International Journal of Social Science Archives

ISSN: 2707-8892

Available at *www.ijssa.com*

International Journal of Social Science Archives, September, 2023, 6(2), 287-296

Genderwise Perspective of Students' Mathematics Related Beliefs at Secondary Level

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***Abstract*:** Mathematics related belief with respect to the gender at secondary level schools has been the focus of this study. The study targeted the investigation of answers to these questions; What are students' mathematics related beliefs at secondary level?, What are students' mathematics related beliefs in context of teacher's instruction?, What is the comparison of students' mathematics related beliefs gender wise? & What is the interaction effect between genders in mathematics related beliefs? For data collection 400 students were selected using retrospective questionnaires in district Buner. Questionnaire was developed by the researcher in order to collect data from the respondents. The collected data were fed to the SPSS version 17 for analysis purposes. ANOVA test was applied in order to ascertain the gender-wise comparison between the study's variables. A number of learners' problem solving strategies that reflected their general behavior in non-routine mathematical problem solving were identified, that include in systematic guess, check and revise; systematic guess, check and revise; trial-and-error; systematic listing; looking for a pattern; making a model; and considering a simple case. A weak positive linear relationship between learners' mathematics-related belief systems and their approaches to non-routine problem solving was discovered.

Keywords: Assessment, Mathematical belief, Problem solving approach, Belief & knowledge

1. Introduction

Mathematics related beliefs might be the beliefs that math is only memorizing and most of the mathematical problems can be solved in just a minute or two. In a research study (Schoenfeld 1989). Exploration of the students; behavior and math related beliefs. He found that most of the students think that learning of mathematics is just only memorizing and needs more practice. In this study he also find that students believe that problems can be solved in just two minutes, if they feel that they are working for longer time than they thought, they think that this one impossible problem to solve. He discovered that the difficult aspect is that most of the students have the beliefs that the declared things were not well in line with their behavior. He concluded that students should have their separate school math, which they know and always practice in their own class room. He proposed the measurement of

student's beliefs about math is very much difficult. According to (COONY 1985, and Frank1988, 1990) that the beliefs of teachers and students regarding mathematics are documented well in recent years in the research literature history. Research shows that some of the beliefs are so silent in the various people. It also mentioned that usually these beliefs consists the following as; 1. Math is only computation, 2. Math problem can be solved within five minutes or less time. The aim of solving math problems is to get correct answers.3. The goals of exercising math problems is to get the right answer.4.The student is always passive and the teacher is active in the math teaching and learning process. In his research study (FRANK 1988) agreed that some of these beliefs are not to be strong and are not helpful to math teaching and learning planned in the evaluation standard for school math and curriculum. Beliefs and learning have cyclic relationship. This fact is found by various researchers that the learning experiences of students contribute to their beliefs regarding math learning. Similarly their beliefs regarding mathematics also affect their new approaches and math experiences. As per the standards, student's beliefs exercise a lot of influence on students influence on students' own ability.(Ntm, 1989 p, 233).These relations of learning and beliefs created some issues how the students can broke this cycle of influence. This kind of math learning and teaching proposed in the standards can deliver math experience which can improve students' beliefs regarding math. So this experience deliver a place where involvement may occurs, however, it may also be beneficial to interfere at the other point in the same cycle known as the students' beliefs. This is suggested that generally teachers use the informal approaches for the assessments of students' mathematical beliefs. (NCTM 1981).But teachers should be aware of students' beliefs. It is also important for both the teachers and students to be aware of mathematical beliefs. To bring students to a sensible level is open ended questionnaire.

1.2 Objectives of this Study

1. To investigate students' mathematics related beliefs at secondary level
2. To investigate students' mathematics related beliefs in context of teachers instruction
3. To compare students' mathematics related beliefs gender wise
4. To identify interaction effect gender-wise in mathematics related beliefs

1.3 Research Questions

1. What are students' mathematics related beliefs at secondary level?
2. What are students' mathematics related beliefs in context of teacher's instruction?
3. What is the comparison of students' mathematics related beliefs gender wise?
4. What is the interaction effect between genders in mathematics related beliefs?

2. Literatur Review

Leder and Forgasz stated that "In everyday language, the term belief' is used in common, such as attitude, nature, opinion, imaginations, philosophy, and boundaries. Since these different concepts are not directly observable and have failed individually, and because of their most nature, it is not easy to produce precise definitions of beliefs." (Leder & Forgasz, 2002, p. 96). Various scholars encourage mutual confidence and inspiration. Kloosterman (2002) regards direct contact in belief and attempt. "Student's belief is something the student knows or feels that affects effort – in this case effort to learn mathematics" (p. 248). In addition, Kloosterman (2002) claims that the selection of students is based upon the same beliefs and also on personal goals. So, there is a very close connection in beliefs and the choices. But sometimes personal goals and beliefs vary. An important example is mathematical education. Many students believe that math is boring, and it requires a lot of effort to know, but it is still very important for life. This is essential for better professionals and somewhat better for life. "Most youngsters know, as an empirical and sociological fact, that mathematical competence – even if for unclear reasons – is a key to attractive education and job opportunities" (Niss, 1994, p. 377). Jens Hojgaard Jensen has an amazing idea that "Mathematics is useless to me, but at the same time I know that I am useless without mathematics" (Niss, 1994. (377).

The beliefs were considered subtle variables. Many researches have since been done. At this moment, subtle variables in mathematics education are no longer considered. To some extent, some beliefs may affect, it is worth being able to admire the Green (1971) belief systems: therefore, we can identify three identities of the belief

system. Among the first beliefs is an extraordinary relationship. They are basic or common. Second, there are relationships between their local order and their psychological power beliefs. They are vital and foreign. There is another element as well. Clauses are apprehended in beliefs, like being isolated from other clusters, or at least with other beliefs with a relationship. Each of these features of the beliefs system does not have to do to the element of our beliefs, rather the means we capture them. (Green, 1971, p. 47-48)

2.1 Beliefs

Beliefs have an important function in building sentiments and developing attitude according to the cognitive framework of Mandler (1989). D'Andrade (1989; as cited by McLeod, 1992) points out so as to values evolve in due course to a large extent such as "guided discovery" that the students promote their own values with their own circumstances. Such sort of individual incidences occurred in classroom's intellectual environment, where a lot of researchers believe that the students' creed has been promoted. No one could define the description regarding "belief", however, a lot of scholars define the term. McLeod (1992) classifies the beliefs of student in four types of beliefs: beliefs regarding themselves, beliefs regarding math education, as well as the beliefs of tourism, that teach math.

2.2 Correlation between Beliefs and Knowledge

There is a strong connection between beliefs and knowledge in a well-defined communication. "The main difficulty has been the inability to distinguish beliefs from knowledge, and the question is still unclarified" (Pehkonen, 1994, p. 27). In 1992, Thomson describes the two behaviours to confess knowledge with 'faith' (p. 129) and consensus. First of all, the beliefs could be weakened gradually. One can argue: "the new mathematics teacher is nice but she has not assessed us still so it can be changed" or "I know that the test in mathematics will be hard". The beliefs could make some uncertainty, not important or important as blankets. But it cannot be said that one knows the fact is weakened or strong. At sea level water boils at a 100 degree, and this is fact! Secondly, it is possible to be sure to believe that some people are not of the opinion and consider different views about it. For instance, "I believe gold can be found in North Pole".

No one is required to evaluate or validate beliefs; this is the one that is related to the person. But it is absolutely needed to describe knowledge-related thoughts because no facts will be accepted as knowledge. If a person begins to validate according to the nature, the consequences would be known. "Knowledge is justified true belief" (Furinghetti & Pehkonen, 2002, p. 42).

The difference in beliefs and knowledge could not be made clearly. Depending on this, we describe these two terms. Many of the scholars claim to have believed in humans with humans, such declaration: "All knowledge is a set of beliefs" (Underhill, 1991, p. 5, emphasis original) to be really professional can.

2.3 Affect and Personal Goal

Op'tEynde & De Cort (2003) states in detail the beliefs of mathematics of education which are including "(1) students' beliefs about mathematics, (2) about mathematical learning and problem solving, and (3) their beliefs about mathematical teaching" (p. 4). The beliefs of the learners regarding self pass on to " (1) their intrinsic goal orientation beliefs related to mathematics, (2) extrinsic goal orientation beliefs, (3) task value beliefs, (4) control beliefs, and (5) self-efficacy beliefs" (p. 4). In the last, classrooms are included in contextual beliefs: "(1) beliefs about the role and functioning of their teacher, (2) beliefs about the role and functioning of the students in their own class, and (3) beliefs about the socio-mathematical norms and practices in their class" (p. 4). With structure, Op'tEynde& De Corte (2003) present the definition regarding the systems of beliefs in mathematics so as to: "The implicitly or explicitly held subjective conceptions students hold to be true about mathematics education, about themselves as mathematics learners, and about the mathematics class context. These beliefs determine in close interaction with each other and with student's prior knowledge their mathematical learning and problem-solving activities in class" (p. 4).

2.4 Gender Differences

Generally, the study shows the mathematical beliefs of people are always positive than women (Fennema, 1989;

Pehkonen, 1997). Fennema, (1989) in his research summary, put in plain words that men are considered mathematical as more helpful article than women. If we compare the beliefs between men and women, we would come to know that there is a sharp difference in these two genders. (Reyes (1984; as cited by McLeod, 1992) and Meyer and Fennema (1988l; as cited by McLeod, 1992) shows men more trust than women, even when women feel more dependent on their performance. In addition, women experience maximum mathematical diagnosis than men (Frost, Hyde & Fennema, 1976).

We can find gender differences in terms of success and failure warnings. McLeod (1992) said that men's ability is likely to feature mathematical success, but due to the lack of women's ability, their failure is more likely. In addition, more than men, women attribute their success to extra efforts, while men indicate their failure due to lack of more efforts than women. More recently, Nurmi et al. (2007) sees as gender differences appear in mathematics. By using a questionnaire, they collect data about men and women about self-esteem in the subject of mathematics. When we got the data after analysis then the researchers divided into three elements: (i) self-esteem, (ii) hearing (or wish to be succeeded), and (iii) protection course (with severe shame and fear of surviving). They felt that in samples the male students made the maximum number of runs in their own self-assurance; therefore, no data were found in it. Boys and girls score difference on victory and protection point of reference. In the last, unlike the initial results of research (for example, Minkkinen, 2001; as cited by Nurmi et al., 2007), Nurmi et al have explored so as to the difference in confidence of self were also the significant and vital when most of them are compared to boys with the most skilled girls.

Finally, in Andrews et al's (2007) analysis of Op'tEynde and DeCorte's (2003) MRBQ in respect of nationalism, gender, and age Andrews et al. explore girls who are less positive about their own, without age or nationality and capacity than boys. According to mathematics, being incredible and harassment, he felt that both men and women shared a negative perspective; on the other hand women had an important negative view. Finally, he realized that his studies were positive as mathematical compatibility for their learning.

3. Research Methodology

3.1 Population & Sample of the Study

For data collection purposes both gender i.e. male and female were targeted. Data were collected from secondary schools of District Buner. Random sampling was utilized for selection of sample at a ratio of 130 & 100 male and female students respectively.

4. Data Analysis

4.1 Descriptive Analysis

Table 1: Mean Value of Sub Constructs

	Gender	N	Mean	Std. Deviation
Significance	Male	218	9.317	2.6736
total	Female	182	9.830	2.2370
Competence	Male	218	8.294	2.5211
total	Female	182	9.088	2.5733
Teacher	Male	218	7.110	2.5065
Role total	Female	182	7.566	2.3770
Contents	Male	218	9.294	3.2395
total	Female	182	9.637	2.9415
Total	Male	218	34.014	8.0175
	Female	182	36.121	7.6170

The above table shows that mean value of sub construct of Students' Mathematics Related Beliefs i.e. significance, competence, role of teacher and contents showing that Female students have relatively better mean score than male students in the sub construct. However, stand deviation in three sub constructs i.e. significance, competence and teacher role is almost same. Standard deviation in the sub category of contents, the score of male students is greater

than female students. The total score of mean shows that female students have greater mean score than male students while the total score of standard deviation of male students exceed than female students.

4.2 Independent Samples Test

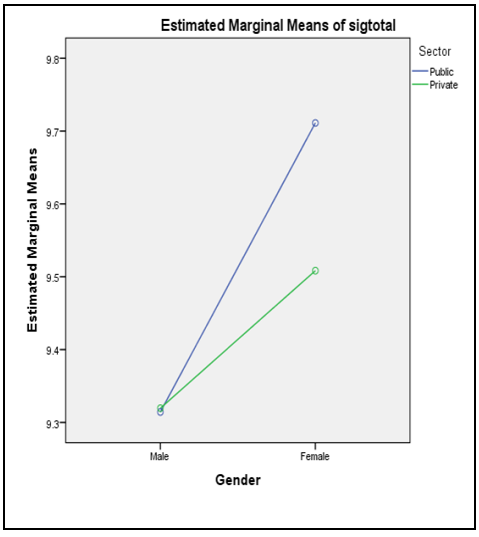
Table 2: Values of Variables

Variables	Sig.	t	Difference
Significance Total	.067	-2.057	397.997
Competence Total	.238	-3.109	382.457
Teacher role Total	.804	-1.854	391.569
Contents Total	.320	-1.102	395.175
Total	.963	-2.677	391.390

The above table shows that significance value of teacher role is the greatest in all sub constructs i.e. 0.804 showing that the teachers have a great role in building beliefs of students about mathematics. The T-test shows that the value of contents is more than rest of the sub constructs.

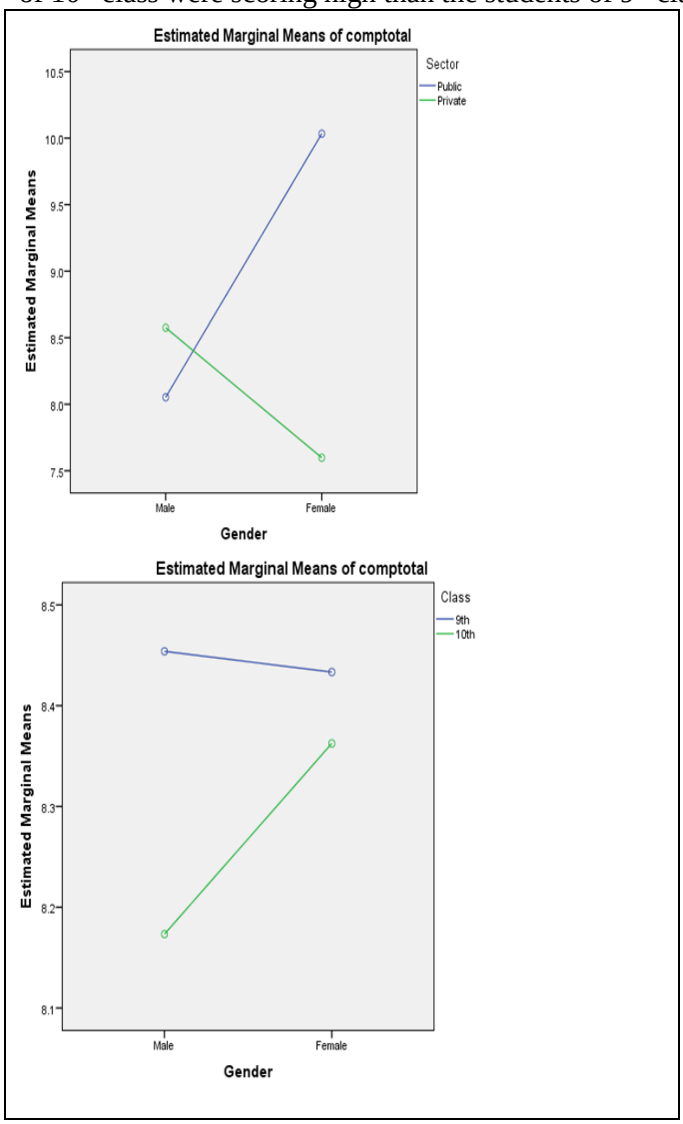
4.3 Interaction Graphs of Gender and Class in the Field of Significance

The potential gender-sector interaction was found in the graph below. The figure shows that the score of both male belonging to public and private school students in the level of Significance were almost same because they are joining on the same point. While the score of female students belonging to public sector was greater than female students belonging to private sector. While comparing the students of male and female of 9^{th} and 10^{th}class, the score of male students of 10^{th} class were scoring a bit more than the male students of class 9^{th}. Whereas, female students of 10^{th} class were scoring very high than female students of 9^{th}class. Now comparing the students of 9^{th} and 10^{th} class belonging to public and private sectors we got that there is a cross intersection in the students of 9^{th} class scored greater than the students of 10^{th} class in the public sector. While the students of 10^{th}class were scoring very high than the students of 9^{th} class in private sector.



4.4 Interaction Graphs of Gender,and Class in the Field of Competence

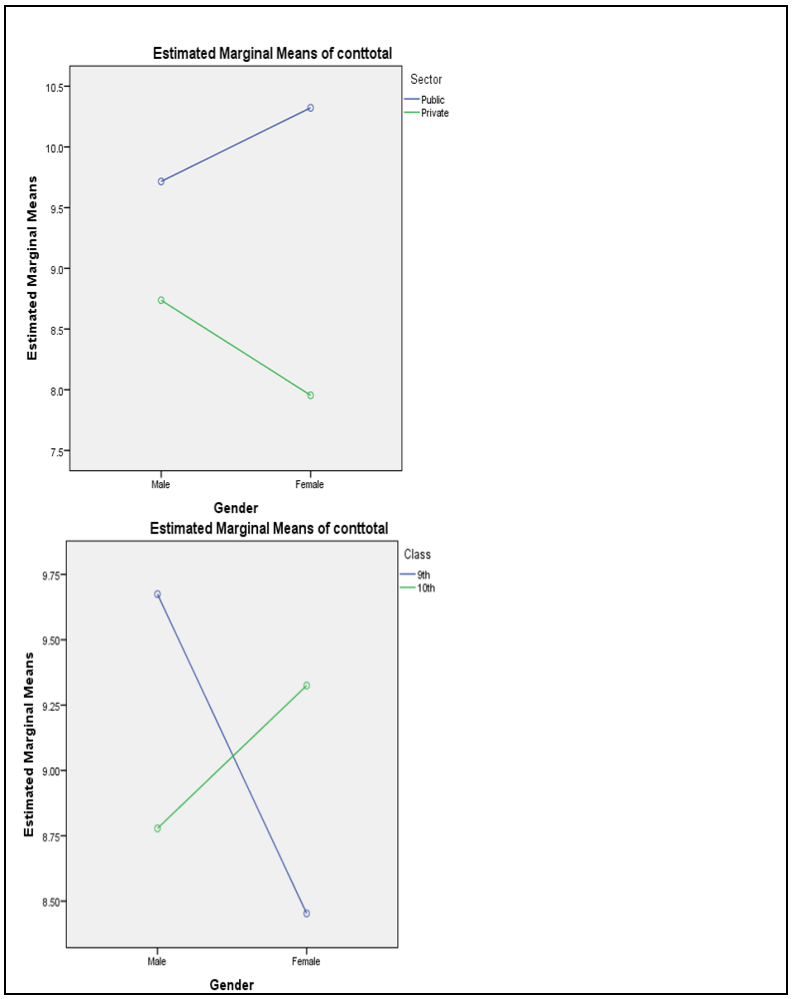
The potential interaction between gender, sector and class in the level of competence has been investigated with the help of the graph of the interaction below. There is a cross intersection between gender and sector in this graph. It has been shown in figure below that the male students of private sector scoring better than the male students of public sector. While female students of belonging to public were scoring very high than the female students of private sector. We saw a big difference between male students of 9th and 10th class. The male students of 9th class were scoring better than male students of 10th class while female students of 9th class were also scoring high than the female students of 10th class. Once again there is cross intersection in this very graph. It has been also shown that the students of 9th class were scoring better than the students of 10th class in the public sector while the students of 10th class were scoring high than the students of 9th class in private sector.



4.4 Interaction Graphs of Gender and Class in the Field of Contents

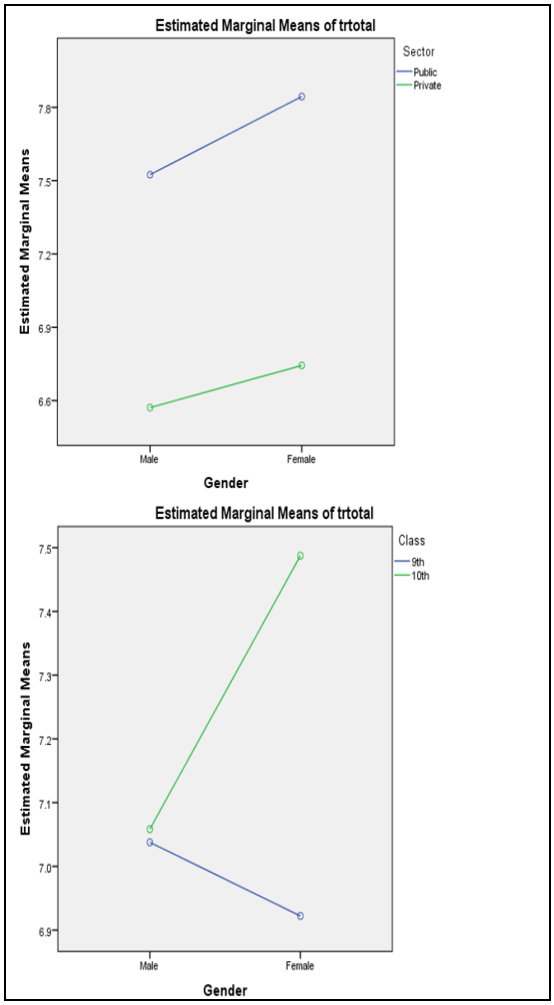
The possible interaction between gender and sector and class in the level of contents has been shown in the graph below. There is no cross interaction in this graph regarding contents. The figure shows that the male students belonging to public sector scoring better than the male students of private sector. Same is the case with the female students here; the female students of public sector were scoring high than the female students of the private sector in the field of contents. Now there is a cross interaction in the graph of gender and class. The male students of 9th class scoring better than the male students of 10th class. Once again there is a cross intersection between sector and

class. We found that the students of 9th class were scoring better than the students of 10th class in public sector. Here the case is reversal; the students of 10th class belonging to private were scoring better than the students of 10th class in private sector.



4.5 Interaction Graphs of Gender and Class in the Field of Teacher's Role

The potential interaction between gender, sector and class has been investigated with the help of the graph of the interaction below. There is no intersection in the graph between gender and sector in the level of role of teacher. We found that the male students belonging to public sector were scoring better than the male students of private sector. Same is the case with the female students in these sectors, that female students of public were also scoring high than the female students of private sector in the level of teachers' role. The male students of 10th class were scoring slightly better than the male students of 9th class, while the female students of 10th class were showing very high score than the female students of 9th class. There is a cross intersection in this graph of sector and class. The students of 9th class were scoring better than the students of 10th class in the public sector. While the case is reverse with female students of private sector, because female students of 10th class were scoring better than the students of 9th class in private sector.



4.6 Findings

Following are the important findings of this study.

1. Mean score of sub scale i.e. Significance, Competence, Teachers' Role and Contents was 9.317, 8.294, 7.110, and 9.294 for male as compared to the score of 9.830, 9.088, 7.566 and 9.637 for female respectively. (Table 4.1)
2. Score of Standard deviation was 2.6736, 2.5211, 2.5065 and 3.2395 form male as compared to the score of female i.e. 2.2370, 2.5733, 2.3770 and 2.9415 respectively. (Table 4.1)
3. The significance value for all sub scale was 0.067, 0.238, 0.804 and 0.320 respectively. (Table 4.2)
4. Mean score was 9.452, 9.057, 7.390 and 9.871 for 9^{th} Class as compared to the 10^{th} Class was 9.658, 8.211, 7.237 and 8.984 respectively in the Class Wise Comparison of Students regarding Students' Mathematics Related Beliefs in the sub scale. (Table. 4.4)
5. Score of Standard Deviation for students of 9^{th} Class was 2.4338, 2.4488, 2.3190 and 2.9457 respectively as compared to the score of students of 10^{th} Class was 2.5622, 2.6383, 2.6027 and 3.2227 respectively. (Table 4.4)
6. The value of Significance of sub scales i.e. Significance, Competence, Teachers' Role and Contents was 0.551, 0.879, 0.319 and 0.623 respectively. (Table 4.4)

5. Conclusion

1. Four aspects of Students' Mathematics Related Beliefs were identified in this study i.e. Significance, Competence, Teachers' Role and Contents (Finding No.1)
2. This prevalence in Students' results showed a difference in the level of students' capacity and sample diversity that contained students with different characteristics. (Finding No.2)
3. The value of mean of female students has relatively better mean score than male students. However, greater Standard Deviation of male in most of the sub scale shows that male students had more variety in their beliefs in Gender Wise Comparison of Students' Mathematics Related Beliefs. (Finding No.3)
4. The value of Significance of Students is the greatest in the sub scale of Teachers' Role i.e. 0.804 showing that teachers have a great role in building beliefs of students about mathematics. (Finding No.4)
5. The value of mean of Public Students have relatively better mean score than Private Students in most of the sub scales, however this difference of mean is not so much significant in Sector Wise Comparison of Students' Mathematics Related Beliefs (Finding No.5)
6. Larger Standard Deviation in most of the cases of Private Students shows that private students had a little bit more variety in their beliefs than public school students (Finding No.6)

5.1 Recommendations

Self-impact on teachers' role and items are designed in separate factors. Students' answers have indicated that they agree with the role of authority in the classroom, but their classroom experiences have many beliefs about the associated nature of mathematical knowledge and solutions to mathematical problems.

1. In this study, four aspects of students' mathematics related beliefs were identified and verified for the development of instruments. These aspects are recognized for the purpose that special attention should be made to gain more success in building creative beliefs and reduce the concern the level of concern.
2. It is recommended that students' beliefs on teachers' role and gender significantly contributed to their beliefs on being mathematically competent.
3. It is essential for math teachers to bring mathematical classrooms into a positive environment so that students in mathematics can increase their performance in building beliefs in the subject of mathematics.
4. Open queries should be encouraged while enhancing beliefs regarding mathematics.

The suggestions from teachers and experts show that the main reason for facing the problem of lack of ability to enhance the creative beliefs in the subject of math is due to the lack of lack of knowledge in math. Therefore, these suggestions can be considered and they can help, and encourage them to perform these activities.

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