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Damtew Bewket Kitaro
Lecturer, Department of
Mathematics, Assosa University,
Ethiopia

Michael Merga
Lecturer, Department of
Mathematics, Assosa University,
Ethiopia

Lemi Moges
Lecturer, Department of
Mathematics, Assosa University,
Ethiopia

Assessment of factors influencing students' achievement in applied mathematics I: The case of weekend and evening engineering and technology students at Assosa University

Damtew Bewket Kitaro, Michael Merga and Lemi Moges

Abstract

The purpose of this study was to investigate factors influencing students' achievement in Applied Mathematics I in the case of Weekend and Evening Engineering and Technology students at Assosa University. Based on review of the related literature, basic research questions were formulated. Both quantitative and qualitative research methods were used for data gathering. The quantitative data were obtained by using questionnaire and the qualitative data were gathered by using Focus Group Discussion. A pilot study was conducted to validate the instrument using 20 second year university students and was followed by the main study. The final version of the questionnaire was administered for 108 undergraduate Weekend and Evening Engineering and Technology students at Assosa University. The SPSS 20.0 was used for analysis of the data collected by questionnaire. Statistical techniques such as Percentage, Pearson Correlation and t-test were used in the data analysis. The majority of factors that influence students' achievement in Applied Mathematics I are Mathematics self-efficacy, attitude towards Applied Mathematics I, poor prior knowledge in Mathematics, Mathematics Self Concept and Mathematics Anxiety. In addition to this the Pearson Correlation yielded that there is a positive correlation between prior knowledge in Mathematics and the achievement in Applied Mathematics I. Moreover, the t-test showed that there is no significant difference between the achievement of male and female students in Applied Mathematics I.

Keywords: Factors, applied mathematics I, students' achievement, prior knowledge

Introduction

The social and economic development of the country is directly linked with student academic achievement. The students' academic achievement (performance) plays an important role in producing the best quality graduates who will become great leader and manpower for the country thus responsible for the country's economic and social development (Ali *et al.*, 2009) [1].

Mathematics is the subject which is recognized as the mother of all learning with other subjects deriving their concepts from it, in both arts and sciences. It is also an international language and is essential in almost every field, such as handling money, measurements in fashion and carpentry, technical economics, etc. Mathematics is also regarded as the queen of all sciences, such as chemistry, physics, biology, economics, etc. Mathematics is a way of thinking and organizing a logical proof. It can be used to determine whether or not an idea is true, or at least, whether it is probably true as a way of thinking, as it gives insight into the power of human mind and becomes a challenge to intellectual curiosity. No wonder, any individual who is competent in mathematical sciences, can equally have the ability to do any other courses. Consequently, a good performance in mathematics is important (Oseiwu Ali, 2013) [4].

Furthermore, Ethiopia and the world are talking about sustainable development, where STEM (science, technology, engineering, and mathematics) cannot be set aside, nor separated from the plans to achieve sustainable development. According to Nwafor (2012) [5], development is a process, in which the people or the beneficiaries are actively involved in deciding what they need and how to provide for them.

Correspondence

Damtew Bewket Kitaro
Lecturer, Department of
Mathematics, Assosa University,
Ethiopia

As is the case in the past, most people nowadays still think that mathematics is all about computation. However, computation for mathematicians is just a tool for comprehending structures, relationships and patterns of mathematical concepts, and therefore producing solutions for complex real life problems. This perspective of mathematicians has gained more attention and importance with rapid advancements in information and communication technologies. It becomes necessary for people of all ages to reach, analyze and apply the mathematical knowledge effectively and efficiently to be successful citizens in our information age. Particularly, students are expected to be well-equipped with higher-order mathematical knowledge.

In this era of globalization and technological revolution, education is considered as a first step for every human activity. It plays a vital role in the development of human capital and is linked with an individual's well-being and opportunities for better living (Battle & Lewis, 2002). It ensures the acquisition of knowledge and skills that enable individuals to increase their productivity and improve their quality of life. This increase in productivity also leads towards new sources of earning which enhances the economic growth of a country (Saxton, 2000) [3]. The quality of students' performance remains at top priority for educators. It is meant for making a difference locally, regionally, nationally and globally.

Mathematics is an abstract subject, yet important for scientific and technological development in any society. Tella (2008:16) remarked, "Its usefulness in science, mathematical and technological activities as well as commerce, economics, education and even humanities is almost at par with the importance of education as a whole". In Ethiopia, as in most countries, Mathematics is one of the compulsory core subjects in primary and lower secondary levels of education. This is intended to improve mathematical literacy, and steer the country towards economic growth and development. Despite the wide applicability and importance of Mathematics, students consistently perform poorly in the subject, which makes Ethiopia lose economic advantage over other countries, because its students lag behind their counterparts in Mathematics and Science. Hence, Mathematics achievement has been a great concern for researchers, policymakers, educators, teachers, parents and students themselves. But, the desired level of Mathematics Achievement seems to require a dynamic interplay between student, class/teacher, and school factors.

The knowledge of mathematics is an essential tool in our society (Baroody, 1987). It is a tool that can be used in our daily life to overcome the difficulties faced (Bishop, 1996). Due to this mathematics has been considered as one of the most important core subject in a school curriculum. More mathematics lessons are likely to be taught in schools and colleges throughout the world than any other subject (A. Orton, D. Orton, & Frobisher, 2004).

Students' mathematics achievement is often associated with the future economic power and competitiveness of a country. Therefore, the desire to understand and identify factors that may have meaningful and consistent relationships with mathematics achievement has been shared among national policy makers and educators around the world.

Statement of the problem

There are many problems that affect academic achievement of the students. In particular, at the University level there are many factors; like students' background knowledge, facilities

such as well-organized library, class room conditions, teaching and learning materials, offices and etc. which affect the academic achievement of the students in Applied Mathematics I.

Applied Mathematics I is a course delivered to all Engineering Extension students in Assosa University. Over the academic year 2013 to 2016 students' performance in the Applied Mathematics I has been poor. The implication of such low students' achievement in the course means that many students cannot pursue the follow-up Applied Mathematics courses. Poor performance in this area also lowers the Grade Point Average (GPA) of students. This leads one to know about the underperformances in Applied Mathematics related to prior mathematics achievement at the Ethiopian General Secondary School Leaving Examination Certificate (EGSLEC) level or is the underperformance related to other factors. Thus, this research will identify and examine those factors which affect the academic achievement of the students. Among the factors which can be identified as predictors are prior academic achievement, self-efficacy beliefs, Math Anxiety, students' learning styles, academic resources and students' attitude towards mathematics. The question is that what are the factors contributing to the failure in Applied Mathematics? The central of this study is that some factors have a significant effect on academic achievement of students in Applied Mathematics I. Therefore, what are prevailing factors contributing to students' low academic achievement in Applied Mathematics?

Objective of the study

The general objective of the study was to assess factors influencing students' achievement in Applied Mathematics I in the case of weekend and evening engineering and technology students at Assosa University.

The specific objectives of this study were:

- To examine factors which influence the academic achievement of students in Applied Mathematics I.
- To compare the academic achievement of the students in Applied Mathematics I on gender basis.
- To identify the relationship between students' prior mathematics performance and the academic achievement in Applied Mathematics I.

Significance of the study

Mathematics achievement has been a great concern for researchers, policy makers, educators, teachers, parents and students themselves. It is expected that identifying factors that influence students' achievement in Applied Mathematics I in the case of Weekend and Evening Engineering and Technology students at Assosa University will provide instructors, learners and the University with a means of designing and implementing intervention strategies that promote improved results. Furthermore, it will add to the body of existing knowledge on the predictors of Applied Mathematics I achievement in higher education since there is no study to date which has investigated factors that influence Applied Mathematics I achievement with the population identified in the study area.

Limitations of the Study

The following limitations were important to this study. The findings of the study were limited to Assosa University and are only applicable for Weekend and Evening Engineering and Technology students. The validity and reliability of the data collected were dependent on the information given by the participant students.

Methodology

In this study a descriptive survey method followed by correlation analysis was employed.

Data Sources

Primary data were used in this research study. The primary data were collected by using questionnaire survey.

Population

The targeted population of this study were 380 Weekend and Evening program Engineering and Technology students of Assosa University. All students of each department in Weekend and Evening program were included as the population of the study.

Sample and Sampling

A sample size of 108 students was selected from the Colleges by using proportional simple random sampling. A sample size has to be representative of population from which it is selected and there should be no considerable difference between the sample and population on any key characteristics.

Procedure

The data collection instrument was organized and pilot-tested to obtain reliability. Class schedules were reviewed to identify the most appropriate date and time of participants. Potential participants were reached through arbitrarily visits to classes

at each department. The purpose of the study was explained to students and their voluntary participation was requested. Printed questionnaires were distributed to 108 students and 96 students completed and returned it on the same day.

This study was conducted on the bases of descriptive survey method combined with inferential statistics. Therefore, different analysis methods such as percentage, T- test and Pearson’s Correlation were used by researchers.

Result and Discussion

A total of number of 108 students were sampled for this study, from which 96 of them filled the Questionnaires correctly and returned it in given period of time so that it was used in the data analysis.

Characteristics of the Samples

Table 1: Characteristic of respondents by their sex

Sex	Frequency	Percentage
Male	41	42.7
Female	55	57.3
Total	96	100

As it can be observed from Table 1, out of the 96 respondents most of the respondents 55 (57.3%) are females and the rest 41 (42.7%) are males.

Table 2: Factors influencing the achievement of students in Applied Mathematics I

Statements	SD		D		U		A		SA	
	f	%	F	%	F	%	f	%	f	%
Attitude towards Applied Mathematics I.	3	3.1	7	7.3	2	2.1	62	64.6	22	22.9
Poor background knowledge in Mathematics.	3	3.1	8	8.3	2	2.1	50	52.1	33	34.4
Lack of qualified Mathematics teachers.	16	16.7	22	22.9	17	17.7	27	28.1	14	14.6
Lack of adequate study time due to workload.	6	6.3	15	15.6	22	22.9	27	28.1	26	27.1
Lack of using my preferred learning styles.	5	5.2	17	17.7	20	20.8	41	42.7	13	13.5
Mathematics Self Efficacy.	1	1.1	9	9.4	10	10.4	37	38.5	39	40.6
Mathematics Self Concept.	3	3.1	8	8.3	6	6.3	52	54.2	27	28.1
Mathematics Anxiety.	9	9.4	14	14.6	8	8.3	46	47.9	19	19.8
Lack of adequate academic resources for Applied Mathematics I.	9	9.4	23	24	14	14.6	32	33.3	18	18.8
Motivation towards learning Applied Mathematics I.	3	3.1	19	19.8	12	12.5	38	39.6	24	25
Poor prior academic achievement.	8	8.3	15	15.6	9	9.4	41	42.7	23	24
Teaching methods preferred by Applied Mathematics I Teachers.	9	9.4	21	21.9	18	18.8	31	32.3	17	17.7
Assessment methods used by Applied Mathematics I teachers.	11	11.5	19	19.8	14	14.6	30	31.3	22	22.9
Peer influence.	9	9.4	18	18.8	17	17.7	35	36.5	17	17.7

From table 2, it can be seen that 62 (64.6%) respondents agreed and 22 (22.9%) respondents strongly agreed that Attitude towards Applied Mathematics I influenced their achievement. Moreover, 52 (52.1%) respondents agreed and 33 (34.4%) respondents strongly agreed that Poor background knowledge in Mathematics contributed for their achievement to be poor in Applied Mathematics I. It can also be observed that 27 (28.1%) respondents agreed but 22 (22.9%) respondents disagreed that lack of qualified Mathematics teachers influenced their achievement in Applied Mathematics I. It can also be observed that 27 (28.1%) respondents agreed and 26 (27.1%) respondents strongly agreed as lack of adequate study time due to workload influenced their achievement in Applied Mathematics I. The table also indicates that 41 (42.7%) respondents agreed but 20 (20.8%) respondents disagreed that lack of using their preferred learning styles influences their achievement in Applied Mathematics I. Furthermore, 39 (40.6%) respondents strongly agreed and 37 (38.5%) respondents agreed as Mathematics Self Efficacy influenced their achievement in Applied Mathematics I. Similarly, 52

(54.2%) respondents agreed and 27 (28.1%) respondents strongly agreed as Mathematics Self concept influenced their achievement in Applied Mathematics I.

In addition to this, the table indicates that 52 (54.2%) respondents agreed and 46 (47.9%) respondents strongly agreed as Mathematics Anxiety contributed for their achievement in Applied Mathematics I to be poor. The table also shows that 32 (33.3%) respondents agreed but 23 (24%) respondents disagreed that lack of adequate academic resources for Applied Mathematics I influences their achievement in Applied Mathematics I. The table indicates that 41 (42.7%) respondents agreed and 23 (24%) respondents strongly agreed as Motivation towards learning Applied Mathematics I influenced their achievement in Applied Mathematics I.

It can also be seen that 38 (39.6%) respondents agreed and 24 (25%) respondents strongly agreed as Poor prior academic achievement influenced their achievement in Applied Mathematics I.

As it can be observed from the table above 31 (32.5%) respondents agreed but 21 (21.9%) respondents disagreed that teaching methods preferred by Applied Mathematics I Teachers influences their achievement in Applied Mathematics I. Moreover, it can be observed that 30 (31.3%) respondents agreed and 22 (22.9%) respondents strongly agreed that

assessment methods used by Applied Mathematics I teachers influenced their achievement in Applied Mathematics I. As it can be seen from the above table, 35 (36.5%) respondents agreed but 18 (18.8%) respondents disagreed that Peer influence contributed for their achievement in Applied Mathematics I to be poor.

Table 3: Students' prior Mathematics achievement and the achievement in Applied Mathematics I Correlations

		Prior Mathematics Achievement	Applied Math I Achievement
Prior Mathematics Achievement	Pearson Correlation	1	.457**
	Sig. (2-tailed)		0
	N	96	96
Applied Math I Achievement	Pearson Correlation	.457**	1
	Sig. (2-tailed)	0	
	N	96	96

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

As shown in Table 3 above, there is a significant positive relationship between Prior Mathematics Achievement and achievement in applied Mathematics I. This indicates that if students have good prior mathematics knowledge, then their achievement in applied mathematics I will be good. On the

other hand, students have poor prior mathematics knowledge, then their achievement in applied mathematics I will be poor. To find if there is any significant difference in mathematics achievement of male and female students; Applied Mathematics I result of 41 male and 55 female students was analyzed using SPSS 20 and the result is shown in table 4.

Table 4: Students' Applied Mathematics I achievement on gender basis Independent Sample t-test

Sex of respondents	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Male	41	2.3983	0.66739	0.10423	1.006	94	0.317
Female	55	2.2678	0.5987	0.08073			

As it can be seen from Table 4 above, there is no significant difference between males (Mean= 2.3983, SD=.66739) and females (Mean=2.2678, SD=.59870; $t(94)=1.006$ with $p=.317$). Thus, there is no evidence to generalize that significant difference occurred between the achievement of male and female students in Applied Mathematics I since $.317 > 0.05$.

Conclusion

The major findings of this study include

- The study revealed that Mathematics self-efficacy, attitudes towards Applied Mathematics I, Mathematics Self Concept, poor background knowledge in Mathematics and Mathematics Anxiety are among the prominent factors that influence the achievement of students in Applied Mathematics I.
- Moreover, the result showed that there is no significant difference between Applied Mathematics I achievement of male and female students.
- Furthermore, the finding indicated that there is a positive correlation between Prior Mathematics Achievement and the achievement in applied Mathematics I.

Recommendation

Based on the findings of the study, the following possible recommendations are forwarded.

- Any concerned body shall work towards improving the Mathematics self-efficacy, attitude towards Applied Mathematics I, poor background knowledge in Mathematics, Mathematics Self Concept and Mathematics Anxiety.
- To get a better result, all stakeholders shall focus on building strong prior knowledge in mathematics as there is a positive correlation between Prior Mathematics

Achievement and the achievement in applied Mathematics I.

- It could be better if some selected topics are taught before this course in order to fill the knowledge gap.

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