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Gender dispositional empathy on student's mathematical engagement: A qualitative approach

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Abstract
The study used a cross-sectional quantitative survey design to study the influence of Dispositional Empathy on Mathematical Engagement (mathematical performance) among Atiwa Senior High School (SHS) students in Ghana, West Africa. Participants across SHS 1, 2 and 3 were selected from the three clustered SHS to take part in the study.
The methodology used for the study was the descriptive research design purported to investigate the research questions along the magnitude of qualitative analyses using the Pearson independent chi-square test statistics. The study's inferential statistics was done under the assumption of the qualitative test using chi-square estimator supported with Cramer's V and under rare cases, the use of simple percentages. This helped in analyzing the existing collinearity among the study variables and defining a best fitted hypothetical test for the study variables considered to be associated.
It was concluded however that, students' mathematical engagement is independent of their gender status. The fact that a student is male or female, boy or girl doesn't mean he or she can't get full engagement or participation in mathematics lesson. The study's investigation of Students decision on whether their gender dispositional status affect their Mathematical engagement, descriptive response reveals a modal NO as against YES response of students (comprising 63.16 against 46.34%) to this contention respectively. However, the decision seems to favour males than female in the response to whether gender dispositional status affect mathematical engagement. It is concluded here however that, Dispositional empathy (DE) on student Academic Performance (AP) is independent of students' gender status and tested to be significant at $\alpha = 0.05$. The fact that a student is male or female does not guarantee that he or she cannot engage fully in mathematics lesson leading to proportionate academic performance.
After careful analyses of the study variables, we recommend the following to GES, the SHS school administration, parent, teachers, students and future researchers where applicable. Students and teachers should not have a generalized outlook on gender disparities in the teaching and learning of mathematics**.** Teachers should try as much as possible to satisfy students' affective domain when considering lesson objectives, methodology and evaluation of mathematical lessons**.** Students should take their mathematics lessons serious and stop shifting blames on the cause of their poor performance.

Keywords: Dispositional Empathy (DE), mathematical engagement, attitude, academic performance, perception, SHS

1.0 Introduction
In delivering mathematics, there are several major factors for which mathematics educator could focus to bring about achievable mathematical engagement and understanding of mathematical concepts. Content delivery should be appealed to the head more since it involves more reasoning and calculations. The knowledge-based acquisition restrictions of the content and engagement could be measured along gender dispositional empathies. Issues of emotions should not be a major concern in adolescent's stage in human developmental stages. It is therefore imperative that mathematics teachers recognize this gender dispositions which causes difficulties in mathematical engagement and understanding.

Empathy is an individual's ability to experience the perspectives and feelings of other people's experience or what they are going through (Davis, 1994). The dispositional component means that, the ability to do so is something that is internal and not learnt and can be genetically bounded. In other words, dispositional empathy is the inherent ability to sense or feel what others are going through in such a way that it produces a willingness or desire to intervene and help (Decety and Lamm, (2006). Davis (1994) states that research on

dispositional empathy started with emergence of two main perspectives. One perspective viewed dispositional empathy as affective in nature and the other viewed it as cognitive in nature. Therefore earlier researchers made distinctions between cognitive empathy and affective sympathy. Researchers therefore took an "either or" approach towards an assessment of how cognitive and affective components interact to produce dispositional empathy. The current study therefore adopted the integrative approach to study mathematics engagement by assessing gender component of the dispositions with respect to students' mathematical engagement of Atiwa Senior High School (SHS) students in Ghana comprising the three principal SHS.

The senior high school of the educational system in Ghana is a crucial one because it is at this level that some specialization begins. It is from this level that specialized training colleges and tertiary institutions admit their students. However, this level of Ghana's educational system is hit with problems that is geared towards students' inability to appreciate mathematics and get along with it well. Salient among the root causes of this phenomena is the gender dispositional empathy viewed as either male or female perform better in mathematics, or perhaps, engage along well with the other respectively. This is why it has become necessary for researchers to be interested in looking at this psychological syndrome to investigate how this gender dispositional empathy influence mathematics engagement at Atiwa Senior High Schools. This study therefore assessed a qualitative study on the influence of gender dispositional empathy on mathematics engagement among Atiwa SHS students.

1.1 Objective of the study

The main aim of the study was to assess the influence of gender dispositional empathy on mathematical engagement of Atiwa Senior High School Students. The specific objectives of the study were to:

1. to investigate whether gender dispositional empathy affect Atiwa SHS students' mathematical engagement and
2. to find the extent to which students' gender dispositional empathy affect their academic performance?

2.0 Literature Review

Empathy has many different definitions that encompass a broad range of emotional states, including caring for other people and having a desire to help them; experiencing emotions that match another person's emotions; discerning what another person is thinking or feeling; and making less distinct the differences between the self and the other. It also is the ability to feel and share another person's emotion. Some believe that empathy involves the ability to match another's emotions, while others believe that empathy involves being tenderhearted toward another person. Compassion and sympathy are two terms that many associate with empathy, but all three of these terms are unique. Compassion is an emotion we feel when others are in need, which motivates us to help them. Sympathy is a feeling of care and understanding for someone in need. It can also be understood as having the separateness of defining oneself and another blur.

Empathy necessarily has a "more or less" quality. The paradigm case of an empathic interaction, however, involves a person communicating an accurate recognition of the significance of another person's ongoing intentional actions, associated emotional states, and personal characteristics in a manner that the recognized person can tolerate. Recognitions that are both accurate and tolerable are central features of empathy. The genetic personality of the individual student assumes the state of being male or female and can have advert effect on the mathematical engagement

The human capacity to recognize the bodily feelings of another is related to one's imitative capacities and seems to be grounded in an innate capacity to associate the bodily movements and facial expressions one sees in another with the proprioceptive feelings of producing those corresponding movements or expressing oneself. Humans seem to make the same immediate connection between the tone of voice and other vocal expressions and inner feeling.

Empathy is distinct from sympathy, pity, and emotional contagion. Sympathy or empathic concern is the feeling of compassion or concern for another, the wish to see them better off or happier. Pity is a feeling that another is in trouble and in need of help as they cannot fix their problems themselves, often described as "feeling sorry" for someone. Emotional contagion is when a person (especially an infant or a member of a mob) imitatively "the emotions that others are showing without necessarily recognizing this is happening.

An empathic disposition has been seen as a desirable trait for teachers in diverse settings. This disposition has been identified as key characteristics in being effective in urban diverse schools (Darling Hammond, 2000; Gordon, 1999).

This empathic disposition often manifests itself in teachers' caring relationships with students. Researchers have noted that students, especially students of color, who have caring relationships with their teachers, are more motivated and perform better academically than students who do not (Foster, 1995; Gay, 2000; Irvine, 1990). In addition, empathy can potentially foster openness, attentiveness, and positive relationships. In culturally diverse classrooms, being open and flexible helps teachers adjust to varying contexts (Delpit, 1995). This is much felt is gender disposition is considered. Teachers are better able to modify pedagogy and curricula to fit their students' needs, such as the teacher who changed a classroom ritual to be more comfortable for her Vietnamese students by simply offering her students multiple ways to say goodbye rather than to hug her before they left the classroom. The effect of students gender status can way or the other play enormous role in mathematical engagement irrespective of the teacher's methodological and pedagogical move set in the classroom.

Gender differences are a recurrent theme throughout the literature in academic studies in general and in mathematics studies in particular. Mathematics is often considered to be a domain in which boys are higher achievers, both in terms of attitudes and self-concept. Contrary to this, findings show that mathematics grade point (weighted average) achievement and grades do not differ significantly between males and females, (Owusu-Darko, N. Frimpong & I. K. Adu, 2014)

2.1 Gender issues versus Mathematics performance

Gender issues in mathematics education has been a topic of run over. Several researches are conducted to investigate the significant impact of students Mathematics performance

influenced by Gender related dispositions. Majority of literature exist along a descriptive analyses of this phenomenon avoiding inferential significance test. Few consider their analyses along a significance test. It would be important if this is investigated along students' mathematical engagement which adversely leads to students' performance.

Hyde et al, (2016) considered a meta-analysis to analyze gender differences in recent studies of mathematics performance. The study used a meta-analyzed data from 242 studies published between 1990 and 2007, representing the testing of 1,286,350 people. Overall, d = 0.05, indicating no gender difference, and variance ratio = 1.08, indicating nearly equal male and female variances. The study further analyzed data from large data sets based on probability sampling of U.S. adolescents over the past 20 years: the National Longitudinal Surveys of Youth, the National Education Longitudinal Study of 1988, the Longitudinal Study of American Youth, and the National Assessment of Educational Progress. Effect sizes for the gender difference ranged between –0.15 and +0.22. Variance ratios ranged from 0.88 to 1.34. Taken together, these findings support the view that males and females perform similarly in mathematics. (PsycINFO Database Record (c) 2016 APA). Similar research have been conducted severally to reveal the gender difference in mathematics performance that normally favored the male more than the female. There is little consideration of looking at this phenomenon form a longitudinal pattern student's mathematical engagement and modelling the effect of gender on the academic performance of students before understanding the phenomenon better especially in Ghana Education structure.

In the study of "stereotype threat and women's Math Performance" conducted by Steven, Steele & Quinn, (2002), When women perform math, unlike men, they risk being judged by the negative stereotype that women have weaker math ability. We call this predicament *stereotype threat* and hypothesize that the apprehension it causes may disrupt women's math performance in as far as the engage in mathematical activities. After 1st 2nd experiments, Steven et al conducted a third experiment replicated findings with a less highly selected population and explored the mediation of the effect. The implication that stereotype threat may underlie gender differences in advanced math performance, even those that have been attributed to genetically rooted sex differences, was discussed.

Steven et al performed a meta-analysis of 100 studies (published 1963–1988) of gender differences in mathematics performance. They yielded 254 independent effect sizes, representing the testing of 3,175,188 Ss. Averaged overall effect sizes based on samples of the general population indicated that females outperformed males by only a negligible amount. An examination of age trends indicated that girls showed a slight superiority in computation in elementary school and middle school. There were no gender differences in problem solving in elementary or middle school; differences favoring men emerged in high school and college. Gender differences were smallest and actually favored females in samples of the general population, grew larger with increasingly selective samples, and were largest for highly selected samples and samples of highly precocious persons. The magnitude of the gender difference has declined over the years. Gender differences in mathematics performance are small. Nonetheless, the lower performance of women in problem solving that is evident in high school requires attention. (PsycINFO Database Record (c) 2016 APA). A similar situation needs to be looked at in Atiwa District of Ghana where mixed gender ability level homogeneously triumph in this community schools.

A quasi-experimental study with male and female college students revealed that individual differences in gender identification (i.e., importance placed on gender identity) moderated the effects of gender identity relevance on women's (but not men's) math performance. When their gender identity was linked to their performance on a math test, women with higher levels of gender identification performed worse than men, but women with lower levels of gender identification performed equally to men. When gender identity was not linked to test performance, women performed equally to men regardless of the importance they placed on gender identity, Quine (2013)

Hyde (2009), using contemporary data from the U.S. and other nations, addressed 3 questions: Do gender differences in mathematics performance exist in the general population? Do gender differences exist among the mathematically talented? Do females exist who possess profound mathematical talent? In regard to the first question, contemporary data indicate that girls in the U.S. have reached parity with boys in mathematics performance, a pattern that is found in some other nations as well. What is the case of Atiwa District of Ghana then their mathematical engagement? Focusing on the second question, studies find more males than females scoring above the 95th or 99th percentile engaged well in mathematics, but this gender gap has significantly narrowed over time in the U.S. and is not found among some ethnic groups and in some nations, most especially Ghana in West Africa. Furthermore, data from several studies indicate that greater male variability with respect to mathematics is not ubiquitous. Rather, its presence correlates with several measures of gender inequality. Thus, it is largely an artifact of changeable sociocultural factors, not immutable, innate biological differences between the sexes. Responding to the third question, it could be a document of existence of females who possess profound mathematical talent irrespective of gender disposition. A look at this from less endowed communities such as Atiwa District of Ghana along their mathematical engagement and their measures of scores is the focus then.

3.0 Method and Materials

The study used a cross sectional source of data with a sample size of 100 respondents across the students randomly selected from the three SHS in Atiwa District of Ghana namely, Kwabeng Anglican SHS, Sekyere SDA SHS and Anyinam Atiwa SHS. The study adopted both descriptive and qualitative methods in analyzing the data. A random sampling method was used to solicit for information about the respondents in the study area per their mathematical engagement relative to their gender disposition in Mathematics lesson. The study used questionnaires and interviews to retrieve all the relevant information needed for the study. The study used both SPSS and STATA software's in the processing and the interpretation of the data gathered from the field. A Pearson chi-square test of independence and Crammer's V test of were used for the analyses

3.1: Conceptual Framework of Pearson Chi-Square and Crammer's V

The chi-square statistic is a sum of terms each of which is a quotient obtained by dividing the square of the difference between the observed and theoretical values of a quantity by the theoretical value defined along the magnitude of categorical counts (qualitative response variables).

In general, the hypothesis of independence between two variables in which one is classified into r classes and the other into c classes gives an $r \times c$ contingency table or r, mutually exclusive cells, where r is the number of rows and c the number of columns. That is, one variables contingent (or dependent) on the other. Table 4.0 is an$r \times c$ contingency table in which variable 1 is classified into r classes and variable 2 into c classes.

Table 1: An $r \times c$ contingency table

Variable 1	1	2	⋯	c	Totals
1	0_{11}	0_{12}	⋯	0_{1c}	R_1
2	0_{21}	0_{22}	⋯	0_{2c}	R_2
⋮	⋮	⋮	⋮	⋮	⋮
r	0_{r1}	⋯	⋯	0_{rc}	R_c
Totals	C_1	C_2	⋯	C_c	n

The observation in each cell is called the observed cell frequency representing number of categories defined by total number of respondent in respective nominal study variables**.**

$R_i = \sum_{j=1}^{c} o_{ij}$ is the marginal total for row i, whilst

$C_j = \sum_{i=j}^{r} o_{ij}$is the marginal for column j.

Where $\sum_{i=1}^{r} R_i = \sum_{j=1}^{c} C_j = n$ is the total sample size.

We can test the null hypothesis:

H_0: $variables\ are\ independent\ against\ the\ alternative$

H_1: $variables\ are\ not\ independent$

The test statistic (Pearson independent chi-square estimator) is given by

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(o_{ij} - e_{ij})^2}{e_{ij}}, \quad (4.1)$$

Where e_{ij} is the expected cell frequency for the (ij)th cell. It can be shown that

$$e_{ij} = \frac{R_i \times C_j}{n}$$

The statistic in Equation (4.1) under the null hypothesis has an approximate chi-square distribution with the number of degrees of freedom given by $(r-1)(c-1)$.The critical region for the test at $\alpha\%$ significance level is therefore,

$$\chi^2 \geq \chi^2{}_a[(r-1)(c-1)]$$

In tests for independence, both row and column marginal totals are free to vary although the sample size is fixed. The test for independence or homogeneity is a test of association under consideration.

After we have performed a chi-square test of independence and found the two variables to be dependent we may want to measure the strength of dependence between the two variables. This may be done by finding a constant$e$. called the contingency coefficient. It is given by

$$c = \sqrt{\frac{\chi^2}{n + \chi^2}}$$

Where

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(o_{ij} - eij)}{eij}$$

and n is the sample size. The coefficient, c, is always 0 when the two variables are independent. A disadvantage associated with is that its value is always less than 1, even when the two variables are completely dependent on each other. For this reason, Cramer's V, given by

$$V = \sqrt{\frac{\chi^2}{nt}}$$

Where t is the smallest of the two numbers (r–1) and (c–1), is preferred. The value of V lies in the internal from 0 to 1.

A descriptive response where necessary could be expressed as percentages

$$\frac{X_i}{\sum_{i=1}^{n} F_i} \times 100 = \varphi\%$$

Of students' response on categorical variables defined for SDE

4.0 Empirical Results

4.1: Descriptive Analysis

This sub-section discusses the nature of relationship existing between students' response variable on gender status and their mathematics engagement in Atiwa SHS. The analyses further elaborates on the dependency of students' Academic Performance (AP) on gender disposition.

Table 2

Gender Status of Respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	76	48.1	48.1	48.1
	Female	82	51.9	51.9	100.0
	Total	158	100.0	100.0	
Whether gender status affect Mathematical engagement					
Valid	Yes	72	45.6	45.6	45.6
	No	86	54.4	54.4	100.0
	Total	158	100.0	100.0	
Whether male students are mostly engaged than females					
valid	Yes	62	39.2	39.2	39.2
	No	86	54.4	54.4	93.7
	Undecided	10	6.3	6.3	100.0
	Total	158	100.0	100.0	

Data source: field primary data survey

Table 2 elaborate on the study's descriptive data analyses of the structured questionnaire on respondents' belief on how their mathematics engagement is being affected by their state of being as male or female and their dispositional empathy on mathematics studies. Out of 158 respondents students, 76 (48.1%) were males and 82 (51.9%) were females. A relatively dominant number of 86 (54%) disagreed to whether gender status affect their mathematical engagement as against 72 (54.6%) agreeing to this assertion.

On the decision to whether males students are mostly engaged than females in mathematics lessons, 86 comprising 54.4% said no, 62 (39.2%) said yes and a few 10 (6.3) were undecided about this matter.

A Pearson chi-square estimate on the relationship between gender status and Mathematics engagement as were as status of dispositional empathy is discussed hereafter in table 4.2 and 4.3 respectively.

Table 3: Whether gender status of respondents is dependent on mathematical engagement

		Whether gender status affect Mathematical engagement				
		Yes	No	Undecided	Total	Pearson chi-square
		Count	Count	Count	Count	$\chi^2 - statistics$
Gender Status of Respondents	Male	28	48	0	76	$\chi^2{}_{(0.05,1)} = 4.497$
	Female	44	38	0	82	$p - value = 0.034$

Data source: field survey.

Results are based on nonempty rows and columns in each innermost sub-table. The Chi-square statistic is significant at the 0.05 level.

The study sought to test the hypothesis

H_0: Mathematical engagement is independent of students' gender status

H_1: Mathematical engagement is not independent of students' gender status

At a significance level of $\alpha = 0.05$, a decision precision level of

$$100(1-\alpha)\% \cong 95\%$$

A Pearson independent chi square is computed using an SPSS output as

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(o_{ij}-e_{ij})^2}{e_{ij}} = 4.497,$$

That is $\chi^2{}_{(0.05,1)} = 4.497$

Where e_{ij} is the expected cell frequency for the $(ij)^{\text{th}}$ cell. It can be shown that

$$e_{ij} = \frac{R_i \times C_j}{n}$$

under the null hypothesis has an approximate chi-square distribution with the number of degrees of freedom given by $(r-1)(c-1) = 1$. The critical region for the test at $\alpha\% = 5\%$ significance level is therefore,

$$\chi^2{}_{[(r-1)(c-1)]} \geq X_a^2[(r-1)(c-1)] = \chi^2{}_{(0.05,1)} = 4.497$$

The study realized a significance chi-square test at $\alpha = 0.05$ since SPSS calculated $p - value\ of\ 0.034 < \alpha = 0.05$. We fail to reject H_0, hence it is statistically significant. We have insufficient evidence to reject H_0.

Computing the Cramer's V, given by

$$V = \sqrt{\frac{\chi^2}{nt}} = \frac{4.497}{158(1)} = 0.028$$

Where t is the smaller of the two numbers $(r-1)$ and $(c-1)$, is preferred. The value of V lies in the internal from 0 to 1. A crammers V measure of 0.028 shows insignificant dependence between the variables compared.

It is concluded here however that, students' mathematical engagement is independent of their gender status. The fact that a student is male or female, boy or girl doesn't mean he or she can't get full engagement or participation in mathematics lesson.

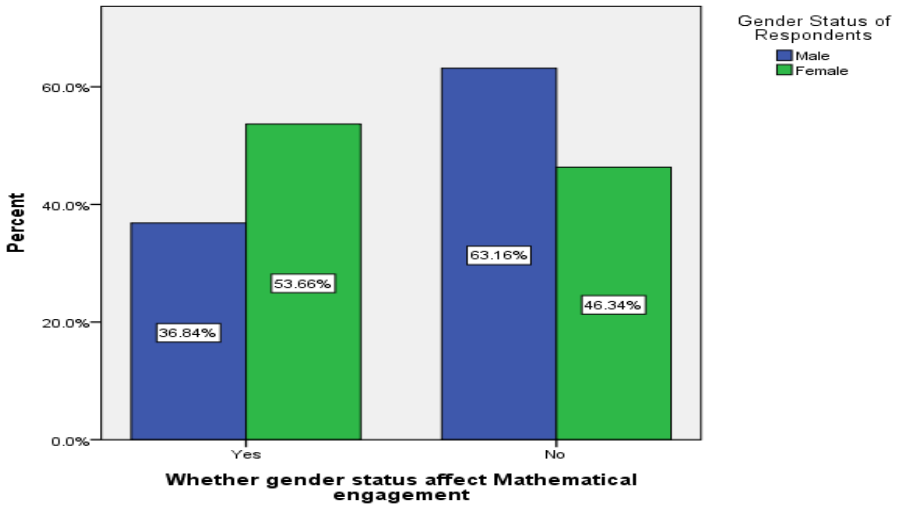

Fig 1: Students decision on whether their gender status affect Mathematical engagement

Figure 1 above shows Students decision on whether their gender status affect their Mathematical engagement. The descriptive chart further reveals a modal NO response of students (comprising 63.16 and 46.34%) to this contention. However, the decision seems to favour males than female in the response to whether gender status affect mathematical engagement.

Table 4: Whether gender status of respondents is dependent on Dispositional empathy

		Effect of dispositional empathy on Students Academic Performance							
		Excellent	Very good	Good	Credit	Pass	Fail	Total	Pearson chi-sqr
		Count	Count	Count	Count	Count	Count	Count	$\chi^2 - statistics$
Gender Status of Respondents	Male	4	6	10	20	12	24	76	$\chi^2_{(0.05,5)} = 10.038$
	Female	4	10	12	24	22	10	82	$p - value = 0.074$

Source: field's survey 2016-Results are based on nonempty rows and columns in each innermost sub table.

Table 4 gives a 2 by 6 contingency Pearson chi-square independence test between gender status of students and their dispositional empathy on Academic performance.

The study sought to test the hypothesis that

H_0: *Gender dispositional empathy on student mathematics engagement is independent of their Academic Performance (AP).*

H_1: *Gender dispositional empathy on student mathematics engagement is dependent of their Academic Performance (AP).*

At a significance level of $\alpha = 0.05$, a decision precision level of

$$100(1-\alpha)\% \cong 95\%$$

A Pearson independent chi square is computed using an SPSS out as

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(o_{ij}-e_{ij})^2}{e_{ij}} = 10.038$$

That is

$$\chi^2_{(0.05,5)} = 10.038$$

with the number of degrees of freedom given by

$(r-1)(c-1) = (2-1)(6-1) = 5.$

The critical region for the test at $\alpha\% = 5\%$ significance level is therefore,

$$\chi^2_{[(r-1)(c-1)]} = \chi^2_{(0.05,5)} = 10.038$$

The study realized a significance chi-square test at $\alpha = 0.05$ since SPSS calculated

$p - value\ of\ 0.0074 > \alpha = 0.05.$

We fail to reject H_0, hence it is statistically significant. We have insufficient evidence to reject H_0.

It is concluded here however that, Dispositional empathy (DE) on student Academic Performance (AP) is independent of students' gender status. Again, the fact that a student is male or female, boy or girl doesn't mean he or she can't pass mathematics evaluated lesson. That is, a student boy or girl passing with excellent, very good, good, credit, pass or fail etc. does not depend so much on the gender disposition of the student.

The graph below is a pictorial representation of the relationship between gender status and students dispositional grades usually obtained in each term.

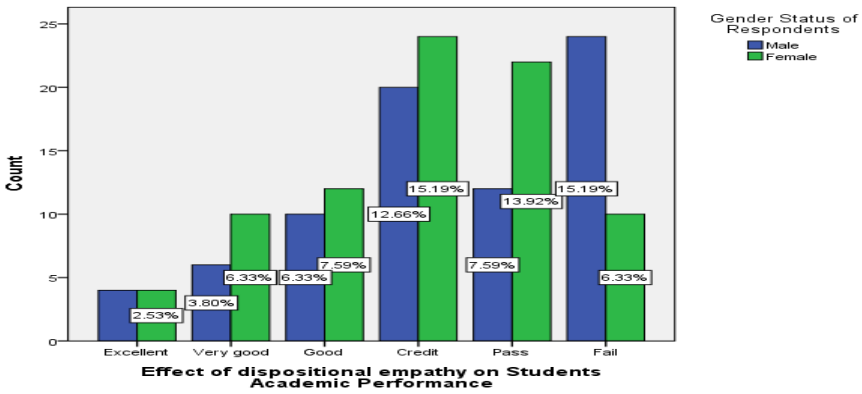

Fig 2: Multiple Bar Graph showing Effect of dispositional empathy on students AP

Figure 2 shows multiple Bar Graph displaying Effect of dispositional empathy on studentsacademic performance (AP). It could be seen from the chart that, even though gender is independent of dispositional grade, but majority of the students average score revolves around failure grades to credit grade.

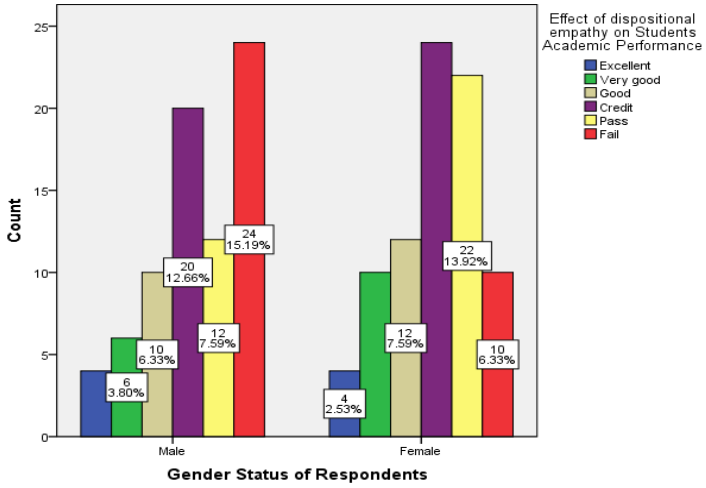

Fig 3: A multiple bar chart showing gender status of Respondent clustered on their effect of dispositional empathy on AP

Figure 3 shows a multiple bar chart showing gender status of Respondent clustered on their effect of dispositional empathy on AP. This is still consistent with the afore discussed performance status of the students at Atiwa Senior High School.

Table 5: Whether males are mostly engaged than female is related to Dispositional empathy

		Effect of dispositional empathy on Students Academic Performance							
		Excellent	Very good	Good	Credit	Pass	Fail	Total	Chi-square
		Count	Count	Count	Count	Count	Count	Count	$\chi^2_{(0.05,10)}$
Whether male students are mostly engaged than females	Yes	4	10	16	12	6	14	62	$\chi^2_{(0.05,10)} = 63.569$
	No	4	0	6	32	24	20	86	$P - value = .0.00$
	Undecided	0	6	0	0	4	0	10	

Source: field's survey 2016-Results are based on nonempty rows and columns in each innermost sub table.

Table 5 gives a 3×6 contingency table, estimating a chi-square statistic of

$$\chi^2_{(0.05,10)} = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(o_{ij} - e_{ij})^2}{e_{ij}} = 63.569$$

There is an insignificance relationship between whether males are mostly engaged in mathematics than female students in connection with Dispositional Empathy (DE) on AP. The findings here are not different from table 4.2 and 4.3 respectively.

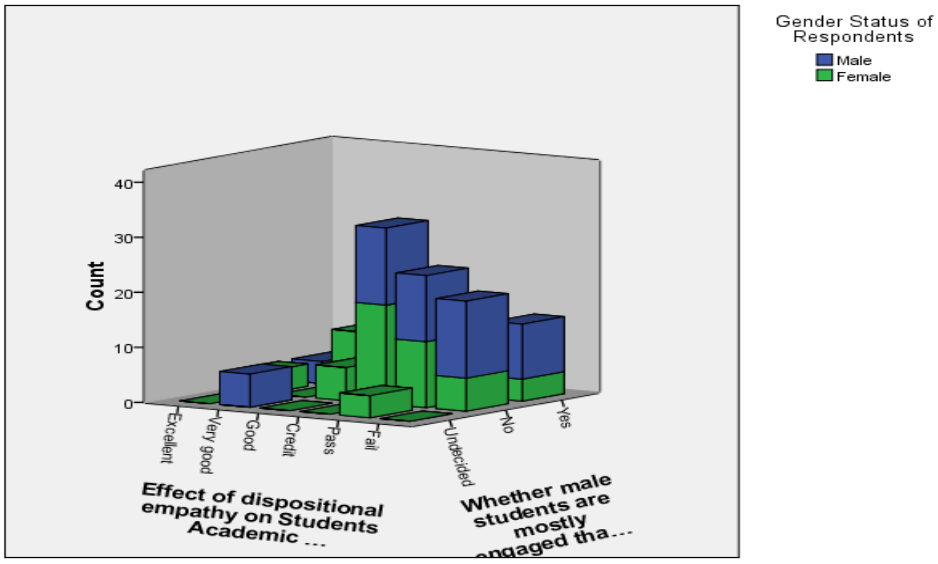

Fig 4: A three dimensional Bar Chart on Dispositional empathy and whether males are mostly engaged than females

A three dimensional Bar chart at figure 4 displays effect of dispositional empathy on students AP and decision on whether males are mostly engaged in mathematics content than female students. The modal response is clustered around NO with dominant pass range between fail to credit.

5.0 Findings

Students response on questionnaires were analyzed using the SPSS output. Analyses were based on different Dispositional Empathy (Gender status, Cognitive factors, emotional status and Perceptual response on Students AP). Results are based on nonempty rows and columns in each innermost sub-table.

1. In the inferential hypothetical test to find out whether mathematical engagement is independent of students' gender status, a chi-square estimate of 4.497 was computed and tested to be significant at $\alpha\% = 5\%$ significance level. i.e.
   $\chi^2_{[(r-1)(c-1)]} \geq X_a^2[(r-1)(c-1)] = \chi^2_{(0.05,1)} = 4.497.$
   The study had insufficient evidence to reject the H_0.A Computation of the Cramer's V, given by as 0.028. The value of V lies in the internal range from 0 to 1. A crammers V measure of 0.028 shows insignificant dependence between the variables compared.
2. A 2×6 contingency Pearson chi-square independence test between gender status of students and their dispositional empathy on Academic performance realized a chi-square value $\chi^2_{(0.05,5)} = 10.038$, which was tested to be significant at 1%, 5% and 10% respectively.

5.1 Conclusion

It is concluded here however that, students' mathematical engagement is independent of their gender status. The fact that a student is male or female, boy or girl doesn't mean he or she can't get full engagement or participation in mathematics lesson. The study's investigation of Students decision on whether their gender status affect their Mathematical engagement, descriptive response further reveals a modal NO response of students (comprising 63.16 against 46.34%) to this contention. However, the decision seems to favour males than female in the response to

whether gender status affect mathematical engagement. It is concluded here however that, Dispositional empathy (DE) on student Academic Performance (AP) is independent of students' gender status a tested to be significant at $\alpha = 0.05$. Again, the fact that a student is male or female, boy or girl doesn't mean he or she can't pass mathematics evaluated lesson. That is, a student boy or girl passing with excellent, very good, good, credit, pass or fail etc does not depend so much on the gender disposition of the student. There is an insignificance relationship between whether males are mostly engaged in mathematics than female students in connection with Dispositional Empathy (DE) on AP.

There was in general, a statistical significance estimate of the chi-square for all the hypotheses defined in light of the study's research questionnaires at $\alpha = 0.05$. In some cases, the results were tested to be statistically significant at 1%, 5% and 10% respectively.

5.2 Recommendations

After careful analyses of the study variables, we recommend the following to GES, the SHS school administration, parent, teachers, students and future researchers where applicable.

1. Students and teachers should not have a generalized outlook on gender disparities in the teaching and learning of mathematics since performance was seen as not dependent on Gender Dispositional Empathy.
2. Teachers should try as much as possible to satisfy students' affective domain when considering lesson objectives, methodology and evaluation of mathematical lessons as suggested by Bloom et al (1957) taxonomy for instructional learning.
3. Students should take their mathematics lessons serious and stop shifting blames on the cause of their poor performance. Some of the cases could be attributed to their dispositional imbalances that are inherent in the cover of their own sleeves such as emotions, cognitions, perception and psychological status desired to meet mathematical lessons etc.

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