between motivation and students' Academic achievement in science courses: The Case of Degree Students at Kotebe University of Education

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Abstract

The study aimed to examine the correlation between students' motivation and their academic achievement explained in terms of Cumulative Grade point Average (CGPA) and investigated the motivational factors effect on the students' overall academic achievement in the Applied Science courses. 393 students were selected using both stratified and random sampling techniques from the regular students attending 2nd and 3rd-year degree programs at Kotebe University of Education. Data were collected using a questionnaire to measure the intrinsic and extrinsic motivation of the sample students on a 5-point Likert scale. The results reveal that the supportive behavior of students significantly accounted for 1% of the variance in CGPA. Besides, students' supportive and personal behaviors significantly explained about 2.2% variance in the criterion measure (CGPA). However, assessing the relative importance of each factor, "challenging oneself" and "the need for personal growth and development" significantly contributed to 1.1% and 1.6 % of the variance in CGPA respectively. Such a low proportion of variance in CGPA might be associated with the range of restriction in scores of both independent and dependent variables. Thus, among the intrinsic motivation these two components appeared to be the direct factors that influence students' CGPA in science courses. It could be inferred that students' strong internal motivation seems to advance their successful science learning and achievement. Thus, to help students be motivated to learn science tangibly, teachers' commitment in using interactive methods, providing reasonably challenging tasks, and giving timely feedback, through organizing the science teaching and learning environment is decisive.

Key words: Academic achievement, Correlation, Motivation, Science course

1. **Introduction**

The purpose of science learning is to improve students' understanding of the nature and application of science and its relevance to their daily lives. Students are expected to willingly continue their science study in school. However, in a study conducted by Lumsden (1994) the need for learning science seems to fade as children grow. Learning sometimes becomes coercion than pleasure, which in most cases students' lose interest in learning science subjects.

According to Beal and Stevens (2011), students' motivation in science learning is considered an important supporting factor for academic performance and the development of critical thinking in school science. Motivation refers to the factors that initiate and sustain behavior, reflected in students' interests, willingness, and desire to engage in learning activities. In the context of science education, motivation is often viewed as a driving force that enhances students' performance. It encompasses several dimensions, including intrinsic and extrinsic motivation, task value, control of learning beliefs, and self-efficacy (Tuana, Chin, & Shieh, 2005; Bautista, 2012). Kostelecky and Hoskinson (2005) define motivation as an internal state that initiates, guides, and sustains behavior. In higher education, motivation is considered a key factor influencing students' academic performance and is regarded as an essential component for effective learning.

Ryan and Deci (2000) explain that student motivation can be understood from two perspectives: intrinsic and extrinsic motivation. Intrinsic motivation occurs when students engage in learning activities out of personal interest, enjoyment, or the desire to achieve self-set goals. In this case, the activity itself serves as the reward and is performed voluntarily. In contrast, extrinsic motivation arises when students complete tasks in order to obtain external rewards such as good grades, praise, or recognition (Dev, 1998).

In our context, usually, students select and pursue their education in Social Sciences than Natural Sciences. One reason could be that the science courses are thought to be difficult to understand and demand lots of effort. As a result, students are observed developing negative attitude towards

the science courses. Teachers even think that the solid sciences are challenging and require re-teaching and tutoring students for better conceptual understanding.

On the other hand, the country has been striving to produce competent graduates, particularly in engineering, technology, and the natural sciences, by introducing high-quality science and mathematics curricula at the primary and secondary school levels. Furthermore, the higher education policy that introduced the 70:30 university intake ratio, which prioritizes science and technology fields, further reinforces this national focus (MoE, 2010). Consequently, university students are expected to demonstrate strong motivation, performance, and competence in the science courses they pursue.

In Ethiopia, the number of Higher Education Institutes is increasing from year to year. For example, the number of public Universities has increased from two in 1991 to fifty in 2019 (MoE, 2019). Due to the expansion of higher education institutes, the number of graduating students is increasing from year to year, which worsened the unemployment of graduates (Wondwosen,2018; Salmi, Sursock and Olefir, 2017; Tamiru, 2017; and Hiruy**,** 2012). Consequently, the labor market is not absorbing graduates as expected and employers hesitate to employ graduates, thinking that they lack soft skills relevant for employment. Moreover, searching for jobs is becoming a hard task for graduates from year to year (Wondwosen, 2018; Tamiru, 2017; and Aklilu and Teshome, 2013; and Hiruy, 2012). Such conditions, might have a negative impact on students' motivation for learning in higher education.

Furthermore, students in science education face various challenges. They encounter lack of motivation, low self-confidence, difficulty in understanding science concepts, and inadequate instructional resources. Teacher characteristics, course contents, and learning environment, as well influence students' learning and achievement. These conditions have interested the author to conduct this research.

Several studies have examined the role of student motivation in academic performance. For instance, Ames (1990) and Marshall (1987) noted that motivation acts as a significant driving force that encourages learners to develop sustained engagement and commitment to the learning process. Similarly, Bomia et al. (1997) described student motivation as the learners' willingness, need, desire, and sense of responsibility to actively participate and succeed in their learning

activities.

As said by Dev (1997) and Lepper (1988), a student who is intrinsically motivated is more likely to complete the chosen task and eager to challenge the activity. In this respect, motivation refers to engaging in a task for one's own sake, for the enjoyment it provides, the learning it permits, or the feeling of accomplishment it evokes (Brophy, 1998; and Pintrich and Schunk, 1996).

Moreover, intrinsically motivated ones are more eager, self-initiated, demand challenges and feel happy in their studies, whereas extrinsically motivated ones feel compelled to learn, and put negligible amount of effort necessary to achieve maximum reward. Generally, students can be either intrinsically or extrinsically motivated to be successful in their learning (Ryan and Deci, 2000; Kamauru, 2000; Dev., 1997; Goldberg, 1994; and Lepper, 1988).

Eppler and Harju (1997) examined the relationship among college students' learning and performance goal orientation, in which they reported that students who had a learning motivation had completed more semesters. In similar studies, significant relationship was found between academic performance and motivation (Skaalvik and Skaalvik, 2006, and 2004; Broussard and Garrison, 2004; Sandra, 2002; and Johnson, 1996).

In a related study, Remali et al. (2013) found a significant relationship between motivational factors and students' academic performance. The results showed that student motivation positively influences academic achievement and serves as a strong predictor of Grade Point Average (GPA). Similarly, Abu Bakar et al. (2010) examined the relationship between university students' achievement motivation, attitudes toward learning, and academic performance in Malaysia. Their findings revealed a significant positive correlation between students' attitudes toward learning and achievement motivation. The study also indicated a positive relationship between students' attitudes and academic achievement. However, the results showed a weak and negative correlation between students' achievement motivation and their academic performance.

In a study conducted on freshman students at Bahir Dar University, motivational directions were found decisive in science achievement setting. Therefore, it is essential to design intervention strategies that aim to help students internalize the value of education and academic achievement (Amare, 2014). Moneta and Siu (2002) conducted two studies to examine whether intrinsic and extrinsic motivation predict academic performance and creativity in Hong Kong in the same way

as in North America. In the first study, the results unexpectedly showed that intrinsic motivation had a negative correlation with first-year self-reported GPA ($r = -.24$, $p < .009$), whereas extrinsic motivation showed a positive correlation ($r = .33$, $p < .001$). These findings suggest that students with higher levels of intrinsic motivation tended to report lower academic performance, while those with stronger extrinsic motivation tended to achieve higher academic performance. Consequently, students who achieved the highest academic performance were those with low intrinsic motivation but high extrinsic motivation, whereas those with the lowest academic performance were characterized by high intrinsic motivation and low extrinsic motivation (Moneta & Siu, 2002).

Moneta and Siu (2002) further reported in their second study that GPA was positively and significantly associated with extrinsic motivation ($r = .38$, $p < .001$), while its relationship with intrinsic motivation was negative but not statistically significant ($r = -.12$, $p < .17$). Additionally, GPA showed a positive and significant correlation with first-year GPA ($r = .38$, $p < .001$). This pattern of relationships suggests a degree of inconsistency or ambiguity in how intrinsic and extrinsic motivations relate to academic performance.

Similarly, the results of the regression analysis indicated that intrinsic motivation remained a significant negative predictor of GPA, whereas extrinsic motivation continued to be a significant positive predictor. In contrast, achievement motivation showed a positive but statistically non-significant relationship with GPA. These findings contrast sharply with results commonly reported in North American college contexts (Moneta & Siu, 2002).

In contrast to North America, where intrinsic motivation is associated with higher pre-admission academic ability scores and better course grades, in Hong Kong intrinsic motivation appears unrelated, or possibly negatively related, to pre-admission scores and is linked to lower course grades. Conversely, while extrinsic motivation in North America shows no relationship with either pre-admission scores or course grades, in Hong Kong it is associated with higher pre-enrollment scores and improved course performance. These findings suggest that the Hong Kong college environment discourages self-motivation while favoring external motivation (Moneta & Siu, 2002).

As can be seen from the results above, it may be seen that there are inconsistencies regarding which

motivational factor (intrinsic or extrinsic) really plays a decisive role and contributes most in energizing science learning. Thus, it is of great importance to investigate the degree of correlation and the effect of these motivational factors on students' achievement in science learning. The purpose of this study was, therefore, to investigate the correlation between motivational factors (intrinsic and/or extrinsic) and their effect on students' academic achievement in learning science courses.

2. Research Methodology

2.1 Research design

The research was an ex-post facto design where the researcher did not have direct control over the independent variables because their manifestations have already occurred or because they are inherently not manipulated. In other words, this research was a descriptive and correlation study. The design focused on observing the degree of relationship between students' motivation and their effect measured on Likert scales questionnaire and their academic achievement (CGPA).

2.2 Population, sample, and sampling procedure

The target population of the study were second and third year students attending their education in the degree program in the Natural Science and Computational College at KUE. These groups were considered in the study since they are expected to cover most of the science courses by the time the data was collected (2^{nd} semester, 2017). Stratified and simple random sampling methods were employed orderly to select sampling units (study subjects) proportionally from their respective departments (i.e. Biology, Chemistry, Physics, Mathematics, Computer Science, and Environmental Science). As a result, 400 participants were selected.

2.3 Data collection and Analysis

The questionnaire developed by Neill (2004) was adapted and used to collect the required data. In the questionnaire, a total of 30 items were included. Of which, 10 scale items were used to measure students' intrinsic motivation, and 20 scale items to measure extrinsic motivation towards science courses. The researcher considered Neill's questionnaire since it was prepared with the purpose to investigate university student's motivation and satisfaction.

A pilot study was conducted and the scales under the intrinsic motivation were found to be reliable as their Cronbach's Alpha varied between .516 and .596. However, the sub scales that make up

the extrinsic motivation did not seem reliable, because the reliability indices vary between .325 and .366, which were very low. On the other hand, the reliability index for each aggregate component, i.e. for the intrinsic and extrinsic motivation was 0.735 and 0.601 respectively. Finally, the questionnaire was distributed to 400 sample students, and 393 of them completed and returned the questionnaire, and its return rate was 98.25%.

Data analysis was carried out based on the determined reliability indices, descriptive statistics (medians, standard deviations, and inter-correlations), exploratory factor analysis and multiple and stepwise regression analyses. In general, the statistical analysis was computed using Software Package for Social Science (SPSS), version 20 of statistical program (George and Mallery, 2003).

3. Results

3.1 Demographic Characteristics

The demographic characteristics of the sampling units are presented in Table 1.

Table 1 Samples of the Study

S. N	*Departments*	*Regular Degree Program Students*			
		Gender		*Total*	*%*
		M	*F*		
1	*Biology*	*48*	*28*	*76*	*19.3*
2	*Chemistry*	*53*	*24*	*77*	*19.6*
3	*Physics*	*14*	*17*	*32*	*8.1*
4	*Mathematics*	*23*	*41*	*64*	*16.3*
5	*Computer Science*	*43*	*33*	*76*	*19.3*
6	*Environmental Science*	*20*	*48*	*68*	*17.3*
Total		***201 (51.1%)***	***192 (48.9%)***	***393***	***100.0***

As can be seen from Table 1, 48.9 percent were females and 51 percent were males. Almost a similar percentage of students (19.3-19.6%) from Chemistry, Biology and Computer Science Departments were made to participate in the study. Between 16.3 to 17.3 percent of them were also selected from Mathematics and Environmental Science Departments. The least sample size was taken from Physics Department since they were few in number.

To see the trend of students' responses for better understanding, the Likert scale items on a 5 scale grouped into three categories are given in Table 2. Here, the responses strongly disagree and

disagree into one group, and strongly agree and agree into another group and leaving the undecided as it was in the table below. For your information, the original 5 scale Likert data was not changed.

Table 2 Students' Responses as to their Intrinsic Motivation

N	***Statements*** *I attend the university because---*	***Responses***							
		SDA/DA*		***UND****		***A /SA****		***Mdn****	***IQR****
		N	***%***	***N***	***%***	***N***	***%***		
1	*I want to understand oneself better.*	*21*	*5.3*	*49*	*12.5*	*313*	*82.2*	*4.00*	*1.00*
2	*I want to explore new ideas.*	*54*	*13.7*	*66*	*16.8*	*273*	*69.5*	*4.00*	*2.00*
3	*I want to challenge oneself.*	*36*	*9.2*	*45*	*11.5*	*312*	*79.4*	*4.00*	*1.00*
4	*I want personal growth and development.*	*43*	*10.9*	*36*	*9.2*	*314*	*79.9*	*5.00*	*1.00*
5	*I love learning.*	*30*	*7.6*	*63*	*16.0*	*300*	*76.3*	*4.00*	*1.00*
6	*I want to help others.*	*32*	*8.1*	*59*	*15.0*	*302*	*76.8*	*4.00*	*1.00*
7	*I want to contribute to the society.*	*23*	*5.9*	*42*	*10.7*	*328*	*83.5*	*5.00*	*1.00*
8	*I need to solve societal problems.*	*39*	*9.9*	*66*	*16.8*	*288*	*73.3*	*4.00*	*2.00*
9	*I want to improve the world situation.*	*28*	*7.1*	*33*	*8.4*	*332*	*84.4*	*5.00*	*1,00*
10	*I want to be more useful to the society.*	*176*	*44.8*	*82*	*20.9*	*135*	*34.3*	*3.00*	*3.00*

**SDA- strongly disagree, DA- disagree, UND- undecided, A-agree, SA- strongly agree, Mdn. – median and IQR-Interquartile range*

As observed in Table 2, the majority of students between 69 and 84.4 percent responded that they are attending the university by strongly agreeing or agreeing to the issues raised most. More specifically, they attended the university because they want to improve the world situation (84.4%), contribute to the society (83.5%), understand oneself better (82.2%), personal growth and development (79.9%), challenge themselves (79.4%), and help others (76.6%) and because they love learning (76.3%).

You can visualize that more than three-fourth of the students' responses strongly tilted to the right side of the Likert scale by agreeing (4) or strongly agreeing (5). This may indicate that there was a consensus on the issues raised by the sample students with a median of 4.00 and interquartile range of 1.00.

3.2 Inter-correlation Matrices

Examining the first research question that states, "What is the degree of relationship between students' intrinsic motivation and their academic achievement? And the corresponding alternative hypothesis, "There is a significant positive correlation between students' intrinsic motivation and their academic achievement" are critical.

To answer these, the inter-correlations among the non-parametric variables (intrinsic motivation of students) were computed using Kendall's correlation formula and summarized in Table 3 and 4.

Table 3 Inter-correlations among Items of Self-Explorations with CGPA

Kendall's tau_b	*understanding oneself*	*Exploring*	*challenging oneself*	*For personal growth*	*I love learning*	*CGPA*
understanding oneself	1.000	0.156**	0.166**	0.098*	0.203**	-.034
Exploring		1.000	0.202**	0.154**	0.163*	-.043
challenging oneself			1.000	0.128*	0.164*	0.058
For personal growth and development				1.000	0.053	0.078*
I love learning					1.000	0.045
CGPA						1.000

***Correlation is significant at 0.01 level (2-tailed)*
**Correlation is significant at 0.05 level (2-tailed)*

Referring to Table 3, it could be understood that "I am attending in the university to understand oneself" is significantly related with"---- to explore new ideas"(r=.156, p< 0.01), "--- to challenging oneself" (r=.166, p< 0.01), "---for personal growth and development" (r=.098, p< 0.05) and with "---I love learning" (r=.203, p< 0.01). Likewise, " exploring new ideas" significantly correlated with "---challenging oneself "(r= .202, p< 0.01), with " for personal growth and development" (r=.154, p< 0.01) and with "---I love learning" (r=.163, p< 0.01). So also "---challenging oneself "was correlated significantly with "---for personal growth and development (r=.128, p< 0.01) and with I love learning (r=.164, p< 0.01). However, only one variable from self-exploration variables, that is, "I

attend in the university for personal growth and development" correlated significantly with students' CGPA (r= .078, p< 0.05) though it was low.

Table 4: ***Inter-correlations among Items of Altruism with CGPA***

Variables	***To help others***	***To contribute to the society***	***To solve societal problems***	***To improve the world***	***To be more useful to society***	
To help others	1.000	.281**	.210**	.326**	.068	
To contribute to the society		1.000	.280**	.295**	-.073	
To solve societal problems			1.000	.244**	-.055	
To improve the world				1.000	.003	.039
To be more useful to society					1.000	-.037
CGPA						1.000

***. Correlation is significant at the 0.01 level (2-tailed).*

As indicated in Table 4, one can see that the item that states "----to help others" is correlated significantly with variable "---to contribute to the society" (r=.281, p< 0.01), "---to solve societal problems"(r=.210, p< 0.01), "---to improve the world situation" (r=.326, p< 0.01) respectively. Similarly, the item, which refers "----to contribute to the society" is significantly related with "---to solve societal problems" (r=.280, p< 0.01), and "to improve the world situation" (r=.295, p< 0.01). So also, the item "----to solve societal problems" is significantly correlated with " to improve the world situation" (r=. 244, p< 0.01). Nevertheless, no variable from the independent variables was significantly correlated with the criterion measure (i.e., CGPA).

3.3 Exploratory factor Analysis

Factor analysis is a valuable statistical technique for exploring the relationships among variables, particularly for complex constructs like socio-economic status or psychological scales. It enables the examination of concepts that are difficult to measure directly, such as intrinsic or extrinsic motivations, by reducing multiple observed variables into a smaller number of interpretable underlying factors (Karen, 2016). To identify the number of factors contributing to the proportion of variance in the dependent variable, factor analysis was conducted as outlined below.

First KMO Bartlett's test was calculated to measure the sampling adequacy. The KMO measure is 0.841, which is acceptable, at .001 significant level (χ^2 = 532.731, p<.001, df. =45).To determine a goodness-of-fit test, which gives us an absolute of model fit, the chi-square test with non-significant values suggest a good fitting model. Failing to detect a non-significant departure from the model at the 5% level (χ^2 (1) = 33.812, p = 0.140, df. = 26). So, according to the maximum likelihood test criterion, a two-factor model seems reasonable for these data.

Chi-Square	df.	Sig.
33.812	26	.140

Table 5:**Communalities**

Variables	Initial	Extraction
Understand oneself better	1.000	.546
Exploring new ideas	1.000	.539
Challenging oneself	1.000	.244
For personal growth and development	1.000	.366
I love learning	1.000	.431
To help others	1.000	.312
To contribute to the society	1.000	.418
To solve societal problems	1.000	.475
To improve the world situation	1.000	.390
To be more useful to the society	1.000	.509

Extraction Method: Principal Component Analysis.

As observed in Table 5, among the variables, understanding oneself, exploring ideas, loving learning, contributing to the society, solving societal problems and being more useful to the society are with communality value more than 0.4, indicate the proportion of variance in the observed variables that is explained by the extracted factors.

Table 6: ***Principal component analysis output for intrinsic motivation variables (Total Variance Explained)***

Component	***Initial Eigen values***			***Extraction Sums of Squared Loadings***			***Rotation Sums of Squared Loadings***		
	Total	***% of Variance***	***Cumulative %***	***Total***	***% of Variance***	***Cumulative %***	***Total***	***% of Variance***	***Cumulative %***
1	2.912	29.121	29.121	2.912	29.121	29.121	2.647	26.474	26.474
2	1.196	11.960	41.081	1.196	11.960	41.081	1.461	14.606	41.081
3	.942	9.423	50.503						
4	.855	8.548	59.051						
5	.819	8.187	67.238						
6	.748	7.480	74.718						
7	.716	7.158	81.876						
8	.668	6.676	88.552						
9	.639	6.391	94.943						
10	.506	5.057	100.000						

Extraction Method: Principal Component Analysis

Table 6 shows that the Eigenvalue results are presented in two main sections: Initial Eigenvalues, Extracted Sums of Squared Loadings, and Rotation Sums of Squared Loadings. For interpretation, the focus should be on the extraction and rotation sums of squared loadings. From Table 7, two factors stand out with relatively large Eigenvalues. The first factor accounts for 29.12% of the variance, and the second accounts for 11.96% of the variance in students' intrinsic motivation, indicating that these factors explain more variance than any single observed variable. The remaining variables, however, do not show significant contributions.

Table 7 :**Component Matrix output for intrinsic motivation variables**

Variables	**Component**	
	1	**2**
Understand oneself better	.464	-.421
Exploring new ideas	.507	.101
Challenging oneself	.562	-.158
For personal growth and development	.501	.476
I love learning	.456	-.159
To help others	.631	.172
To contribute to the society	.659	-.171
To solve societal problems	.625	-.104
To improve the world situation	.664	.176
To be more useful to the society	.024	.795

Extraction Method: Principal Component Analysis

2 components extracted

As observed in Table 7, the un-rotated factor loadings for all the factors using the principal component method of extraction, two factors have been identified with Eigen value greater than 1. Since factor loadings can be interpreted like standardized regression coefficients, one could say that the variables, such as improving the world situation (0.664), contributing to society (0.659), helping others (0.631), and solving societal problems (0.625) have strong correlation (factor loadings) respectively with factor 1, together (all in all) indicating *supportive behavior*.

Similarly, challenging oneself (0.562), exploring new ideas (0.507) and for personal growth and development (0.501) has moderate correlation (factor loadings) individually with factor 1 designating together *personal development*. On the other hand, being more useful to society has a very strong correlation /factor loading (0.795) with factor 2, which shows *supportive behavior*.

Nevertheless, to determine or identify the factor that explains more variance in the three categories, a varimox rotation simplifies the loading and allows easy interpretation of the factor loadings.

Table 8 Rotated Component Matrix output for the intrinsic motivation variables

Variable	Component	
	1	2
Understand oneself better	.592	-.205
Exploring new ideas	.427	.292
Challenging oneself	.578	.075
For personal growth and development	.274	.635
I love learning	.482	.032
To help others	.513	.406
To contribute to the society	.673	.102
To solve societal problems	.616	.150
To improve the world situation	.542	.422
To be more useful to the society	-.290	.740

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 3 iterations

Un-rotated factor loadings are often difficult to interpret. As presented in Table 8, Factor rotation simplifies the loading and allows us to more easily interpret the factor loadings. In these results, a varimox rotation was performed on the data. Using the rotated loadings, the factors can be interpreted as follows:

a. Contributing to society (0.673), and solving societal problems (0.616) have large positive loadings on factor 1. On the other hand, challenging oneself (.578), and loving for learning (0.482) have moderate positive loadings on factor 1. Thus, this factor describes students' learning to be useful to society (*Supportive behavior*).
b. To be more useful to the society (0.740) and for personal growth and development, (0.635) have a positive loading on factor 2 respectively, thus, indicating *supportive and personal development behavior.*

From our culture context, we know that families live together supporting and sharing to one another and students have been developing this experience since their childhood. As a result, such supportive variables belonging to altruism were strongly selected by agreeing and/or strongly

agreeing most by the sample students, whereas some of the self-exploration variables were selected next. That is why a large positive loading is observed both on factors 1and 2.

3.4. Results of the Multiple and Stepwise Regression Analysis

To answer the third research question that was concerned with determining the predictive capability of the factors was more important in explaining the variation in students' achievement, which is defined in terms of CGPA and denoted by Y. Step-wise regression analysis was carried out as follows:

Table 9a Final summary of regression onY (n= 392)

Sources of Variation	Sum of square	df	MS	F- value	p	R^2
Regression	1.244	1	1.244	4.143	.042*	.010
Residual	117.434	391	.300			
Total	**118.679**	**392**				

a. Dependent Variable: The cumulative GPA (y)

b. Predictors: (Constant), Supportive behavior

*P<.05**

Analyzing the result in table 9a, a multiple correlation index of .010 was observed between student's CGPA (y) and students' supportive behavior (factor 1) for the total sample students considered.

The independent variables "contributing to society", "solving societal problem", "challenging oneself", and "love of learning", in combination, explained about 1% of the variance in students' academic achievement(y). The portion of variance accounted in the criterion measure due to per supportive behavior of students is statistically significant ($F_{(1,391)} = 4.143, p < .05$).

Table 9b Summary of Stepwise regression results of the independent variables on CGPA

Variables	B-Coefficients	Beta	t- values	R	R^2	F change	P Value
Constant	2.439		22.028*				.000*
Factor 1 (supportive behavior)				.102	.010	4.143*	.042*
Challenging oneself	.054	.104	2.062*	.104[a]	.011	4.251*	.040*
I love learning	.030		0.576				. 565
To contribute to society	.071		1.319				. 188

To solve societal problem	.004	.081	.935

a. Predictors: (Constant), Challenging oneself

b. Dependent Variable: The cumulative GPA

*c. P<.05**

As indicated in Table 9b, the magnitude of beta weight of each predictor variable to the prediction of the criterion measure (CGPA), the t-value of " I attend university to challenge oneself", indicates that it significantly contributes to predict CGPA (t_{392}=2.062, p< .05). However, "---I love learning (t_{392}=0.576, p >.05), "---to contribute to society" (t_{392}= 1.319, p> .05) and "--to solve societal problem" (t_{392} = .081, p > .05) did not significantly contribute to predict the students' academic achievement (CGPA).

Regarding to the proportion of variance accounted, "I attend in the university to challenge oneself" accounted significantly for about 1.1% of the variance in students' CGPA, from the ANOVA test ($F_{(1, 391)}$ = 4.251, p<.05).

Table 10a Final summary of regression onY (n= 392)

Sources of variance	**Sum of Square**	**df**	**MS**	**R^2F**	**Sig.**
Regression	1.861	1	1.861	022* 4.304	.014[b]
Residual	116.818	391	.299		
Total	118.679	392			

a. Dependent Variable: The cumulative GPA

a. Predictors: (Constant), supportive &personal behavior

*b. P< .05**

Analyzing the result in table 10a, a multiple correlation index of .022 was observed between student's CGPA (y) and his/her supportive and personal behavior for the total sample students considered. Factor 2, (supportive & personal behavior) explained about 2.2% of the variance in students' academic achievement(y). This portion of variance accounted in the criterion measure due to the combined effect of "---to be more useful to the society" and one's interest "for personal growth and development" of students is statistically significant. The F-value, R^2= .022,($F_{(1,391)} = 4.304$ $p < .05$) shows that the two predictor variables taken together under factor 2 makes a statistically significant contribution to the prediction of students' achievement in science learning.

To see the relative importance of each predictor variable, a stepwise regression was employed and beta values were determined in Table 10b below.

Table 10b Summary of the Stepwise regression results of the independent variables on CGPA

Variables	**B-Coefficients**	**Beta**	**t- values**	**R**	**R^2**	**F change**	**P Value**
constant	2.411		23.324*				.000
Factor2(supportive &personal behavior				.147[a]	.022	4.304*	.014
For personal growth and development	.060	.125	2.496*	.125	.016	6.228*	.013
To be more useful to the society	-.032	-.078	0.576				.125

a. Predictors: (Constant),personal growth and development

b. Dependent Variable: The cumulative GPA

*c. P<.05**

As observed in Table 10b, the stepwise multiple regression analysis was employed to identify an independent variable that explains the proportion of variance in the dependent variable. As a result, the variable that states "I attend in the university for personal growth and development" significantly predicted and explained about 1.6% of the variance in the criterion measure (CGPA), the F-value, R^2= .016 , $F_{(1,392)}$ = 6.228., p<.05).

To assess the relative importance of a predictor variable in predicting the criterion measure the calculated t-value for personal growth and development is statistically significant, (t_{392} = 2.496, p< .05), while the t- value computed for the variable that states " I attend in the university to be more useful to the society" was not statistically significant (t_{392} = 0.576, P>.05). This indicates that it does not contribute to the prediction of the students' CGPA.

4. Discussion

The main purpose of the study was to examine the degree of correlation between student's motivation and their effect on academic achievement (CGPA). Besides, it was set out to find out

adequate evidence regarding the validity of each independent variable relative to CGPA achieved in the science courses.

In the study, to ensure the reliability of the item scales for measuring the intrinsic and extrinsic motivation of students, a pilot study was conducted. As a result, the extrinsic motivation items were discarded due to low indices of reliability, whereas those items in the intrinsic motivation were used to collect the required data since they satisfied the minimum reliability indices. To this end, the first research question chiefly addressed the determination of the degree of correlation between intrinsic motivation variables respectively with the criterion measure.

Assessing the correlations found, it could be realized that students' self-exploration variables positively and significantly correlated with altruism variables. However, in relation to students' academic achievement (CGPA), except for one variable (i.e., attending the University for personal growth and development which correlated significantly with CGPA($r=.078$, $p<.05$)), all the other variables did not correlate significantly. Besides, all the variables of altruism didn't correlate significantly with the criterion measure (CGPA). Perhaps this finding is consistent with the finding in a study conducted in Malaysia and Hong Kong in which GPA negatively but non- significantly correlated with intrinsic motivation (Abu Bakar et al., 2010; and Moneta and Siu, 2002). It implies that the more a student is intrinsically motivated, the lower will be his or her GPA and the converse also holds true. On the other hand, these results disagree from those studies conducted by (Remali et al., 2013, Skaalvik, et al., 2006 and 2004, Broussard, et al., 2004; and Sandar, 2002), which emphasized that a significant relationship prevails between academic performance and motivation.

Such low and non- significant correlations between the intrinsic motivation variables and students' CGPA might be associated with restriction in the range of variability in both cases. Since Likert scale produces ordinal data, median values for averages and interquartile ranges for dispersions were computed. As a result, for the intrinsic motivation variables, the interquartile ranges calculated not varied this much between them because about seven items have equal IQR of 1.00, which indicate a small dispersion from the median values determined. Most of the sample students rated the majority of the items in the questionnaire by agreeing or strongly agreeing. You can imagine that with negatively skewed values the range will be small. This condition shows restriction on the range. Moreover, you can still see the range of restriction (0.49-0.50) in the

criterion measure (GCPA). As a result, the correlation coefficients obtained were small and could not be statistically significant. Furthermore, the influence is found to be high on the predictions.

The third research question focused on determining the combined effect and relative contribution of each independent variable to the prediction of students' CGPA (Y).To answer this question, a step-wise regression model and exploratory factor analysis were carried out to reduce the number of variables into fewer ones of relevant factor (s) that can be used as an index of all variables, for further analysis. Consequently, supportive behavior as factor 1 and supportive and personal behavior as factor 2 were identified out of the 10 variables respectively.

Analyzing the validity coefficients determined in Tables10a-b, to the maximum prediction of students' academic achievement (Y's), the step-wise regression analysis identified *supportive behavior* as the sole factor to predict the criterion measure (CGPA). "Challenging one-self", "love of learning", "contributing to society" and "solving societal problem" in combination explained about 1% of the CGPA (Y) variance for the entire sample studied. It may be suggested that a linear combination of these selected predictor variables look to have a reliable relation with student's academic achievement (Y) and contribute to the accuracy of prediction, though the proportion of the variances accounted was extremely low.

Considering the relative importance of each selected independent variable to the prediction of the criterion measure (Y), only "I attended in the University for challenging oneself" accounted for the variance in the criterion measure (Y). This could mean the variable challenging oneself has positive influence on students' academic performance or students motivated to challenge themselves on different tasks seem to get better scores.

Similarly, evaluating closely the summary of the regression result in Tables 10a-b, it could be confirmed that "attending the university to be more useful to society" and "attending university for personal growth and development" combined and significantly contributed a 2.2% variation in CGPA. But, "--- for personal growth and development" came out as the single predictor variable selected in the model in relation to the criterion measure (CGPA) than the other independent variable. So, it seems that students motivated for personal growth and development via self-exploration have the ability to perform well academically.

Even though the predictive power of "-to challenge oneself "and "-for personal growth and development" determined with respect to CGPA are low, this finding agrees with past research findings, which explain intrinsic motivation components are positively related to academic achievement (Amare, 2014; Kostelecky, *et al*. 2005; Kamauru, 2000; Ryan and Deci, 2000; Dev., 1997; Bomia, *et.al*., 1997; and Lepper, 1988). The point is, such types of students are more likely to complete a chosen task and keen to challenge the activity and strive for personal development. The inadequate predictive power of the elements of the intrinsic motivation to predict CGPA might be associated with the following reasons:

- Restriction of range was observed in the CGPA. The standard deviation for the criterion measure was 0.55 for the total group. This implies that the range of ability among the sample subjects considered is restricted and has effect on the coefficients determined.
- Students' responses for the items in each scale with regard to their motivation toward science courses could appear to be partly not genuine or may not represent their real behavior.

5. Conclusion and Implications

5.1 Conclusion

It was obvious that low correlations are observed between students' intrinsic motivation and academic achievement as measured by CGPAs to the entire sample subjects studied. Even if the low correlations determined might have occurred due to the restriction of range of scores in the independent variables (Self-exploration and Altruism) and dependent variable (CGPAs), it may be still concluded that students' interest and preference towards the Applied Science Courses seem to be not strong. It appears difficult to say that they are learning science courses with interest and being delighted. Besides, not being placed with their preferences in the different departments of sciences could have its own influence on their motivation and performances.

On the other hand, improved prediction of student's performance was not strongly made within the selected combination of self-exploration and altruism variables. Apparently, the portion of variances (1.1% -1.6%) that contributed to students' achievement as explained by the independent variables is relatively very small. Both data signify that a large portion (98.4% - 98.9%) of the variance in the criterion measures (Y) was unexplained. This condition might have occurred as a result of the restriction of range of scores observed in the independent variable and dependent variable. These statistical conditions perhaps could be expounded as follows.

Examining the responses of students to items in the questionnaire, they fall on "strongly agree" and/or "agree" to most of the items. It implies that there is no an even distribution of scores from strongly disagree to strongly agree. The scores are, therefore, leaning to one direction indicating narrower distribution of scores and it is also negatively skewed graphically. As a result, due to such restriction of range of scores in both the independent variable (intrinsic) and criterion measure (CGPA), low predictive validity coefficients have been observed. However, this condition may signify to us to look the situation from different angles. On the one hand, to replicate the study in other groups and learning situations and combining for other psychological factors that encourage and initiate students' performance. Moreover, it is important to orient and synthesize sample subjects to fill out the questionnaire genuinely.

Most importantly, it is also decisive on the part of teachers to be loyal to their profession, creating opportunities to enhance students' motivation to be successful in their science learning by challenging students setting tasks at a moderate level of difficulty so that they regularly experience success, using novel experiences to arouse curiosity, modeling abstract ideas in concrete ways, and creating a conducive learning environment with adequate resources.

5.2 Implications

Based on the research findings and conclusions made, the following implications could be made.

1. In this study, students' intrinsic motivation (self-exploration & Altruism) towards learning Applied Science Courses does seem to be a direct factor that can influence students' academic achievement (i.e., CGPA), though very low validity coefficients were determined and the proportion of variance they accounted on the criterion measure (CGPA) was that much less due to the statistical reasons mentioned earlier. Yet the results of this study suggest to promote the personal and supportive behaviors, the interest to challenge oneself and the need for personal growth and development are important intrinsic factors to enhance students' academic performances.
2. It may be worthwhile to improve students' intrinsic motivation towards science learning through organizing a variety of stimulating activities in the instruction process. More specifically, creating classroom situations that encourage real-world activities to easily understand the subject matter is vital. Above all, providing honest and informative feedback

and imparting students how they can learn inspire their intrinsic motivation, which in turn are decisive for their learning.

3. Teachers' commitment and dedication to create conducive learning environment, give students options, use varied active learning methods, and provide activities that are appropriately challenging in the classroom are decisive to improve students' motivation and engagement in their learning.
4. Though it is stipulated that students are placed into the field of their choices on a competitive basis using their preparatory grades, (article 72, Senate legislation, 2017), still a student coming to a new environment, may not be effective in making appropriate choices unless they get adequate orientations and feedbacks. Thus, a decisive role should be played by guidance and counseling office in collaboration with faculties and departments in providing the necessary academic advices, guidance and assistance to help students make informed decisions to place themselves to the different fields of studies on the bases of their selection and preferences rather than being imposed by administrative decisions.
5. Essentially, this study proposes further study in the future on intrinsic and extrinsic motivation variables including other psychological factors on wider sample and on those students who are specializing in social science and other fields.

6. Limitations of the Study

The study was confined to a single university; hence, the results may not necessarily apply to students in other institutions. On the other hand, this study focused on investigating specific motivational factors (intrinsic and extrinsic motivation) that may influence student's achievement in higher learning. However, there are varying psychological factors (i.e. motivation, self-efficacy, attitude, learning strategies, learning values, learning goals, performance goal, self-regulated learning, effort, learning environment, etc.,) that influence students' academic achievement, but not treated in this study. Thus, such limitations should be considered before making any form of generalization based on the results of the study.

This study of course has its strength. It has identified two relevant personal internal factors (i.e., the need to challenge oneself and the interest for personal growth and development) that are exhibited by persons with high need for achievement. A person, who has high need for achievement, urges to excel, strives for excellence, struggles for success, considers problems as

challenges to be met, strong need to accomplish a task to a set of standard, and personal conviction of being in charge of one's own fate (Rybnicek, et al., 2019, McClelland, et al., 1953).

Declaration of Conflicting Interests

The author declares that no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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