

Beliefs in Mathematics of Senior High School Teachers

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Abstract—There is a common notion that male students perform better in mathematics because of their inclination toward analysis, while females attribute to being diligent in submitting requirements in mathematics subjects. This study determined the beliefs in mathematics of all senior high school teachers regardless of their field of specialization. A quantitative-descriptive research design was used, and 56 of 60 senior high school teachers were selected as respondents. Findings revealed that teachers have some beliefs in Mathematics, particularly that Mathematics has its role and function in teaching, the significance, and competence in teaching Mathematics, Mathematics as a social activity and a domain of excellence. Beliefs in Mathematics of teachers have no difference according to their gender.

Keywords— Senior High School Teachers, Beliefs in Mathematics, Basilan National High School, MBRQ.

I. INTRODUCTION

In education, gender equity can be thought of as the socialization of men and women [11]. The nature of beliefs and their influence on a person's actions arouse some social psychologists to study human beliefs since the beginning of the first century [20]. Particularly in mathematics education, a researcher focused on teachers' beliefs and their interaction in teaching and learning mathematics [15].

Nisbett and Ross [14] defined beliefs as explicit propositions about the characteristics of objects. Dewey [5] described belief as the third meaning of thought, something beyond itself that asserts something about the matter of fact or principle. Rokeach [17] argued that beliefs have a cognitive component that represents knowledge capable of arousing emotion, which cannot be measured but inferred from what people say, intend, or do.

Human belief is a complex and dynamic system that is changeable based on individual evaluation and assessment from their experiences which is continuously improving [19]. Some researchers agreed that beliefs could be acquired and fostered through schooling, informal observation of others, or cultural information [1]. Beliefs in mathematics evolve and develop over time through an individual's socialization process in the daily interaction with other members of society [1].

According to Elmesky [6], in the educational context, beliefs have become a priority for the development of studies that focus on understanding interactions between teachers and students such as the influence of these beliefs on the learning process.

Research suggests that teachers' beliefs about the teaching and learning of mathematics influence how their students are likely to view the understanding of mathematics [4]. A significant positive relationship has also been found between teachers' beliefs, teachers' knowledge, and students' problem-solving achievement [16]. Because of the positive relationship between teachers' beliefs and students' learning outcomes, to improve the quality of mathematics teaching and learning, we should begin with an understanding of the conceptions held by the teachers and how these are related to their instructional practices. According to Thompson [19], failure to recognize the role that the teachers' conceptions might play in shaping their behavior is likely to result in misguided efforts to improve the quality of mathematics instruction in the schools. Often, teachers are not fully aware of their beliefs [9]. By helping them to define their implicit theories, they may become more reflective [10]. If teachers have a chance to reflect upon their own beliefs and behaviors, then most likely, the teachers will be able to remember and provide decisions that affect the learning of their students [12].

Ernest [7] describes five educational ideologies in mathematics while claiming that teachers' views on mathematics affect their teaching and student learning processes. The five ideologies started at first with mathematics as a set of truths and rules, then as an unquestioned body of sound knowledge, and further followed as a body of pure structured understanding. After the three stages, the teaching process will be characterized by which teachers facilitate personal exploration and try to prevent failures. Lastly, teaching involves discussions of cognitive conflicts and questioning the content and teaching pedagogy.

The belief of teachers in Mathematics may provide a contextual remedy for the learners' learning. Quiliban and Arriola [21] found out that senior high school students have some belief in mathematics. From this perspective, the present investigation was conducted to identify the beliefs of teachers in mathematics.

II. METHODOLOGY

A descriptive-quantitative research design was used and the target population is the senior high school teachers in Basilan National High School (BNHS), Isabela City, Basilan Province, Philippines. There are 60 senior high school students assigned under the department, of which 56 were selected as respondents. Using a Mathematics-Related Belief Questionnaire (MBRQ) which was formulated by Op't Eynde

and De Corte [7] was reconstructed to cope with the teacher's perspective. This instrument was further validated, and reliability was established. A five-point Likert scale was used, ranging from strongly disagree to strongly agree. The Interval scale for interpretation is shown in the table below:

TABLE 1. Interval Scale and Interpretation

Rating	Descriptive Meaning
4.49-5.00	Respondent strongly agreed that a provision is a mathematical belief (Strongly a Belief).
3.50-4.49	Respondent somewhat agreed that a provision is a mathematical belief (Somewhat a Belief).
2.50-3.49	Respondent cannot decide whether a provision is a belief or not a belief (Undecided)
1.50-2.49	Respondent somewhat agreed that a provision is not a mathematical belief (Somewhat not a Belief).
1.00-1.49	Respondents strongly agreed that a provision is not a mathematical belief (Strongly not a Belief).

The instrument was divided into four areas such as The Role and Function of Teachers, The Significance 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

Analysis and discussion will be presented in this section. The discussion will be presented according to the areas or domains under the MBRQ. Most of the respondents were female (69.64%).

Role and Function of Teachers

This section shows the belief of teachers in the area of role and function of teachers. The following table shows the level of belief in Mathematics of the respondents under the role and function of teachers.

TABLE 2. Mean distribution of the beliefs of teachers in Mathematics under the area of role and function of teachers

Role and Function	Mean	Interpretation
[1]. Mathematics teachers are friendly to their students.	4.25	Somewhat a Belief
[2]. Mathematics teachers listen carefully to their students when they ask for something.	4.49	Somewhat a Belief
[3]. Mathematics teachers understand the problems and difficulties that their students experience.	4.34	Somewhat a Belief
[4]. Mathematics teachers care about how their students feel in class. The student absorbed the content of the mathematics course.	3.82	Somewhat a Belief
[5]. Mathematics teachers care about how their students feel about the mathematical lessons.	4.34	Somewhat a Belief
[6]. Mathematics teachers appreciate it when their students have tried hard, even if the results are not so good.	4.39	Somewhat a Belief
[7]. Mathematics teachers want their students to enjoy learning new things.	4.55	Strongly a Belief
[8]. Mathematics teachers want that their students understand the content of the mathematics course, not just memorize it.	4.41	Somewhat a Belief
[9]. Mathematics teachers try to make mathematics lessons interesting.	4.46	Somewhat a Belief
[10]. Mathematics teachers give their students the time to explore new problems and try out possible solution strategies.	4.38	Somewhat a Belief

[11]. Mathematics teachers make their students think mistakes are okay as long as they are learning.	4.40	Somewhat a Belief
[12]. Mathematics teachers make their student thinks that teachers know everything best.	4.08	Somewhat a Belief
[13]. Mathematics teachers first show step by step how the student has to solve a specific mathematical problem before giving their students similar exercises.	4.47	Somewhat a Belief
[14]. Teachers explain why mathematics is important.	4.49	Somewhat a Belief
[15]. Mathematics teachers don't allow students to ask fellow students for help during classwork.	2.82	Somewhat not a Belief
[16]. Mathematics teachers give their students a lot of group work in class.	3.48	Undecided
Area Mean	4.24	Somewhat a Belief

The senior high school teachers considered all indicators as 'somewhat a belief' except items 15 and 16, on which teachers perceived that it is not a belief and undecided, respectively.

The Significance and Competence in Teaching Mathematics

This section shows the belief of teachers under the significance and competence in teaching mathematics. The following table shows the respondents' level of belief in Mathematics under the area of The Significance and Competence of Teaching Mathematics.

TABLE 3. Mean distribution of the beliefs of teachers in Mathematics under the area of the significance and competence in teaching mathematics

The Significance and Competence in Mathematics	Mean	Interpretation
[17]. I like doing mathematics.	3.44	Undecided
[18]. I believe that I will be an excellent teacher of mathematics.	3.36	Undecided
[19]. I'm very interested in mathematics.	3.45	Undecided
[20]. Taking into account the difficulty level of the mathematics course, I am confident that students will get good grades in mathematics.	3.78	Somewhat a Belief
[21]. Mathematics teachers help students understand the course material in mathematics.	3.98	Somewhat a Belief
[22]. I expect that students will get good grades on assignments and tests of mathematics.	3.80	Somewhat a Belief
[23]. I believe that if the student tries hard enough, they will understand the course material of the mathematics class.	4.32	Somewhat a Belief
[24]. To me, mathematics is an important subject.	4.34	Somewhat a Belief
[25]. I believe that students should exert more effort to find solutions to mathematical problems.	3.80	Somewhat a Belief
[26]. Mathematics learning is mainly memorizing.	2.49	Somewhat not a Belief
[27]. I believe it is a waste of time for the students to think independently about how to solve a new mathematical problem.	2.95	Undecided
[28]. Group work facilitates the learning of mathematics.	4.12	Somewhat a Belief
Area Mean	3.67	Somewhat a Belief

Teachers are undecided about their beliefs on indicators 17, 18, 19, and 27. On indicator 26, teachers somewhat do not

believe about the statement. In other indicators, teachers somewhat believe the situation indicated.

Mathematics as a Social Activity

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

TABLE 4. Mean distribution of the beliefs of teachers in Mathematics under the area of mathematics as a social activity

Mathematics as a Social Activity	Mean	Interpretation
[29]. I think mathematics is helpful in other courses.	4.33	Somewhat a Belief
[30]. Mathematics enables men to understand better the world they live.	4.18	Somewhat a Belief
[31]. Solving a mathematics problem is demanding and requires thinking from intelligent students.	3.87	Somewhat a Belief
[32]. Mathematics is used by a lot of people in their daily life.	4.21	Somewhat a Belief
[33]. Mathematics is continuously evolving. New things are still discovered.	4.34	Somewhat a Belief
[34]. There are several ways to find the correct solution to a mathematics problem.	4.04	Somewhat a Belief
[35]. Anyone can learn mathematics.	4.12	Somewhat a Belief
[36]. When there is an opportunity, students choose mathematical assignments they can learn from even when they are not sure of getting a good grade.	3.96	Somewhat a Belief
[37]. I think mathematics is helpful in other courses.	4.37	Somewhat a Belief
Area Mean	4.19	Somewhat a Belief

Teachers somewhat believe that mathematics is practical in other courses, it enables men to better understand the world, it is demanding and requires thinking, many people in their daily life use it, 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, teachers somewhat believe that Mathematics is a social activity.

Mathematics as a Domain of Excellence

This section shows teachers' belief in mathematics as a domain of excellence.

TABLE 5. Mean distribution of the beliefs of teachers 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 Mathematics teachers that they are better than most other students.	3.75	Somewhat a Belief
[39]. The students want to do well in mathematics to show Mathematics teachers and fellow students how good they are.	3.66	Somewhat a Belief
[40]. The primary concern of students in learning mathematics is to get a good grade.	3.49	Undecided
[41]. Students believe there is only one way to find the correct solution to a mathematics problem.	3.22	Undecided
[42]. Good students can solve any mathematical problem in a few minutes.	3.80	Somewhat a Belief
[43]. Students are satisfied only when they get good grades in mathematics.	3.53	Somewhat a Belief
Area Mean	3.60	Somewhat a Belief

Teachers somewhat believe that by doing their best, some students show better than the other students by doing the best they can in Mathematics, they let the students show how good they are in mathematics and let them solve mathematical problems in just a few minutes, and they let their students feel satisfied when they get good grades. Moreover, teachers cannot decide on their beliefs about the items that the student's major concern in learning mathematics is to get a good grade, and making the students believe that there is only one way to find the correct solutions to a mathematics problem. Overall, teachers somewhat believe that Mathematics is a domain of excellence.

Gender Difference

Now, let us determine the differences in teachers' beliefs according to gender. Using the student t-test for two independent samples with a 0.05 level of significance, the following table shows the computed t-value and p-values under the area of role and function of teachers.

TABLE 6. Computed t-value and p-value for the beliefs of students in terms of the role and function of teachers when they are grouped according to gender

Role and Function	t-Value	p-Value	Interpretation
Item 1	1.484	0.040	Significant
Item 2	0.544	0.207	Not Significant
Item 3	-0.218	0.876	Not Significant
Item 4	1.060	0.477	Not Significant
Item 5	-0.494	0.619	Not Significant
Item 6	1.424	0.304	Not Significant
Item 7	0.929	0.164	Not Significant
Item 8	0.528	0.821	Not Significant
Item 9	0.379	0.241	Not Significant
Item 10	0.939	0.767	Not Significant
Item 11	1.185	0.257	Not Significant
Item 12	0.471	0.891	Not Significant
Item 13	0.182	0.767	Not Significant
Item 14	-0.946	0.093	Not Significant
Item 15	-1.087	0.249	Not Significant
Item 16	-2.581	0.284	Not Significant
Overall	0.237	0.441	Not Significant

The data shows that in all items, there were no significant differences between male and female teachers on the belief in Mathematics under role and function area except for item 1. That is, the beliefs in mathematics of teachers under the area role and function of teachers regardless of their gender are the same. However, in item 1, there is a significant difference between the male and female teachers on the belief of being friendly to students. The mean score of a male under item 1 is 3.88, while the female has a mean score of 4.41. This shows that female teachers are more friendly to students than male teachers.

The following table shows the computed t-value and p-values under the area of significance and competence in teaching mathematics.

TABLE 7. Computed t-value and p-value for the beliefs students in terms of the significance and competence in teaching mathematics when grouped according to gender

Significance and Competence in Teaching Mathematics	t-Value	p-Value	Interpretation
Item 17	0.227	0.878	Not Significant
Item 18	1.516	0.452	Not Significant
Item 19	1.237	0.494	Not Significant
Item 20	1.214	0.492	Not Significant
Item 21	0.205	0.342	Not Significant
Item 22	0.491	0.997	Not Significant
Item 23	0.600	0.962	Not Significant
Item 24	0.748	0.509	Not Significant
Item 25	0.478	0.648	Not Significant
Item 26	-1.005	0.443	Not Significant
Item 27	-2.297	0.519	Not Significant
Item 28	-0.011	0.458	Not Significant
Overall	0.284	0.600	Not Significant

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

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

TABLE 8. Computed t-value and p-value for the beliefs of teachers 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	0.410	0.292	Not Significant
Item 30	-0.384	0.998	Not Significant
Item 31	-0.991	0.486	Not Significant
Item 32	0.098	0.704	Not Significant
Item 33	-0.209	0.514	Not Significant
Item 34	-0.371	0.792	Not Significant
Item 35	0.475	0.954	Not Significant
Item 36	-0.788	0.682	Not Significant
Item 37	0.287	0.906	Not Significant
Overall	-0.220	0.678	Not Significant

Under the area Mathematics as a social activity of the beliefs in Mathematics of teachers, the data show that there were no significant differences between the male and female teachers on the beliefs in mathematics under the area of mathematics as a social activity. That is, male and female teachers regardless of their gender have the same belief in mathematics under the area of mathematics as a social activity.

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

TABLE 9. Computed t-value and p-value for the beliefs of teachers 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	0.179	0.856	Not Significant
Item 39	-0.260	0.462	Not Significant
Item 40	-0.584	0.872	Not Significant
Item 41	-0.024	0.786	Not Significant
Item 42	-0.413	0.970	Not Significant
Item 43	0.287	0.906	Not Significant
Overall	-0.075	0.823	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 teachers on the belief in mathematics under the area of mathematics as a domain of excellence. That is, the beliefs in mathematics of teachers under the area of mathematics as a domain of excellence, regardless of their gender, are the same.

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

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

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