

Students' Beliefs toward Mathematics as Related to Their Performance in College Algebra

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Abstract - The study was to determine the beliefs of SLSU-San Juan BSED freshmen towards mathematics and their performance in college algebra . Data gathered were analyzed and interpreted using Weighted Mean, Percentages, Pearson r, and the Point Biserial coefficient of correlation. Findings showed that students' educational background is 62% and 38% from public and private respectively. Majority (66%) strongly agreed that mathematics is a challenging subject and 34% considered the latter as one of the difficult subjects. Relationship between beliefs about mathematics and performance in college algebra is statistically significant at 0.05. Relationship between students' educational background and performance in college algebra was found to be not significant. The study proved that male students have better performance in college algebra than female. Students with positive beliefs about mathematics performed better in the subject. Educational background of the students was not a determinant for having good performance in college algebra. Considering the result of the study, teaching development program focusing on giving the importance of belief in teaching college algebra was recommended. Thus, values formation towards mathematics will be integrated in lesson planning to build positive beliefs.

Keywords - Students' performance in Algebra, beliefs, gender and educational background.

INTRODUCTION

Almost two decades of research revealed how students' beliefs shape their cognitive and affective processes in the classroom. In learning environment, students' belief might propagate the idea for achievements and smoothness of learning. In the mathematics learning process, student's belief about the nature of Mathematics and factors related to learning are two components that always concern mathematics educator (Lester, Garofalo, & Kroll, 1989).

As mentioned in the National Council of Teachers of Mathematics Standards (1998), students' beliefs about learning and beliefs about the nature of the subject matter affect their learning. This significantly affects the appreciative dimension of the learning since students' perceptions and beliefs about mathematics are based on what they do in the classroom.

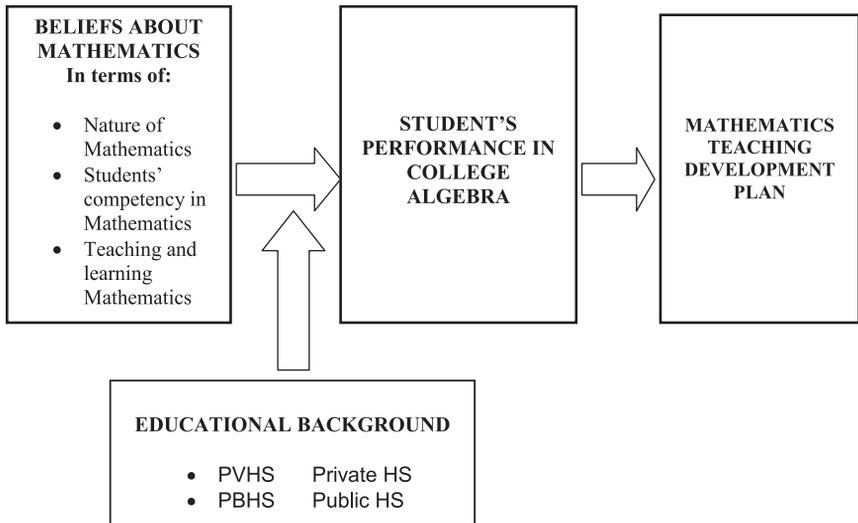
Past researches revealed how students' beliefs shape their cognitive domain in the learning processes. Students' mathematics-related belief systems are rarely intensively studied, in spite of the fact that Schoenfeld (1999) even in his initial publication already pointed out that the systemic nature is one of the key features of the functioning of beliefs. He clarified that belief systems are one's mathematical world view, the perspective with which one approaches mathematics and mathematical tasks.

Garcia (2008) on his unpublished thesis cited that students who have Poor mathematical ability have beliefs far different from those who are Excellent. It provides possible possibilities that beliefs have direct implication in the performance of students in mathematics. He added that a negligible relationship was found for beliefs in terms of the students' competency, teaching and learning of the subject. The researcher developed interest to further examine the consistency or contradiction of what have been cited from the previous studies.

FRAMEWORK

The conceptual framework for this study has been patterned from Cobb & Yackel, 1998. They have concluded that beliefs and knowledge operate in close interaction. Schemas or mental models are considered higher-order constructs that characterize on a conceptual level the integrated functioning of knowledge and beliefs. The current study is aimed at testing the same relationship by using College Algebra students' data. The study considered the students' beliefs about Mathematics as the independent variable. The dependent variable was the student's performance in College Algebra. To further the description and analysis of results, educational background was considered as an intervening variable.

As shown in Figure 1, students' beliefs about mathematics were categorized as beliefs about the nature of Mathematics, competency of students in Mathematics, learning and teaching Mathematics.



OBJECTIVES OF THE STUDY

The purpose of this study was to determine the beliefs of SLSU-San Juan BSEd freshmen towards mathematics and their performance in algebra. Specifically, this study aimed to determine students' educational background, and student beliefs in terms of the nature of mathematics, students' competency in mathematics, teaching and learning mathematics.

It also sought to test the significant relationship between students' beliefs towards mathematics, and the relationship between students' educational background and their performance in college algebra.

MATERIALS AND METHODS

The study examined the students' belief towards mathematics and their performance in college algebra. It started at the early start of the second semester of AY 2010-2011. The respondents of this study were all SLSU-San Juan BSED freshmen students taking up college algebra.

The study utilized the following instruments:

- a. Self-made assessment test in algebra,
- b. Student portfolio/school records,
- c. Questionnaire on the beliefs towards mathematics.

In order to meet the research objectives, a mathematics belief questionnaire was constructed based on the outlined theoretical considerations. Basically, the questionnaire consists of three dimensions to represent four facets in student's beliefs. The dimensions include the beliefs about the nature of Mathematics, students' competence in Mathematics, and teaching and learning Mathematics,

The responses of the respondents on the items were categorized using the following scales:

Scale	Interpretation
1	Strongly Disagree (SD)
2	Disagree (D)
3	Uncertain (U)

- 4 Agree (A)
5 Strongly Agree (SA)

Students' educational background was determined using form 137 and was categorized as (PVHS) Private High School and (PBHS) Public High School.

The other instrument is the 40 items self-made assessment test which was constructed based on the college algebra competencies.

Performance in college algebra of the students was categorized based on the following scale:

<i>Grade</i>	<i>Category</i>
70-74	Poor
75-79	Below Average
80-84	Average
85-89	Above Average
90-95	Excellent

The data gathered from the responses in the questionnaires were analyzed and interpreted using the following statistical tools: Weighted Mean and Percentages which was used in describing the students' beliefs towards mathematics and their performance in college algebra, the Pearson r , the Point Biserial, and the coefficient of correlation.

RESULTS AND DISCUSSION

Educational Background of the Student

Table 1 shows the educational background of the students where 62% of the students were coming from public high school and only 38% from private. In terms of population, female outnumbered male in both private and public institutions. Relatively, previous survey revealed that there were more women than men who enrolled in the university during the SY 2000-2001 with 55.5% while only 44.5% for men. Specifically, women outnumbered men in Trade and Craft and Industrial courses and Mass Communication and Documentation (National Statistics Office, 2002)

Table 1. Educational background of the students

	Male	Female	Total	Percent
Private HS	4	20	24	41%
Public HS	6	28	34	59%
Total	10	48	58	100%

Students Performance in College Algebra

The weighted mean 3.1 and 2.42 shown in Table 2 implies that male students perform better in algebra than female students. The same table further shows that more than half 56% (26 out of 48) of female students fall below average level compared to male with only 20% (2 out of 10) below average. Results revealed not in favor to Elizabeth Spelke’s (2010) who claimed that males and females show no difference in their intrinsic aptitudes for math or science. In her article published in “American Psychologist,” Spelke rejects several aspects of the myth that males outperform females in these subjects.

Table 2. Students performance in college algebra

	E		AA		A		BA		P		TOTAL		
	f	%	f	%	f	%	f	%	f	%	f	%	wm
Male	1	10%	2	20%	5	50%	1	10%	1	10%	10	100%	3.1
Female	1	2.1%	9	18.7%	12	25%	13	27.1%	13	27.1%	48	100%	2.42
Total	2	3.4%	11	19.0%	17	29.3%	14	24.1%	14	24.1%	58	100%	2.53

Legend: E = Excellent
 AA = Above Average
 A = Average
 BA = Below Average
 P = Poor

Beliefs of the Students towards Mathematics in Terms of the Nature of Mathematics

Table 3 reflects the beliefs of the students toward mathematics in terms of its nature. As shown, most (32 out of 58) of the students agreed that mathematics is a way of thinking using symbols and equations. The same number of students strongly disagreed that mathematics is not important in real life. This implies that they were able to see the usefulness and applicability of mathematics.

Similar results were observed in items 2 and 8, where (27 out of 58) and (26 out of 58) respectively were undecided that mathematics is an assurance to succeed, and mathematics enables men understand the world better. However, majority (38 out of 58) of the students strongly agreed that mathematics is a challenging subject. Indeed, 20 out of 58 or 34% of the students strongly agreed that mathematics is considered as one of the difficult subjects.

Table 3. Beliefs of the students towards mathematics in terms of the nature of mathematics

Items	SA	A	U	D	SD	wm
1. Mathematics is a way of thinking using symbols and equations.	32	19	4	2	1	4
2. Mathematics is an assurance to succeed	2	22	27	7	0	3
3. Mathematics is not important in real life.	3	4	5	14	32	2
4. Mathematics is a field of manipulating numbers and symbols.	24	27	3	3	1	4
5. Mathematics is a challenging subject.	38	16	3	1	0	5
6. Mathematics is considered as one of the difficult subjects.	20	19	16	9	2	4
7. Mathematics does not provide foundations for applied sciences.	26	14	10	5	3	4
8. Mathematics enables men understand the world better.	1	3	13	26	15	3

Beliefs of Students toward Mathematics in terms of their Competence

As shown, a total of 25 (10 strongly agreed and 15 agreed) the

statement “I like Mathematics”. It points out that the love for this subject is rational. For Item 2 in the same table, only one strongly agreed and seven agreed that they are not interested in Mathematics. In addition, the weighted mean 2 indicates that majority disagreed the statement. The preceding items 4, 7, and 8 show that students were undecided (24 out of 58) if they can do mathematics problems, (27 out of 58) understand even the most difficult materials presented in a mathematics course, and (35 out of 58) if they are good in computation.

Table 4. Beliefs of the students about mathematics in terms of their competency

Items	SA	A	U	D	SD	wm
1. I like mathematics.	10	15	25	4	4	3
2. I'm not interested in mathematics.	1	7	14	20	16	4
3. I can understand even the most difficult material presented in a mathematics course.	1	8	27	20	2	3
4. I don't think I can do mathematics problem .	0	8	24	22	0	3
5. I have been doing well in mathematics.	3	27	21	6	1	3
6. I have been interested in mathematics since primary school.	6	18	21	9	4	3
7. I really hate mathematics since grade I	2	5	12	25	14	2
8. I am good in computation.	8	9	35	3	3	3

Beliefs of the Students toward Mathematics in terms of Learning and Teaching the subject

Table 5 shows that in item 1 only 18 out of 58 agreed that learning the origin of mathematics makes the subject not interesting. This implies that majority of the respondents considered learning mathematics as an interesting activity when they also learn its origin. Out of 58 respondents, 31 agreed and 12 strongly disagreed in Item 2 of the same table. This indicates that most of the respondents believed on the importance of drill and practice for better learning in mathematics.

In the succeeding item, three respondents did not believe that trying to solve until the correct answer is determined makes mathematics easy to understand. In item 4, (25 out of 58) were undecided if they

can do well in mathematics when their teacher let them discover how to do mathematics on their own. However, similar results in items 5 and 6 confirmed that students would not ignore any mistakes when it is being observed. Responses in item 9 proved independent learning among tertiary students, as revealed, 44 out of 58 were not in favor of copying answers from their classmates. However, team work was also practiced by 55% of the students as reflected in item 10. In all probability, students were challenged with unique mathematical problems as shown in items 15 and 16 in which almost 100% responded positively.

Table 5. Beliefs of the students about mathematics in terms of learning and teaching the Subject

Items	SA	A	U	D	SD	wm
1. Learning about the origin of mathematics concept makes mathematics not enjoyable.	3	19	18	14	4	3.05
2. I don't believe drills and practice is one of the best ways in learning mathematics.	2	7	6	31	12	2.24
3. Trying to solve until the correct answer is determined makes mathematics easy to understand.	20	24	11	3	0	4.05
4. I cannot do well in mathematics when my teacher let me discover how to do mathematics on my own.	4	8	25	18	3	2.86
5. When I spot a mistake in the solution steps of a problem solved on the board, which happens to be the same mistake I usually commit in a test, I try to correct the mistake.	11	31	11	5	0	3.83
6. When I spot a mistake in the solution steps of a problem solved on the board, which happens to be the same mistake I usually commit in a test, I will ignore everything.	0	3	9	35	11	2.07
7. When my classmates' solution of a problem is entirely different from my own, I will compare solution to his solution.	7	23	18	6	4	3.4
8. When my classmates' solution of a problem is entirely different from my own, I will check or review my solution.	14	35	6	3	0	4.03
9. When my classmates' solution of a problem is entirely different from my own, I will copy the solution of my classmate.	0	4	10	24	20	2.31

10. When my classmates' solution of a problem is entirely different from my own, I will discuss the solution with my classmate.	5	27	19	6	1	3.5
11. When my teachers forget an important fact related to the days lesson and refers the class to a book in the library for verification, I will not go to the library.	1	5	14	26	12	2.26
12. When there are contradictions or inconsistencies between statement and words in mathematical problem, I will ask the teacher to clarify or correct to contradiction or inconsistencies.	7	31	16	3	1	3.69
13. When there are contradictions or inconsistencies between statement and words in mathematical problem, I will analyze the contradiction or inconsistencies.	7	29	18	4	0	3.67
14. When I doubt whether my answer to a problem is correct or not, I review or check my answer.	16	35	5	2	0	4.12
15. When I see that a mathematical problem is unique and is so different from the problem I usually encountered, I will skip the problem.	0	10	23	18	7	2.62
16. When I see that a mathematical problem is unique and is so different from the problem I usually encountered, I will try to solve it.	11	41	4	2	0	4.05

Significance of relationship between beliefs toward mathematics and performance in college algebra

As presented in Table 6, the correlation coefficient between beliefs about mathematics and performance in college algebra is 0.5475 and is quite a bit higher than the critical value 0.2732. It indicates that relationship between the two is statistically significant.

Table 6. Significance of relationship between beliefs about mathematics and performance in college algebra

Variables	df	Critical Value	Correlation coefficient	Interpretation	Results
Beliefs about mathematics vs performance in college algebra	56	.2732	0.7716	Very high positive correlation	Significant

Significant at .05

Figure 1 shows the graph of correlation between beliefs about mathematics and performance in college algebra. The dots are closely located at the line, it signifies almost perfect positive correlation of the variables.



Figure 1. Correlation coefficient between beliefs towards mathematics and performance in college algebra

Significance of Relationship between Student's Educational Background and Performance in College Algebra

Table 7 shows the computed value 0.0018 which signifies negligible correlation. Hence, the computed value is lesser than the critical value 0.2732, the relationship between the two variables is not significant. It means that the educational background of the students is not a determinant to have good performance in college algebra.

Table 7. Significance of relationship between students educational background and performance in college algebra

Variables	df	Critical Value	Correlation coefficient	Interpretation	Results
Public High School vs Private High School	56	.2732	0.0018	negligible	not significant

Significant at .05

CONCLUSIONS

From the findings of the study, the research formulated the following conclusions:

1. Population distribution is an evidence of gender profession preference.
2. Male students have better performance in college algebra than female students
3. Majority of the students have positive beliefs about mathematics
4. Beliefs toward mathematics varied performance in college algebra. Hence, students with positive beliefs about mathematics perform better in college algebra than those who have negative beliefs.
5. Educational background of the students is not a determinant of students' performance in college algebra.

RECOMMENDATIONS

From the aforementioned conclusions, it is being recommended that there should be teaching development program focusing on giving the importance of belief in teaching college algebra. Thus, values formation towards mathematics will be included in lesson planning to build positive beliefs. Finally, mathematics instructors, department heads, dean of the undergraduate studies, parents and other stakeholders should be informed on the result of this study so they will be able to understand the importance of beliefs in learning college algebra.

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