

## EXTENT OF UNDER GRADUATING CLASS UNDERSTANDING ON BASIC EXPONENT AND POLYNOMIAL QUESTIONS OF PRE- CALCULUS MATHEMATICS: ACASE OF AN ETHIPIAN UNIVERSITY BSC MATHEMATICS GRADUATING STUDENTS

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### ABSTRACT

The main purpose of this study was to assess the understanding of BSc mathematics students regarding basic exponent and polynomial questions of pre- calculus mathematics. This study was conducted at one of Ethiopian University, Ethiopia/Africa. Population of the study is 3<sup>rd</sup> year mathematics graduating class at one of Ethiopian University. There was one 3<sup>rd</sup> year mathematics graduating class which contained 41 students in this University in 2016 Where 18 males and 23 females. They have taken several Mathematics courses throughout their university education. Among them 8 males and 8 Females selected by random lottery sampling technique. Parameters of population for this study were all selected 3<sup>rd</sup> year mathematics graduating class at this University. The instruments of this research was a test that prepared by researcher from topic of basic exponent and polynomials. Data was interpreted based on descriptive statistics percentage, mean and standard deviation and inferential statistics T-test. Mean result on exponent and polynomial questions of BSc graduating class male students is 6 (six) out of 11 (eleven) i.e they scored 54.5% and their standard deviation is 1.6. And mean result on exponent and polynomial questions of BSc graduating class female students is 4.75out of 11 (eleven) i.e they scored 43.2% and their standard deviation is 2.0, the significance level is 0.011 less than 0.05 which indicate there is a significant difference in academic performance between males and females on basic exponent and polynomial questions. In the present study, the results showed that Bsc graduating class do not have sufficient exponent and polynomial concept, especially female students. They have difficulty to understand the relationship between positive exponent and negative exponent. It is not possible to teach these operations to pupils unless the teachers explain different and similar features of positive and negative exponents. The data also revealed that some of the student teachers don't know the properties of positive exponent and negative exponent and factorization of polynomials. The study showed that Math major BSc graduating class understanding of basic exponent and polynomial questions are not satisfactory. For this reason it is recommended that the teaching service department and the MOE have to step up conscription efforts.

**KEYWORDS:** Pre- Calculus Mathematics, Random Lottery Sampling Technique, Exponent and Polynomials

### INTRODUCTION

Mathematics and its applications are quickly becoming ever more indispensable in our modern technological world. Advancement in fields of applications has prompted the use of computational techniques unique to particular entities. The discipline of applied mathematics must respond to the demands of conceptual analysis, principles and problem solving for a new world filled with more advanced tools of technology. The emphasis of the applied course is on developing the ability of students to start with a problem in non-mathematical form and transform it into mathematical

language. This will enable them to bring mathematical insights and skills in devising a solution, and then interpreting this solution in real-world terms.

Ethiopia is one of the developing countries in Africa, in terms of Science and Technology, Agriculture, Industry, Irrigation and Education. In such a country, the role of mathematics is very important in all aspects. The knowledge of the mathematician can be utilized in various fields. Mathematics is one of the great unifying themes in today's world of scientific era. It is a language, a science, an art form and a tool of tremendous power. Every area of mathematics has its own unique applications to the different career options. For example, Algebra is very important for computer science, cryptology, networking and the study of symmetry in Chemistry and Physics. Analysis (including differential equations) is used in Chemistry and Biology and Physics, Engineering, the motion of water (hydrodynamics), Molecular structure and option price modeling in Business and Economics models.

Quality education is a concern and a challenge to all nations of the world. This is due to the rapidly changing technology and hence changing job demands that have forced the focus of education to change. Today, we live and work in an era dominated by computers, world-wide communication and a global economy. Jobs that contribute to this economy will require workers who are prepared to absorb new ideas, to perceive patterns and solve unconventional problems. As a result, today's employers require workers with higher mathematics skills than in the past. The ability to solve problems, to make conjectures, and to communicate verbally in writing are also increasingly valued in the workforce (IHEANACHOR, 2007).

Mathematics is the key to opportunity for these jobs. Through mathematics, we learn to make sense of things around us. Steen (1989) pointed out that as technology has 'mathematic zed' the workplace, and as statistics has permeated the arena of public policy debate, the mathematical sciences have moved from being a requirement only for future scientists to being an essential ingredient in the education of all students.

Industry expects school graduates to be able to use a wide variety of mathematical methods to solve problems wherever they arise. Therefore, economic necessity demands renaissance of mathematics teaching and teaching (Steen, 1989).

A number of factors may influence the teaching of mathematics but teachers play an important role in the teaching process. The common belief in society is that, if a mathematics teacher knows mathematics very well, he or she is the best person to teach mathematics (Elif B. 2007).

Students' achievement in mathematics depends on a complex interplay of factors both within and outside the classroom. These factors range from teacher's background qualifications, subject majors and years of experience to the professional development the teachers have received to support their teaching and the teaching practices the teachers use to accomplish their teaching, among other factors. The predominance of teachers not qualified to teach could be one of the reasons for the poor academic performances of students in mathematics. Research shows us that the influence of teachers is the single-most important factor in determining students' achievement (IHEANACHOR, 2007), indicate that the impact of a teacher (for good or for bad) is cumulative, having a students with less exposure to qualified teachers, therefore, seem far less likely of achieving academic success than those with more. The goal of teaching is to establish a foundation of knowledge that allows the students to build on as they are exposed to different life experiences.

It is also an essential thing to carry out a research work on gender difference and achievement in mathematics. Gender difference and achievement in Mathematics have attracted the interest of a number of researchers in the recent past researches. Some studies showed that Female performs lower in mathematics and mathematics is a masculine subject which belongs to selected few (Kurumeh and Iji 2009). Some studies reported significant difference in favor of male students by indicating that male students have higher mathematical reasoning ability or perform better than female students (Wushishi and usman 2013). Other studies reported no significant difference in mathematics achievement of male and female students (Popola, 2008). This study therefore investigated understanding of 2016 BSC graduating class on pre-calculus mathematics and examines gender difference on pre-calculus mathematics.

## **RESEARCH QUESTIONS**

### **Statement of the Problem**

This University is one of public university in Ethiopia. As a result the MOE of Ethiopia formed six clusters from all public universities and designed a relatively common and standardized curriculum in six areas of science in 2012. These curricula have been implemented since 2012/13 academic year (MOE 2013). Mathematics profoundly influences the socio-economic development of a society and civilization. Thus, it is imperative that students be equipped with strong Mathematical knowledge and skills which enable them to be productive in areas where rigorous thought and precision of results are emphasized. It is clear that Curriculum development is also a dynamic process which requires continuous assessment. Thus updating and harmonizing national curriculum is vital to ensure the quality, standard and relevance in line with the objective conditions of the country (MOE 2013. The whole body of knowledge in mathematics is a process which involves some of the enumerated skills. So, we must find a way to teach mathematics, not just for beneficiaries, but also as partakers in deciding the course of development, and this cannot be achieved unless we identified factors militating against academic achievement in mathematics, and to tackle them. When we turn out graduates with mass failure or poor pass in mathematics, those graduates cannot successfully partake in sustainable development (Ali, 2013) In other words that set on the curriculum (To provide an in-depth understanding of the fundamental principles and techniques of Mathematics. To develop Mathematical thinking, reasoning and an appreciation of Mathematics as a primary language of science) may be on under question.

As Fennema and Franke in (Elif B. 2007) argue that if a teacher has a conceptual understanding of mathematics, this influences classroom instruction in a positive way; therefore, it is important to have mathematics knowledge for teachers.

It is important to examine current situation of understanding of mathematics BSc graduating class on pre-calculus mathematics.

The study will contribute to mathematics education literature; it will open up new possibilities for improving mathematics teaching and students' achievement in mathematics. It will give information about Mathematics is still in a major crisis even for some of the first class candidates with biases towards mathematics subjects and currently Bsc graduating teachers', who major mathematics itself. Thus, it will provide useful information that can be used to make recommendations to universities, college, department administrators and all stakeholders.

## OBJECTIVE OF THE STUDY

The objective of this study was to examine extent of understanding of 2016 BSc graduating class students' on basic exponent and polynomial concept of pre-calculus mathematics. The following objectives will assist in achieving the main aim of this study:

- To investigate understanding of BSc graduating class on basic exponent and polynomial concept of pre-calculus mathematics
- To investigate if there is significant difference between males and females on basic exponent and polynomial concept of pre-calculus mathematics

Based on the objectives the following research questions were formulated to guide the study:

- What is the level of academic performance of BSc graduating class on some of pre-calculus mathematics basic exponent and polynomial questions?
- Is there any significant difference in academic performance of between two genders on pre-calculus mathematics?

## RESEARCH METHODOLOGY

### Population and Sample

This study was conducted in one of Ethiopian University /Africa. Population of the study is 3<sup>rd</sup> year mathematics graduating class at this university. There was one 3<sup>rd</sup> year mathematics graduating class which contained 41 students at this University in 2016 which was the collection of 18 males and 23 females. They have taken several courses throughout their university education. Among them 8 males and 8 Females selected by random lottery sampling technique. Parameters of population for this study were all selected 3<sup>rd</sup> year mathematics graduating class at selected University.

### Design of the Study

The researcher designed his research in the form of quantitative case study in the view of examine extent of understanding of 2016 BSc graduating class students' on pre-calculus mathematics particularly basic exponent and polynomial concepts. Quantitative data was analyzed based on descriptive statistics and inferential statistics.

Descriptive statistics: - Data obtained from the participants initially was examined to get descriptive statistics of the percentage, mean, and standard deviation is used. Inferential Statistics:-Using the T-test the data were analyzed to determine whether there is significant difference between two genders on basic exponent and polynomial concept of pre-calculus mathematics. Significant difference between two genders has been tested at the 0.05 level of significance.

This research was designed to investigate extent of understanding of 2016 BSc graduating class students' understanding on basic exponent and polynomial concept of pre-calculus mathematics at this University.

Instruments: a test that was prepared by the researcher from topic of pre-calculus mathematics and reliability and validity of the test was examined by two of his colleagues.

### Data Analysis Technique

The Prepared tests were distributed by the researchers and then collected for analyses. Thus, the collected data were organized, interpreted and analyzed using a percentage, mean, standard deviation and T-test of the test, and then

followed by analyses from which summary and conclusions were drawn. Numerical value was multiplied by corresponding values assigned to the degree of agreement. To obtain the rating mean the sum of the products of the value and frequency was divided by the total number of the respondents. Then all rating means within a category that was added and then divided by the number of cases to determine the ground mean. Based on the ground mean interpretation was made and conclusions have been drawn on the basic questions. The standard deviation was used to show how far responses where it has been scattered from grade mean. To assess the significance difference between two genders deviation of pre-calculus mathematics T-test was conducted.

**PRESENTATION AND ANALYSIS OF DATA**

In this section, the analysis and interpretation of data and the major findings are presented.

**Characteristics**

A characteristic of the subjects is 3<sup>rd</sup> year BSc graduating class of mathematics department in 2016 one of Ethiopian University.

The students were given basic exponent and polynomial questions. Analyses of students’ response to questions items are presented below

- For question number one: What is the level of academic performance of BSc graduating class on some of pre-calculus mathematics basic exponent and polynomial questions?

**Exponents: Simplify the Following Expressions. Do Not Leave Negative Exponents in Your Final Answer? Leave all Answers in Fully Reduced Form**

**Table 1**

Item No	Male				Female				Total			
	Incorr		Corr		Incorr		Corr		Incorr		Corr	
	f	%	f	%	f	%	f	%	f	%	f	%
A, $y^3 y^4$	1	12.5	7	87.5	2	25	6	75	3	18.8	13	81.2
B, $(y^3)^4$	2	25	6	75	0	00	8	100	2	12.5	14	17.5
C, $(3a^4)^2$	3	47.5	5	52.5	2	25	6	75	5	31.3	11	68.7
D, $2^0$	0	0	8	100	5	62.5	3	37.5	5	31.3	11	68.7
E, $(1/4)^{-2}$	5	62.5	3	37.5	8	100	0	00	13	81.3	3	18.8
F, $(-2x)^{-4}$	8	100	0	00	8	100	0	00	16	100	0	0
G, $((3x^2 y^{-1})/(x^{-1} y^2))^{-2}$	8	100	0	00	8	100	0	00	16	100	0	0

As can be seen from the above table 1, the first item educes information on the degree which male and female BSc graduating class of mathematics solves different exponent with the same base question. To  $y^3 y^4$  item (12.5%) of male student and (25%) of female students were not able to solve it, the second item educes information on the degree which male and female BSc graduating class of mathematics solves  $(y^3)^4$ . To this item 25% of male student none of female students were not able to solve it, the third item educes information on the degree which male and female BSc graduating class of mathematics solves  $(3a^4)^2$ . To this item 47.5% of male and 45% female were not able to solve it, the fourth item educes information on the degree which male and female BSc graduating class of mathematics solves  $2^0$ . To this item none of male and 62.5% female were not able to solve it, the fifth item educes information on the degree which male and female

BSc graduating class of mathematics solves  $\left(\frac{1}{4}\right)^{-2}$ . To this item 62.5% of male and 100% of sampled female students were not able to solve it, the sixth item educs information on the degree which male and female BSc graduating class of mathematics solves  $(-2x)^{-4}$ . To this item 100% of sampled male students and 100% of sampled female students were not able to solve it; the sixth item educs information on the degree which male and female BSc graduating class of mathematics solves  $\left(\frac{3x^2y^{-1}}{x^{-1}y^2}\right)^{-2}$ . To this item 100% of sampled male students and 100% of sampled female students were not able to solve it.

### Polynomials: Simplify the Following Polynomials

Table 2

Item No	Male				Female				Total			
	Incorr		Corr		Incorr		Corr		Incorr		Corr	
	f	%	f	%	f	%	f	%	f	%	f	%
A, $2x+3y-4x+5y$	1	12.5	7	87.5	2	25	6	75	3	18.8	13	87.2
B, $(7x^2 y^2+4xy^2-5x)-(4x^2 y^2-3xy^2+5)$	5	62.5	3	37.5	6	75	2	25	11	68.75	5	31.25
C, $7a^3 (4a^2-5a)-2a^2 (3a^3-6a^2)$	3	37.5	5	62.5	3	37.5	5	62.5	6	37.5	10	62.5
D, $(2a+b)^2-(2a-b)^2$	5	62.5	3	37.5	6	75	2	25	11	68.75	5	31.25

As can be seen from the above table 2, the first item educs information on the degree which male and female BSc graduating class of mathematics solves  $2x + 3y - 4x + 5y$ . To this item (12.5%) male student and (25%) female students were not able to solve it. the second item educs information on the degree which male and female BSc graduating class of mathematics solves  $7a^3(4a^2 - 5a) - 2a^2(3a^3 - 6a^2)$ . To this item 62.5% of male student 75% of female students were not able to solve it, the third item educs information on the degree which male and female BSc graduating class of mathematics solves  $(7x^2y^2 + 4xy^2 - 5x) - (4x^2y^2 - 3xy^2 + 5)$ . To this item 37.5% of male and 35.5% female were not able to solve it, the fourth item educs information on the degree which male and female BSc graduating class of mathematics solves  $(2a + b)^2 - (2a - b)^2$ . To this item 62.5 of male and 75% female were not able to solve it.

- **For research question number two** (Is there any significant difference in academic performance of between two genders on pre-calculus mathematics?)

Table 3: Paired Samples Statistics

		Mean	N	%	Std. Deviation	Std. Error Mean
Pair 1	Male students	6.0000	8	54.5	1.60357	.56695
	Female students	4.7500	8	43.2	2.05287	.72580

As Table 3 shows as, mean result on exponent and polynomial questions of BSc graduating class male students is 6 (six) out of 11 (eleven) i.e they scored 54.5% and their standard deviation is 1.6. And mean result on exponent and polynomial questions of BSc graduating class female students is 4.75 out of 11 (eleven) i.e they scored 43.2% and their standard deviation is 2.0

**Table 4: Paired Samples Test**

	Paired Differences					t	Df	Sig. (2-Tailed)
	Mean df	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Male students - Female students	1.25000	1.03510	.36596	.38464	2.11536	3.416	7	.011

From table 4 the significance level is 0.011 less than 0.05 which indicate there is a significant difference in academic performance between two genders on basic exponent and polynomial questions

## CONCLUSIONS

In Ethiopia all BSc mathematics gradutors become high school teachers after they took additional one year pedagogy course. The focus of this study was also the graduating class who will join high school as a teacher in the following year. This is the reason why the researcher focuses on this group. In the present study, the results showed that Bsc graduating class do not have sufficient exponent and polynomial concept, especially female students, as it has been seen from the data they have difficulty to understand the relationship between positive exponent and negative exponent. If the teacher does not explain different and similar features of positive exponent and negative exponent, it's not possible to teach these operations to pupils. The data also revealed that some of the student teachers don't know the properties of positive exponent and negative exponent and factorization of polynomials. Iheanachor (2007) indicate that, if all mathematics teachers were highly qualified it is likely that the students' achievement will begin to rise. As stated in Iheanachor (2007), study also found that teachers' subject majors in mathematics or mathematics education correlated positively and significantly with students' achievement. This implies that if the students have chance to learn mathematics by intellectuals who major mathematics and have better performances, their achievement will progress.

## RECOMMENDATION

The study showed that Math major BSc graduating class understanding on basic exponent and polynomial questions are not satisfactory

- It is therefore extremely important that the teaching service department and the MOE have to step up conscription efforts.
- In order to strengthen mathematics, Universities have to take an action like tutorial to fill the gap.

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