

TEACHER-STUDENT INTERACTIONS PATTERNS IN GENERAL BASIC MATHEMATICS CLASSES AT FEDERAL CAPITAL TERRITORY COLLEGE OF EDUCATION, ZUBA-ABUJA NIGERIA

Zinyahs Maris Zakka¹, Zaleha Binti Ismail², Ahmad Zanzali Azlan³ and
Farhad Balash⁴

This study investigates gender bias in terms of teacher-student interactions in mathematics at College of Education, Zuba Abuja. To conduct the study, a mixed method research design was employed in which the teachers were observed three times for three weeks using a modified version of INTERSECT.. The study involved 315 students who were undertaking level 200 of Nigeria Certificate in Education (NCE) The sample consisted of 165 (52.4%) male students and 150 (47.6%) female students. Additionally, two male and two female mathematics teachers were interviewed. Chi-square test statistics and Miles and Huberman model was adopted to analyse the data. The findings indicate that male students received higher percentage of interactions from both male and female mathematics teachers. Female students received lower percentage of interactions as a result of the rate of enrolment of students in the course. Also, difference was recorded in terms of the attention directed by female and male teachers towards their female and male learners. The study also reveals the causes of unequal interactions. The findings have significant pedagogical and psychological implications that require further research.

Keywords: Gender Bias, General Basic Mathematics, Teacher-Student Interactions and Types of Interactions.

1. INTRODUCTION

The present study was conducted following evidence that teachers are treating their students differently in classroom, depending on the subject (McDonell, 2007; Duffy *et al.*, 2001). Previous studies have shown that teachers have been interacting more with male learners than with female learners in classroom (Sadker and Zittleman, 2007; Tietz, 2007; Koca, 2009; Hassaskhah and Zamir, 2013). In one recent study in Nigerian primary schools, Zinyahs and Zanzali (2015) specifically studied the scenario in mathematics classrooms and uncovered that the mathematics teachers had interacted differently towards boys and girls. Boys appeared to have received more attention than girls in mathematics classrooms, from both male and female teachers (Zinyahs and Zanzali, 2015). In another study (Rashidi and Nader, 2012), teachers were found to have (1) asked boys higher-order questions in

¹ Univerisiti Teknologi Malaysia, E-mail: zakkamaris@yahoo.com

² Univerisiti Teknologi Malaysia, E-mail: p-zaleha@utm.my

³ Univerisiti Teknologi Malaysia, E-mail: azanzali3@gmail.com

⁴ Institute of Educational, Psychological & Social Research, Kharazmi University, Iran, E-mail: efarhaddevelopment@gmail.com

mathematics, which demand critical thinking; and (2) made more eye contact frequently with boys than with girls. Research has shown that female and male teachers have directed more criticism towards boys than towards girls in classroom (Hassaskhah and Zamir, 2013). These findings show that teachers' interact less with female than with male students.

The patterns of interactions also appeared to have partially depended on the gender of the teachers. Compared to male teachers, female teachers are found to be more supportive, interactive, and patient with both male and female students (Rashidi and Nader, 2012). Female teachers were also found to have asked more of referential questions, giving more compliments, and using less directive types. As for male teachers, Consuegra (2015) suggests that they have higher expectations for male students in mathematics classrooms and for female students in arts and languages classes. The consequences of the teacher gender in terms of teacher-student interactions pattern have appeared to be different in primary and junior secondary schools (Duffy *et al.*, 2001; Zinyahs and Zanzali, 2015). Findings of the above studies have put male students in a spotlight and as well relegate females to side-lines, or to be invisible.

2. PROBLEM STATEMENT

Gender bias in mathematics classrooms is subtle and oblivious to the teachers. The teachers do not remember how they interact with their students in basic mathematics classes and they do not have ample time to reflect and analyse their pattern of interaction with their students. According to Zinyahs and Zanzali (2015), teachers have not been aware of gender bias in their actions and behaviour towards male and female students due to differential treatment, which is in favour of male students. These patterns, however may give unfavourable outcome to the students. Teachers' different interactions with female and male students can give negative impact on students' self-esteem. Sortino (2012) argues that teachers' unintentional or intentional focus on male students have encouraged the latter to perform well in mathematics compared to their female counterparts. Consequently, female students have been frustrated in mathematics classes, which can lead to their lack of interest hence poor performance.

3. OBJECTIVES OF THE STUDY

Given the above points, the present study sought to determine the interaction patterns in mathematics classrooms. Specifically, the study intends to determine the existence of gender bias in general basic mathematics classrooms of 200 level students in Federal Capital Territory (FCT) College of Education, Zuba. The focus of the study is on teacher-student interactions.

4. RESEARCH QUESTIONS

The present study sought to answer the following questions;

1. What types of teacher-initiated interactions are given by male and female teachers towards their male and female learners' in general basic mathematics classes at FCT College of Education, Zuba Abuja Nigeria?
2. Is there any significant gender bias in terms of teacher-student interactions in the classes?
3. As a mathematics teacher, what is the cause of unequal interaction patterns in your classroom?

5. METHODOLOGY

A quantitative research design approach was adopted for this study. The population of the study consisted of 315 students undertaking level 200 of Nigeria Certificate in Education (NCE) in FCT College of Education, Zuba Abuja. The sample consisted of 165 (52.4%) males and 150 (47.6%) female students. The mathematics teachers were selected via non-random purposive because they were teaching the course at this level and were considered qualified mathematics teachers. The sample consisted of two male and two female mathematics teachers each of whom was observed three times. Chi-square test statistics was used for the analysis. In this study, we adopted Miles and Hurberman (1994) model for the qualitative data analysis.

5.1 Instrument

The main data source for this study came from classroom observations. The data were collected using a modified version of Interaction for Sex Equity in Classroom Teaching Observation System (INTERSECT) adopted in Duffy *et al.*, (2001). The instrument was employed to facilitate the researcher in observing the evaluative types of interactions in mathematics classrooms, which are acceptance, remediation, praise and criticism. The interactions patterns were numerated by frequency counts. The researcher, together with her two assistants purposively observed and recorded the interactions, which took place only between the teachers and their students (Student-teacher and student-student interactions were not observed). For the analysis, a code was allotted to every category. Each code was used to represent the teacher and the student's behaviour in the mathematics classroom. An audio recorder was used to record the observations and interviews. The interrater reliability of the classroom observations was carried out after the recordings and observations. The inter-rater reliability analyses indicated that the four areas of interactions reflected good inter-rater reliability with a kappa value of 0.68 for praise, 0.72 for

acceptance, 0.62 for remediation and 0.78 for criticism. Themes' reliability was determined by subjecting the themes to two experts. Their feedback was analysed using SPSS version 22 and the Cohen's Kappa value obtained was 0.73.

5.2 Data Analysis Procedure

Selection of groups was carried out to ensure that a large sample was obtained. The participants were selected randomly from the schools that have the majority number of students, mostly from school of arts and social sciences. Four (4) teachers in three schools were observed in terms of the four types of interactions (acceptance, praise, remediation and criticism). The observations were conducted three times for each teacher for three weeks and each observation lasted for two hours. The same teachers were individually in a session that lasted about two hours each. With the help of the two research assistants, a total of 361 observations were obtained, and descriptive statistics were employed to quantitatively analyse the patterns of interactions in the mathematics classes. The data obtained were computed and the corresponding counts for each type of interaction were keyed into tables. The observed and expected frequencies were computed in terms of females and males ratio.

6. RESULTS

6.1 Research Question 1

What types of teacher-initiated interactions are given by male and female teachers towards their male and female learners' in general basic mathematics classes at FCT College of Education, Zuba Abuja Nigeria?

Table 1 reports the observation on the three teachers. The teachers were observed three in terms of the four (4) categories of interactions. In group B, the frequency of teachers directing their praise to students was 47 (the highest), followed by group C ($n = 42$) and group A ($n = 41$). The frequency of acceptance observed shows that the teachers in group A directed acceptance towards their students more frequently than those in group B ($n = 31$). In sum, the first and second observations indicated a difference in frequency for the four parameters of interactions. A total of 361 observations were made based on the basis of the four categories of teacher-student interactions as shown in Table 1.

Table 2 presents the frequency and percentage of teacher initial feedback to their students which they often provided more praise to students. Praise accounts for 36.01% in the classroom setting, followed by acceptance (24.93%); remediation (21.05%), and criticism (18.01%).

TABLE 1: FREQUENCY OF OBSERVATIONS ON FOUR PARAMETERS OF LECTURER-STUDENT INTERACTIONS

<i>School</i>	<i>Category</i>	<i>1st Observation</i>	<i>2nd Observation</i>	<i>3rd Observation</i>	<i>Total Observation</i>
A	Praise	16	15	10	41
	Acceptance	14	11	08	33
	Remediation	10	07	08	25
	Criticism	05	07	10	22
B	Praise	20	15	12	47
	Acceptance	14	12	05	31
	Remediation	08	10	12	30
	Criticism	06	09	3	18
C	Praise	13	12	17	42
	Acceptance	08	13	05	26
	Remediation	04	07	10	21
	Criticism	07	08	10	25
Grand Total		125	126	110	361

TABLE 2: FREQUENCIES AND PERCENTAGES OF TEACHER-STUDENT INTERACTIONS

<i>Type of interaction</i>	<i>Frequency (n)</i>	<i>Percentage (%)</i>	<i>No. of times observed</i>	<i>No. of teacher observed</i>
Praise	130	36.01	3	4
Acceptance	90	24.93		
Remediation	76	21.05		
Criticism	65	18.01		
Total	361	100.00	3	4

Table 3 shows the frequency of the different types of teacher interactions with male and female learners in the mathematics classes. The findings reveal the following; praise interaction in which males involved (67%), acceptance (61%), remediation (61%) and criticism (62%). On the other hand, the frequencies of female students involved in the interaction were as follow; praise (33%), acceptance (39%), remediation (39%) and criticism (38%). This shows the different interactions in each category between the male and female learners in the mathematics classrooms.

Table 3 reveals that the male teachers directed 35 (78%) praises to male students and 10 (22%) to female students. The female teachers directed 45 (60%) praises to male students and, 30 (40%) to female students. These results suggest that the male students received more praise from both male and female teachers than did the female students. In the case of acceptance, the male teachers directed 20 (57%) acceptance to male students, (43%), and the female teachers, directed more acceptance (64%) to male students than to female students (36%). This shows that the female and male teachers directed acceptance more towards male students

TABLE 3: OBSERVED FREQUENCY OF THE INITIATED INTERACTIONS OF FEMALE AND MALE TEACHERS TOWARDS FEMALE AND MALE LEARNERS

Teacher	Praise				Acceptance				Remediation				Criticism			
	Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Male	35	78	10	22	20	57	15	43	20	67	10	33	15	60	10	40
Female	45	60	30	40	35	64	20	36	26	57	20	43	25	63	15	37

than towards female learners in the mathematics classrooms. The results also reveal that the female teachers directed more remediation (57%) to male students, than to female students (43%). The male teachers directed 20 (67%) remediation interactions towards male students and, 10 (33%) towards female students. Also, the female and male teachers directed more criticism to male than female students 60%, 63%, 40%, and 37% respectively. The overall findings suggest that the male and female mathematics teachers directed praise, remediation, criticism, and acceptance more towards male than towards female. It is obvious that all types of interactions were directed more towards male students. Table 4 shows the expected frequency of male and female teachers' interaction directed to male and female students.

TABLE 4: EXPECTED FREQUENCY OF MALE AND FEMALE TEACHERS INITIATED INTERACTIONS DIRECTED TO MALE AND FEMALE LEARNERS

Teacher	Praise				Acceptance				Remediation				Criticism			
	Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Male	20	36	35	64	20	51	19	49	18	51	17	49	15	50	15	50
Female	40	62	25	38	25	49	26	51	20	49	21	51	18	51	17	49

Table 4 presents the frequency of teacher-initiated interactions that male and female teachers directed towards female and male learners. The male teachers initiated 20 (36%) praise interactions to male students and 35 (64%) to female students. The female teacher initiated 40 (62%) praise interactions to male students and 25 (38%) to female students. In the case of acceptance, male teachers initiated 51% of such interaction to male students and 49% to female students. Female teacher initiated 49% of acceptance interaction to male students and 51% to female students. A total of 18 (51%) remediation interaction was directed by the male teachers to male students, and 17(49%) to female students. The female teacher directed 49% and 51% of remediation interaction to male and female students respectively. However, the male teachers directed 50% of criticism interaction to both male and female students, whereas the female teacher directed 51% and 49% of criticism interaction to male and female students respectively. The overall results indicate that both the male and female teachers initiated more criticism and

remediation towards male learners than towards female learners. On the other hand, the male teachers initiated more praises towards female students. On the contrary, the female teachers initiated praise more to male learners than to female learners (Table 4).

6.2 Research Question 2

Is there any significant gender bias in terms of teacher-student interactions in the classes?

Table 5 reveals the observed and expected frequency of types of initiated interactions by male and female teachers toward learners. A Chi square statistic test was used for each type of interactions. The findings are presented in Table.5.

TABLE 5: RESULTS OF CHI-SQUARE TEST ON OBSERVED AND EXPECTED FREQUENCY OF DIFFERENCE EVALUATIVE TYPE INTERACTIONS BETWEEN MALE AND FEMALE STUDENTS FROM TEACHERS FEEDBACK

Category	No. of male	No. of female	Total interaction	Observed frequency male		Expected frequency male		Observed frequency female		Expected frequency female		Chi square	df	Asym sign
				n	%	n	%	n	%	n	%			
Praise	165	150	130	80	67	60	50	40	33	60	50	13.333	1	.000
Acceptance	165	150	90	55	61	45	50	35	39	45	50	4.444	1	.035
Remediation	165	150	76	46	61	38	50	30	39	38	50	3.368	1	.066
Criticism	165	150	65	40	62	32.5	50	25	38	32.5	50	3.462	1	.063

*significant at $p < .05$

Table 5 presents the results of the chi-square analysis, which shows a significant difference in the two categories of interactions directed both by male and female teachers towards male and female learners. The categories are praise ($\chi^2 = 13.333$; $df = 1$; $p < .05$), and acceptance ($\chi^2 = 4.444$; $df = 1$; $p < .05$). The results suggest that these categories of interactions were significantly directed to male than female students. On the other hand, no significant difference was noted between male and female learners in terms of remediation directed ($\chi^2 = 3.368$; $df = 1$, $p > .05$ and criticism ($\chi^2 = 3.462$; $df = 1$; $p > .05$). Interestingly, all the four types of interactions were significantly directed towards male than female students (Table 5). Praise received the largest value of chi-square which indicates a large difference between the male and female learners. Remediation received the lowest value of chi-square. The chi-square value of the two categories are ($df = 1$; $p < .05$), and ($df = 1$; $p > .05$) respectively, and of the other two categories of interactions are ($df = 1$ and $p > .05$ respectively). The quantities of interactions directed towards the learners depends on gender of the teachers, the number of which is proportionate to the students' enrolment in general basic mathematics course.

6.3 Research Question 3

As a mathematics teacher, what is the cause of unequal interaction patterns in your classroom?

This section presents the findings obtained from the interviews, which aimed to uncover how teachers have been treating male and female students in their mathematics classes at FCT College of Education, Zuba Abuja. Four teachers (two males and two females) were selected for the interviews. The interview schedule consisted of two open-ended questions;

- (a) As a mathematics teacher, do you think that you are giving the same or different types of feedback to male and female students in your classroom?
- (b) What is likely the cause of the different interactions in your mathematics classroom?

The four teachers interviewed pointed the same responses for the interview questions. They were asked if they have given different or same type of feedback to male and female students in their mathematics classrooms. Almost 83% of the respondents explicitly stated that the category of feedback directed towards male and female students was not gender-dependent. Some maintained that the feedback was based on the student's personality. The following are the comments received from the interviews:

The category of feedback does not depend on gender but rather on the student's personality. Male students may not be more sensitive than female students but some female students are very sensitive. When we criticise them in the classroom they feel offended and may not participate in the lesson (Male teacher A)

Another teacher commented

The student determine the type feedback from me (Female teacher H)

I personally do not ... the sex of my students but once I notice that the particular student is seemed to be worry of my feedback I quickly adjust and in most cases this is mostly noticed by male students (Female teacher Mrs B).

One of the participants claimed to be very careful in treating both male and female student in his classroom. He mentioned,

Hmmm... you see, female students are more emotional than male students. I immediately take my time and as well very careful to direct remediation and criticism towards females. Teachers need ... watchful ... to female students. Also I, have to be polite in directing remediation or criticism to female students (Male teacher J).

The teachers were asked about the possible causes of the different treatment given to male and female students. The responses received were varied, which include the voluntary participation of students (65%), student knowledge accounts

(43%), characteristics of the teacher amounted (21%), classroom contents (52%) and the gap between teaching and practising (18%). Some of the comments received are as follows;

You ... female students do not like to voluntarily participate unless you like ... them, but you see ... male students do voluntary participate in answering questions in my class (Female teacher B)

See ... many male teachers seemed to be comfortable more with males, few female teachers with females. This may depend on the individual teacher temperaments as well as characteristics (Male teacher A).

At this level, it is based on the knowledge of the individual student. I do not ask male or female students different higher or lower questions but I rather asked the same level of question to both students (Female teacher Ms H).

Another participant highlighted the cause of the unequal interaction;

It is the result of the gap between teaching and practicing that the teacher has before coming into the class... and content of the class is another factor I think so...(Male teacher J).

7. DISCUSSION

Findings from the quantitative analysis indicate that the male and female teachers initiated four different evaluative types of interactions (praise, remediation, acceptance and criticism). These types of interaction were examined to understand the extent of gender bias in mathematics classroom. The results reveal that both the male and female teachers directed more praise and acceptance towards male students than towards the female students. This implies a significant difference between male and female learners for the two categories of interactions. Still, no significant difference was noted between the male and female teachers who initiated criticism and remediation towards male and female students. These findings correspond to Sadker (1994), Jones and Dindia (2004), Mutekwe and Modiba (2012), and Hassaskhah and Zamir (2013), who all attest that male and female teachers direct more praise and acceptance towards male students than towards female students. Nevertheless, findings of the present study contradict that of KeChen (2007), McDonnell (2007) and Zinyahs and Zanzalin (2015). The results are also inconsistent with those reported in the literature, in which claim that female teachers directed more praise and acceptance to female learners than to male learners.

The findings also indicate that both female and male teachers direct criticism and remediation equally to both male and female students. This suggests no significant difference in the teacher directing remediation and criticism to male and female students. These results are consistent with the findings of Akinleke and Omowunmi (2013), and Duffy *et al.*, (2001). In conclusion, the four categories

(interactions, criticism, praise, remediation and acceptance) were directed towards males than female students.

The reason for the female and male teachers interacting more with male students may be that male students interact more than female students. Other possible reasons are

1. the notion that mathematics is a male domain, and
2. the cultural belief of some parts of Nigerians that any female reading mathematics is smarter than the males hence reducing her chance to be (Tuwor, 2007).

Also, the findings can be attributed to the intricate chains of interactions of students. In conclusion, the overall findings of the study indicate that female learners sometimes receive subtle interactions, which may affect their self-esteem, self-confidence and mathematics performance negatively. Due to this unfavourable consequences it is crucial for teachers to discern whether their interaction patterns are due to their mental schemes, and whether their interactions are due to gender difference or learners' behaviours. Pertaining to male teachers not directing more criticism and remediation to male students, the interviews suggest that Nigeria male teachers are very cautious in criticising male students as stated by one of the participant:

Hmmm... you see, most especially female students are more emotional than male students. I immediately take my time and as well very careful to direct remediation and criticism towards females. Teachers need ... watchful ... to female students also, i have to be polite in directing remediation or criticism to female students (Male teacher J).

Pertaining to the cause of the unequal interactions, the findings suggest that much of the interactions being directed to male learners, were due to the male students initiating the interactions. A few of the teachers interviewed mentioned that the voluntary participation was likely to have caused by unequal distribution of interactions by the teachers. Previous studies have revealed that more male students volunteered to answer questions compared to female students (D'Amboise and Hamner, 1996; Altermette *et al.*, 1998; Koca, 2009). The classroom observations in this study also demonstrated that the male and female students had also actively participated in a considerable number of turns.

8. IMPLICATION AND CONCLUSION

The main objective of the study on gender equity in teacher-student interactions is to enable mathematics teacher to create critical self-awareness and also gain more insights of gender differences in classrooms interaction. The findings of the study imply that the teachers have not been aware of the bias exhibited in their interactions with students in the GSE 212 mathematics class. Both female and male teachers

interacted more with males than with females. Accordingly, teachers need to be trained on gender issues in mathematics classrooms. The findings of this research have a significant psychological and pedagogical implications hence requiring further research. The study will enable teachers to confront their own interactions patterns that will work towards achieving an equitable experience of female and male students in terms of quality and quantity of their interactions in mathematics classrooms. Our study suggests that a training be conducted on systematic self-analysis and reasoning process of making teaching and gender equity in mathematics classrooms interaction. This training should form an integral portion of teachers' education in both colleges and faculty of education programmes for in-service teachers in Nigeria. There is also a need for further study on the interactions of teachers and student in mathematics at the university level to examine the perception of gender bias by student and teachers.

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