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Beliefs in Mathematics of Senior High School Students

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Abstract— *Teachers often believe that boys learned faster than girls in Mathematics. Students sometimes feel that they perform poorly or good in Mathematics because of their gender. This investigation focuses on determining the beliefs of senior high school students on Mathematics. A quantitative-descriptive research design was used and 350 students were selected as respondents from a population of 2,000 students enrolled in the senior high school department of the Basilan National High School. Findings revealed that students have some belief in Mathematics, particularly that Mathematics has its role, function, and significance; they have competence in Mathematics; Mathematics is a social activity and a domain of excellence. Belief in Mathematics of students has no difference according to their gender.*

Keywords— *Senior High School Students, beliefs in Mathematics, Basilan National High School, MBRQ.*

I. INTRODUCTION

The human person's belief system is dynamic and changeable and when individuals evaluate and assess their experiences and beliefs, then they are restructuring their system continuously [9]. Researchers agree that beliefs evolve as individuals are exposed to the ideas and more of their parents, peers, teachers, neighbors, and various significant others. They are acquired and fostered through schooling, through the informal observation of others, and the folklore of a culture, and they usually persist, unmodified, unless intentionally or explicitly challenged [1]. That is, beliefs evolve and develop over time through an individual's socialization process in the daily interaction with other members of society [1]. Beliefs play a great role in mathematics learning and teaching. The learning outcomes of students are strongly related to their beliefs and attitudes about mathematics [4].

In the context of beliefs in mathematics, stereotyping is the most common belief of not only teachers but even the students. They believe that men are more active or dynamic when it comes to learning mathematics. Gober in [5] states that retaining women in mathematics courses and careers becomes a problem between early elementary school and high school on which during this period, many girls lose interest in mathematics and also lose confidence in their ability to succeed in the subject. Since daily educational decisions that take place in school are made by teachers, teachers are not immune to holding negative stereotypes about girls in mathematics. Again, girls are seen as successful due to their hard work [10], while boys' success is attributed to their talent [6].

Classroom interactions, both with the teacher and other students, are critical components of education. Whether one looks at preschool classrooms or university lecture halls, at female teachers or male teachers, research spanning the past twenty years consistently reveals that males receive more teacher attention than do females [2]. In preschool classrooms, boys receive more instructional time, more hugs, and more teacher attention [3]. This pattern continues through elementary and high school years. After longitudinal studies on this behavioral and instructional pattern, Sadker & Sadker [8] reported that boys in elementary and middle school called out answers significantly more often than girls did.

In this context, the present investigation was conducted to identify the beliefs of students in mathematics. Knowing these beliefs may assist in providing the solution to the existing problems of gender biases among students in mathematics.

II. METHODOLOGY

This study is a descriptive–quantitative research design and the target population is the senior high school students of Basilan National High School, Isabela City, Basilan Province, Philippines. There are 2,000 senior high school students officially enrolled in Basilan National High School of which 350 were selected as respondents. A Mathematics-Related Belief Questionnaire (MBRQ) formulated by Op't Eynde and De Corte in [7] was adopted to determine the beliefs in mathematics of senior high school students. A five-point Likert scale was used ranging from strongly disagree to strongly agree. The MBRQ has four areas such as role and function, the significance of and competence in mathematics, mathematics as a social activity, and mathematics as the domain of excellence. The data was gathered through one-on-one interviews.

III. RESULTS AND DISCUSSIONS

This section will present the discussions of the data gathered. The presentation will be based according to the areas or domains under the MBRQ. Mostly, the respondents were female students (54.43%), that is, 194 female students.

Role and Function

This section shows the belief of students in the area of role and function.

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TABLE I. Mean distribution of the beliefs of students in Mathematics under the area of role and function

Role and Function	Mean	Interpretation
1. Our teacher is friendly to us.	4.54	Strongly a Belief
2. Our teacher listens carefully when we ask for something.	4.58	Strongly a Belief
3. Our teacher understands the problems and difficulties we experience.	4.15	Somewhat a Belief
4. Our teacher does not care how we feel in class. She/he is absorbed with the content of this mathematics course (reverse).	2.92	Undecided
5. Our teacher cares how we feel in the mathematical lessons.	4.23	Somewhat a Belief
6. Our teacher appreciates it when we have tried hard, even if our results are not so good	4.45	Somewhat a Belief
7. Our teacher wants us to enjoy learning new things.	4.52	Strongly a Belief
8. Our teacher wants us to understand the content of this mathematics course, not just memorize it	4.51	Strongly a Belief
9. Our teacher tries to make mathematics lessons interesting.	4.44	Somewhat a Belief
10. Our teacher gives us the time to explore new problems and try out possible solution strategies.	4.37	Somewhat a Belief
11. Our teacher thinks mistakes are okay as long as we are learning.	4.33	Somewhat a Belief
12. Our teacher thinks she/he knows everything best (reverse).	3.86	Somewhat a Belief
13. Our teacher first shows us step by step how we have to solve a specific mathematical problem before he gives us similar exercises.	4.57	Strongly a Belief
14. Our teacher explains why mathematics is important.	4.45	Somewhat a Belief
15. We are not allowed to ask fellow students for help during classwork.	3.40	Undecided
16. We do a lot of group work in this mathematics class.	3.92	Somewhat a Belief
Area Mean	4.20	Somewhat a Belief

Students have a strong belief that their teachers are friendly, listen carefully when asked by students, want students to enjoy learning new things, want students to understand the content of the mathematics course (not just memorizing it), and show students a step step solutions on how to solve a specific mathematical problem before giving similar exercises.

Students somewhat believe that their teachers understand their problems and difficulties that they experience, cares about the students' feeling in the mathematical lesson, appreciate student efforts for trying hard, makes the lessons interesting, gives enough time for the students to explore new problems and possible solutions, makes the students feel that they making mistakes is part of learning, makes the student feel that they know everything, explain thoroughly the importance of mathematics, provide students group works in mathematics class.

Moreover, the students are undecided on the item that their teachers do not care about their feelings in class or teachers are absorbed with the content of the mathematics course. Overall, students somewhat believe in the role and function of teachers in mathematics.

Significance of and Competence in Mathematics

This section shows the belief of students under the significance of Mathematics and competence in Mathematics.

TABLE II. Mean distribution of the beliefs of students in Mathematics under the area of the significance of and competence in Mathematics

Significance of and Competence in Mathematics	Mean	Interpretation
17. I like doing mathematics.	3.54	Somewhat a Belief
18. I believe that I will receive this year an excellent grade for mathematics.	3.45	Undecided
19. I'm very interested in mathematics.	3.57	Somewhat a Belief
20. Taking into account the level of difficulty of our mathematics course, the teacher, and my knowledge and skills, I'm confident that I will get a good grade in mathematics.	3.57	Somewhat a Belief
21. I can understand the course material in mathematics.	3.64	Somewhat a Belief
22. I expect to get good grades on assignments and tests of mathematics.	3.88	Somewhat a Belief
23. If I try hard enough, then I will understand the course material of the mathematics class.	4.22	Somewhat a Belief
24. To me, mathematics is an important subject.	4.44	Somewhat a Belief
25. I prefer mathematics asks for which I have to exert myself to find a solution.	4.08	Somewhat a Belief
26. Mathematics learning is mainly memorizing.	3.40	Undecided
27. It is a waste of time when the teacher makes us think on our own about how to solve a new mathematical problem.	3.13	Undecided
28. Group work facilitates the learning of mathematics.	3.95	Somewhat a Belief
Area Mean	3.74	Somewhat a Belief

Students somewhat believe that they like doing mathematics, feel interested in Mathematics, taking account the teacher, their knowledge and skills, and the level of difficulty of Mathematics course that they are confident to have a good grade in the subject. Students somewhat believe that they can understand the course material if they try hard enough and exert more effort in finding solutions in Mathematics, are expected to get good grades through assignments and tests in Mathematics, and are involved in group work which facilitates learning of Mathematics.

Moreover, students cannot decide whether the following is a belief or not a belief such as they will receive at the present year a good grade, that Mathematics is merely memorizing, and think that solving Mathematics problems is a waste of time. Overall, students somewhat believe in the significance of Mathematics and competence in Mathematics.

Mathematics as a Social Activity

This section shows the belief of students under the Mathematics as a social activity area.

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TABLE III. Mean distribution of the beliefs of students in Mathematics under the area of mathematics as a social activity

Mathematics as a Social Activity	Mean	Interpretation
29. I think mathematics is useful in other courses.	4.29	Somewhat a Belief
30. Mathematics enables men to better understand the world he lives in.	3.88	Somewhat a Belief
31. Solving a mathematics problem is demanding and requires thinking, also from smart students.	3.92	Somewhat a Belief
32. Mathematics is used by a lot of people in their daily life.	4.34	Somewhat a Belief
33. Mathematics is continuously evolving. New things are still discovered.	4.28	Somewhat a Belief
34. There are several ways to find the correct solution to a mathematics problem.	4.15	Somewhat a Belief
35. Anyone can learn mathematics.	4.44	Somewhat a Belief
36. When there is an opportunity, students choose mathematical assignments that they can learn from even when they are not sure of getting a good grade.	4.07	Somewhat a Belief
37. Making mistakes is part of learning mathematics.	4.36	Somewhat a Belief
Area Mean	4.19	Somewhat a Belief

Students somewhat believe that Mathematics is useful in other courses, it enables men to better understand the world, it is demanding and requires thinking, it is used by many people in their daily life, it is continuously evolving, it has many solutions to each problem, it can be learned by anyone, and it is an opportunity to learn even making many mistakes. Overall, students somewhat believe that Mathematics is a social activity.

Mathematics as a Domain of Excellence

This section shows the belief of students in the role and function area.

TABLE IV. Mean distribution of the beliefs of students in Mathematics under the area of mathematics as a domain of excellence

Mathematics as a Domain of Excellence	Mean	Interpretation
38. By doing the best they can in mathematics, the students want to show us he/she is better than most of the other students.	3.71	Somewhat a Belief
39. The students want to do well in mathematics to show us and his/her fellow students how good he/she is.	3.86	Somewhat a Belief
40 The major concern of students in learning mathematics is to get a good grade.	3.56	Somewhat a Belief
41. Students believe that there is only one way to find the correct solution to a mathematics problem.	3.84	Somewhat a Belief
42. Good students can solve any mathematical problem in a few minutes.	3.92	Somewhat a Belief
43. Students are satisfied only when they get good grades in mathematics.	3.73	Somewhat a Belief
Area Mean	3.77	Somewhat a Belief

Students somewhat believe that they are better than the other students by doing the best they can in Mathematics, they can show their fellow students how good they are in Mathematics, they learned Mathematics to get a good grade, they can find only one way in finding the correct solutions of any Mathematical problems, they can solve any Mathematical problems in a few minutes, and they feel satisfied whenever they received higher grades in Mathematics. Overall, students somewhat believe that Mathematics is a domain of excellence.

Gender Difference

Now, let us determine the differences in the beliefs of students according to gender. Using the student t-test for two independent samples with a 0.05 level of significance, the next table shows the computed t-value and p-values under the area of role and function.

TABLE V. Computed t-value and p-value for the beliefs of students in terms of role and function when grouped according to gender

Role and Function	t-Value	p-Value	Interpretation
Item 1	-0.779	0.089	Not Significant
Item 2	-3.099	0.730	Not Significant
Item 3	-1.752	0.451	Not Significant
Item 4	-0.280	0.196	Not Significant
Item 5	1.991	0.078	Not Significant
Item 6	1.113	0.483	Not Significant
Item 7	1.697	0.288	Not Significant
Item 8	0.038	0.935	Not Significant
Item 9	0.878	0.704	Not Significant
Item 10	0.107	0.236	Not Significant
Item 11	-1.596	0.702	Not Significant
Item 12	-0.796	0.056	Not Significant
Item 13	0.035	0.427	Not Significant
Item 14	0.483	0.492	Not Significant
Item 15	0.760	0.587	Not Significant
Item 16	-0.779	0.089	Not Significant
OVERALL	**-0.124**	**0.409**	**Not Significant**

The data shows that in all items, there were no significant differences between male and female students on the belief in Mathematics under role and function area.

the next table shows the computed t-value and p-values under the area of the significance of and competence in Mathematics.

TABLE VI. Computed t-value and p-value for the beliefs students in terms of the significance of and competence in mathematics when grouped according to gender

Significance of and Competence in Mathematics	t-Value	p-Value	Interpretation
Item 17	-2.462	0.154	Not Significant
Item 18	-1.916	0.134	Not Significant
Item 19	-1.266	0.816	Not Significant
Item 20	-1.107	0.312	Not Significant
Item 21	-1.789	0.221	Not Significant
Item 22	-1.215	0.489	Not Significant
Item 23	0.069	0.438	Not Significant
Item 24	0.062	0.717	Not Significant
Item 25	-1.525	0.963	Not Significant
Item 26	-1.007	0.381	Not Significant
Item 27	-1.304	0.383	Not Significant
Item 28	-1.044	0.190	Not Significant
OVERALL	**-1.209**	**0.433**	**Not Significant**

The data shows that in all items, there were no significant differences between male and female students on the belief in Mathematics under the significance of and competence in Mathematics area.

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the next table shows the computed t-value and p-values under the area of Mathematics as a social activity.

TABLE VII. Computed t-value and p-value for the beliefs of students in terms of mathematics as a social activity when grouped according to gender

Mathematics as a social activity	t - Value	P-Value	Interpretation
Item 29	-1.283	0.010	Significant
Item 30	-1.880	0.947	Not Significant
Item 31	-0.202	0.129	Not Significant
Item 32	-0.098	0.370	Not Significant
Item 33	1.034	0.361	Not Significant
Item 34	1.272	0.979	Not Significant
Item 35	1.600	0.265	Not Significant
Item 36	-0.412	0.853	Not Significant
Item 37	1.357	0.063	Not Significant
OVERALL	**0.004**	**0.489**	**Not Significant**

Under the area Mathematics as a social activity of the beliefs in Mathematics, there were no significant differences between the male and female students on the belief except item 29. That is, male and female students differ according to their belief that Mathematics is useful in other courses. The mean score of a male under item 29 is 4.41 (strongly a belief) while the score of the female is 4.20 (somewhat a belief). This shows that male students strongly believe and female students somewhat believe that Mathematics is very useful in other courses.

TABLE VIII. Computed t-value and p-value for the beliefs of students in terms of mathematics as a domain of excellence when grouped according to gender

Mathematics as a domain of excellence	t - Value	P-Value	Interpretation
Item 38	-1.734	0.245	Not Significant
Item 39	-2.223	0.031	Significant
Item 40	-1.256	0.614	Not Significant
Item 41	-0.202	0.384	Not Significant
Item 42	0.153	0.980	Not Significant
Item 43	-0.987	0.542	Not Significant
OVERALL	**-0.699**	**0.408**	**Not Significant**

Under the area Mathematics as a domain of excellence of the beliefs in Mathematics, there were no significant differences between the male and female students on the belief except item 39. That is, male and female students differ according to their belief that they can do well in Mathematics by showing to the teachers and their fellow students how good they are. The mean score of a male under item 39 is 3.57 (somewhat a belief) while the score of the female is 3.84 (somewhat a belief). Even though the qualitative interpretation of the scores of both males and females are the same but females have the highest mean compared to males. This shows that female students firmly believe compared to male students about showing the teachers and their fellow students how good they are in Mathematics.

As a whole, there was no significant difference between the male and female students on the belief in Mathematics which includes the four areas.

IV. Conclusion and Recommendations

The findings revealed that the students somewhat believe that Mathematics has its role and functions, it has significance and they have competence in it, it is a social activity, and serve as a domain of excellence. Moreover, it was also revealed that the belief of students in Mathematics cannot be determined by their gender.

Based on the findings of the study, the following has been recommended:

- Teachers should minimize or discontinue stereotyping in their Mathematics classes because both males and females believe similarly about Mathematics.
- The School Administrator together with the Mathematics teachers should focus on additional intervention in learning Mathematics because Senior High School students already believe in the role, functions, and significance of Mathematics, and they further believe that Mathematics is part of their social activity.
- The Department of Education (DepEd) should intensify its commitment to promoting a learning environment where there is an equal opportunity for both genders.

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