Academic Motivation, Attitude and Achievement in Science Education in Southern Oromia, Ethiopia

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Abstract: Non-cognitive factors play significant roles in academic achievement of science education. The purpose of the study entitled as academic motivation, attitude and science education achievement was to examine relationship between students' academic motivation, attitude and achievement on science education and investigate predictive power of motivation on science achievement. The study used correlational research design. The motivated strategy for learning questionnaire (MSLQ) and attitude scales were used to gather data from participants (78 males, 22 females). Achievement data collected on biology, physics, and chemistry. Analysis of the data has indicated that academic motivation and attitude correlate significantly with each other but not with science achievement except with task value (TVA) ($r = 0.24$, $r^2 = 5.76\%$, $p < .05$, $df = n1 + n2 - 2 = 98$). Regression analysis illustrates that 9% of science achievement accounted for by task value (TVA). Overall, there are low to moderate relationship between motivation and science achievement. It recommends giving high task value to science education, developing science self-efficacy, and not to develop amotivation. The study has offered the implication that science education policy and strategy designers, teachers and parents should encourage natural science students.

Keywords: Academic Motivation; Achievement; Attitude; Science Education

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1. Introduction

Science education is essential for comprehensive development of any nation. Education with science as its major component determines the level of prosperity, welfare, and security of the nation. Poverty reduction and sustainable development programs of developing countries depend by and large on availability and mobilization of scientifically and technically literate working forces. Many of the developed countries were able to achieve so much in science and technology because of science education (Kola, 2013). According to IBE (2001), science education in Ethiopia is concentrated on teaching of science concepts and applications in order to ensure problem solving capacity through the understanding of one's environment.

Generating citizens who have academic motivation and positive attitude toward the development and dissemination of science and technology in society and enabling the generation to participate in economic, politics as well as social life of their country is among national aims of Ethiopian education (MoE, 2009). Without creating scientifically and technologically literate society, these aims are hardly possible. In order to achieve these goals, students need to have academic motivation and positive attitude toward science education.

Motivation and attitude play a large part in determining students' success or failure (Bong, 2004; Sahile, 2004). Motivation is a process whereby goal-directed activity instigates and sustains and it includes self-efficacy, task value, interest, and achievement goal (Pintrich and Schunk, 2002; Bonney *et al*., 2005). A motivated student will take care of his/her education, has a positive thinking and always curious to his/her learning activities. The perception that science education is challenging and burden to students will be not acceptable for those students who have motivation and positive outlook toward science education. Rather, it may be enjoyable for them.

Academic intrinsic motivation is concerned with active engagement of students in learning tasks that they find interesting and promote them to achieve high score whereas academic extrinsic motivation is concerned with behaviors that students do to get pleasure such as reward or avoid punishment. The absence of contingency between one's actions and outcomes refers to amotivation or apathy. According to Sahile (2004), intrinsic motivation is associated with better learning and better performance. When a person is intrinsically motivated, he/she acts naturally, spontaneously, and feeling freedom to follow interest (Ryan and Deci, 2000).

Usually, science education is considered as challenging and burden to students. According to George (2000), students' perceptions of science ability have effect on their attitudes toward science in which their self-concepts and academic motivation were related to attitude toward science. Guido (2013) describes that attitude can distort the perception of information and affect the degree of their retention. On the other hand, students' attitude is affected by their level of interest in science, their ability in science, learning climate, access to extra-curricular science experience, family, their own self-concepts, and their peer groups (Zain *et al*., 2010).

Research finding by Buck *et al*. (2009) reveals that attitudes of African American students toward science are often positive despite low achievement. Bong (2004) also writes that self-efficacy, task value, diverse indexes of motivation, and performance

outcomes are significantly correlated. Köseoğlu (2015) further notes that students with high self-efficacy will favor mastery goals relative to students with low self-efficacy who would probably prefer performance goals. Task value and self-efficacy are moderately and positively correlated to academic achievement and both have been confirmed as effective predictors for varieties of academic outcome (Bong, 2004).

The teaching of science education at secondary schools in Ethiopia is greatly focused on cognitive abilities of learning objectives while little attention has been given to affective domain of educational objectives. Roles of affective abilities in secondary school science education have not received due attention as cognitive abilities in science education. According to IBE (2001), secondary school science education curriculum gives emphasis to pure science.

Academic achievement has relationship not only with cognitive abilities but also with non-cognitive factors such as motivation and attitudinal factors. Regarding this, Bonney *et al*. (2005) state that non-cognitive factors such as students' motivational beliefs should get consideration when examining students' cognitive engagement in classroom. Task value which is among important components of the affective domain has not received more attention by science education curriculum designers, secondary school science education teachers, and students. Task value is defined as initiative to engage in academic activities which comprises perceived importance, usefulness, and interest (Bong, 2004). It is the subjective belief about reason for doing the tasks in science education. High task value leads students to involve more in learning and achieve higher score and this is effective predictor for varieties of academic outcome (Pintrich and Schunk, 2002; Bong, 2004).

Educational objectives should not be concerned only with cognitive but also with affective factors. These factors in science education have received little research attention in Ethiopia. Even though about half of the academic achievement in science education is accounted for by cognitive abilities and the remaining are accounted for by affective factors, roles of motivation and attitude have not been duly emphasized in our secondary school science education curriculum.

The purposes of this study were to examine relationship between academic motivation, attitude and achievement in science education, and investigate attitudinal tendency of natural science students of preparatory school toward science education. To deal with this study, the following research questions are addressed. These are: (a) what are the relationship between students' academic motivation, attitude, and academic achievement in science education?, (b) what percent of achievement in science education explained by academic motivation?, and (c) what is the tendency of students' attitude toward science education?.

2. Research Methods

2.1. Research Design

A descriptive technique correlational research design measures variables to determine whether there are relationship between academic motivation, attitude and academic achievement in science education. Regression analysis was computed to determine

the percentage of academic achievement accounted for by academic motivation. The percentage of students' attitude toward science education was also computed.

Scores on academic motivation, scores on attitude toward science education and achievement in science education are the variables considered in this study. Academic motivation is divided in to six components: intrinsic motivation (IMO), extrinsic motivation (EMO), amotivation (AMO), science self-efficacy (SSE), expectancy for success (EFS) and task value (TVA).

2.2. Participants

The participants of this study were grade 11 and 12 natural science students at Bule Hora preparatory school. This school is located in South Eastern part of Ethiopia. The total population of this study is 293 (Male = 233, Female = 60) students. Simple random sampling via lottery method was used to select 100 (Male = 78, Female = 22) students. The age of participants was between 17 and 21.

2.3. Instruments

Academic motivation and attitude scales were used to collect data. The scale for academic motivation was adapted from motivated strategies for learning questionnaire (MSLQ) by Pintrich *et al*. (1991) and scale for attitude towards science education was adapted from the works of Simpson *et al*. (1994). The reliability of the instruments was piloted and Cronbach alpha (α) $r_{=} 0.81$ and $r = 0.9$ were obtained for MSLQ and attitude towards science education respectively. These scales are chosen because items in both scales are not ambiguous, MSLQ has well established psychometric reports and the scale for attitude towards science education is culture fair. Hence, the scales are appropriate for Ethiopian preparatory school science students.

2.4. Research Procedure

Academic achievement in science education (ACH) was comprised the average grade points of biology, physics and chemistry final examinations were prepared by subject teachers, and the quality of examination was evaluated by examination committee of the school. The scores on these subjects were collected from mark record and the average was computed and matched with responses on the questionnaires parallel to individual name of sample students.

2.5. Data Analysis

Students' responses to instruments were coded based on the 5-point Likert scale that worth strongly disagree (1), disagree (2), undecided (3), agree (4) and strongly agree (5) in which 5 being the highest and 1 being the smallest rate. Using SPSS program, Pearson's product moment correlation analysis was computed to determine relationships between academic motivation, attitude toward science education and academic achievement in science education and regression analysis was computed to infer the proportions of academic achievement that accounted for by academic motivation.

3. Results

The following results were obtained from correlation, regression and frequency analyses regarding academic motivation, attitude toward science education and academic achievement in science education.

3.1. Correlation

Table 1. Relationship between components of academic motivation, attitude toward science education, and achievement in science education (n = 100)

Variables	Correlation coefficients							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. IMO	1.00							
2. EMO	.05	1.00						
3. AMO	-.10	.10	1.00					
4. SSE	.41**	.41**	.05	1.00				
5. EFS	.24*	.17	-.14	.37**	1.00			
6. TVA	.22*	.07	-.07	.12	1.50	1.00		
7. ATT	.32**	.17	-.31**	.24*	.23*	.11	1.00	
8. ACH	.20	.08	-.11	.16	.18	.24*	-.11	1.00

**p <.01, *p < .05

Intrinsic Motivation (IMO), Extrinsic Motivation (EMO), Amotivation (AMO), Science Self Efficacy (SSE), Expectation for Success (EFS), Task Value (TVA), Attitude (ATT), Academic Achievement (ACH).

Table 1 reveals the person's product moment correlation among components of academic motivation, attitude and academic achievement. As can be observed, there is positive and significant correlation between intrinsic motivation (IMO) and science self-efficacy (SSE) ($r = 0\ .41$, $r^2 = 16.81\%$, $p < .01$, $df = n1 + n2 - 2 = 98$). This finding is in line with the research finding by Bedel (2016) that states academic motivation scores were significantly relate to academic self-efficacy scores ($r = .53$, $p < .01$). This implies that increase in academic intrinsic motivation leads to increase in students' self-efficacy. There is also positive and significant correlation between intrinsic motivation (IMO) and expectancy for success in science (EFS) ($r = 0.24$, $r^2 = 5.76\%$, $p < .05$, $df = n1 + n2 - 2 = 98$).

The correlation between intrinsic motivation (IMO) and task value (TVA) is positive and significant ($r = 0.22$, $r^2 = 4.84\%$, $p < .05$, $df = n1+n2-2 = 98$).The correlation between intrinsic motivation (IMO) and attitude toward science education (ATT) is positive and significant ($r = 0.32$, $r^2 = 10.24\%$, $p < .01$, $df = n1 +n2 -2 = 98$). There is negative and significant correlation between amotivation (AMO) and

attitude toward science education (ATT) (r = -0.31, r^2 = 9.61%, p < .05, df = n1 + n2 -2 = 98). This implies that as one's apathy to his/her action decreases, his/her attitude toward his/her action increases or vice versa. Result shows that there is positive and significant correlation between science self-efficacy (SSE) and attitude toward science education (ATT) *(r = 0.24,* r^2 = 5.76%, *p<.05,* df = n1 +n2 -2= 98). This study also reveals that there is positive and significant correlation between task value (TVA) and academic achievement (ACH) (r = 0.24, r^2 = 5.76%, p<.05, df = n1 +n2 -2 = 98).

3.2. Regression

The results of regression analysis show that the proportion of academic achievement accounted for by task value (TVA) is 9 % and the proportion of academic achievement explained for by task value and amotivation (AMO) together is 13%.

Table 2. Stepwise regression analysis for models (n = 100)

Model	Variables interred	Multiple correlation		R^2 changed	Adjusted R^2	F
		R	R^2			
1	Task value	.318	.101	.101	.09	8.56*
2	Task value amotivation	.386	.149	.047	.13	6.55*

*P < .05

Table 2 reveals the predictive power of components of motivation on academic achievement. This shows that Task value and amotivation are models that significantly predict academic achievement in science education. This model explained 13% of variations in academic achievement (R = .386, F (2, 97) = 6.55, P < .05). Task value (TVA) is a single predictor variable among discerned academic motivational orientation that significantly predicts academic achievement in science education. This model accounted 9 % of the proportion of the variations in academic achievement (R =.318, F (1, 98) = 8.56, p < .05). This implies that 9 % of academic achievement in science education is accounted for by task value.

3.3. Attitude

Table 3. Frequency distribution of students' attitude toward science education (n = 100)

Responses	Frequency	Percent (%)
Strongly disagree (most dislike)	0	0
Disagree (dislike)	0	0
Undecided	16	16
Agree (like)	38	38
Strongly agree (most like)	46	46
Total	100	100

Table 3 reveals the frequency of students' responses to attitude scale. As can be seen, students have positive attitude toward science education in which 46% of them like it the most and 38% of them like science education. The result of frequency distribution of students' attitude toward science education indicates that 84% of the participants rated as they have positive attitude towards science subjects by responding "agree" and "strongly agree".

4. Discussion

The results of this study have indicated indicated that components of academic motivation (motivational orientations) and attitude toward science education are more significantly inter-correlated with each other than with achievement in science education. This is in line with the findings by Bedel (2016) that states academic motivation sub-scales are significantly related to academic self-efficacy.

The correlation between attitude toward science education and achievement in science education is not significant. Task value is the important variable that positively and significantly correlated with achievement in science education. This is in line with the finding by Köseoğlu (2015) that states task value produced positive correlation with GPA. Similarly, Bircan and Sungur (2016) state that task value significantly predicted students' science achievement. As the task value students attach to their learning activities increase, their academic achievement also increases. Since these empirical findings agree with the results of this study, the outcome is encouraging.

The correlation and regression studies have displayed that task value is the most predictive variable of achievement in science education. This implies that students, teachers, and curriculum experts had better give due emphasis to task value in science education. The proportion of achievement in science education accounted for by task value and amotivation is 13%. Task value and motivation are the two variables that significantly predict students' achievement in science education.

Preparatory school Students have positive attitude toward science education in which they rated "agree" and "strongly agree" for scale of science attitude was 84%. This is in line with result indicated in Table 1 which reveals attitude toward science education is significantly correlated with intrinsic motivation. The more students motivated intrinsically, the more positive outlook they develop toward science education.

5. Conclusion and Recommendation

5.1. Conclusion

Non-cognitive factors play significant roles in academic achievement of science education. The findings of the study suggest that there is low to moderate relationship among components of academic motivation and between achievement in science education as well as attitude toward science education. 13% of variance in achievement of science education is explained by task value and amotivation. Students' attitudinal inclination toward science education is positive.

5.2. Recommendation

This study reveals that there is positive and significant correlation between task value and academic achievement. Hence, secondary school natural science curriculum should include affective domain. Encouraging students to develop task value of science education in terms of attainment value or the advantages that students will gain as the result of attaching high task value to science education is important. In order to give high task value to science education, develop science self-efficacy and not to develop amotivation, science education policy and strategy designers, teachers and parents should encourage natural science students. Secondary school science teachers should encourage their students by designing learning tasks that are appropriate to students' level and relate those tasks to real world problem, to their future career and life goals.

Natural science students should develop academic motive to participate in science learning by attaching high task value to science education and engage academic works with deep interest. They should also proceed their positive outlook toward science education in order to meet their goal-directed academic activities which in turn meet national goals. Parents should encourage natural science students to develop utility value and worth tasks in science education and not to develop amotivation.

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7. References

Bedel, E. 2016. Exploring academic motivation, academic self-efficacy and attitudes toward teaching in pre-service early childhood education teachers. *Journal of Education and Training Studies,* 4 (1): 142-149.

Bircan, H. and Sungur, S. 2016. The role of motivation and cognitive engagement in science achievement. *Science Education International,* 27 (4): 509-529.

Bonney, C., Klemper, T., Zusho, A., Coppola, B., and Pintrich, P. 2005. Student learning in science classrooms. What role does motivation play? In: Alsop, S. (ed.) Beyond cartesian dualism: encountering affect in teaching and learning of science. Netherlands: Springer, pp.83-97.

Bong, M. 2004. Academic motivation in self-efficacy, task value, achievement goal orientations and attributional beliefs. *Journal of Educational Research,* 97 (6): 287-297.

Buck, G., Cook, K., Quigly, C., Eastwood, J., and Lucas, Y. 2009. Profiles of urban low SES African American girls' attitude toward science. *Journal of Mixed Method Research,* 3 (4): 386-401.

Gaffney, J. 2005. The importance of science literacy in modern culture. (http://www4.ncsu.edu/~jdgaffne/scilit.pdf). (Accesed June 16, 2016).

George, R. 2000. Measuring change in students' attitude on latent variable growth modeling. *Journal of Science Education and Technology,* 9 (3): 213-225.

Guido, R. 2013. Attitude and motivation towards learning physics. *International Journal of Engineering Research and Technology (IJERT)*, 2 (11): 2087-2094.

IBE (International Bureau of Education). 2001. The development of education. National report of Ethiopia. Final version. Ethiopian national agency for UNESCO. Addis Ababa: Ethiopia.

Kola, A. 2013. Importance of science education to national development and problems militating against its development. *American Journal of Educational Research*, 1 (7): 225-229.

Köseoğlu, Y. 2015. Self-efficacy and academic achievement-a case from Turkey. *Journal of Education and Practice*, 6 (29): 131-141.

Ministry of Education (MoE). 2009. *Strategies for improving science and mathematics education in Ethiopia.* Addis Ababa: Ethiopia.

Pintrich, P., Smith, D., Garcia T., and McKeachie, W. J. 1991. A manual for the use of the motivated strategies for learning questionnaire. (http://files.eric.ed.gov/fulltext/ED338122.pdf). (Accesed Marcth 12, 2016).

Pintrich, P., and Schunk, D. 2002. Motivation in education, theory, research, and applications, 2nd edition. New Jersey: Merrill Prentice Hall.

Ryan, R. and Deci, E. 2000. Self-determination theory. (http://en.wikipedia.org/wiki/Self-determination_theory). (Accesed April 20, 2016).

Sahile, Amare. 2004. Perceived academic competence, motivational orientations and academic achievement of junior and high school students in Bahir Dar administrative zone. MA thesis, Addis Ababa University.

Simpson, R., Koballa T., Oliver, S., and Crawley, F. 1994. Research on the affective dimension of science learning. In Gabel, D. (ed.) Handbook of research on science teaching and learning. New York: Macmillan, PP. 211-234.

Zain, A., Rohandi, and Jusoh, A. 2010. Instructional congruence to improve Malaysian students' attitudes and interests toward science in low performing secondary schools. *European Journal of Social Science, 13* (1): 89-100.