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Peer Mentoring as Intervention Strategy towards Improving Secondary Teachers' Interaction and Attitude in Secondary Schools

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Authors' contributions

This work was carried out in collaboration between all authors. Authors EYG and EEA designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors JOE and RMS managed the literature searches and all the authors managed the experimental process and author EYG did the final editing along with authors JOE and RMS while author EEA managed data analysis and interpretation. All authors read and approved the final manuscript.

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ABSTRACT

This study centred on peer mentoring as an intervention strategy for improving classroom interaction and attitude towards teaching among Benue State secondary school science teachers. The study employed two research designs: the survey and the quasi experimental designs. The survey design was relevant in the determination of the kind of classroom interactions that teachers engage in as well as how to persuade the teachers to develop positive attitude to teaching science. The quasi experimental design was the pre-test, post-test type to determine efficacy of the mentoring procedure in teachers' classroom interaction while they underwent mentoring. A total of 36 science teachers participated in mentorship that lasted 4 months. Four instruments were used: The Mentoring Guide (MG), the Mentees Attitude Questionnaire (MAQ), a Modified Flander's Interaction Analysis Category (MFIAC) and the Mentees Evaluation Comments Questionnaire

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(MECQ). Reliability of MAQ was found to be 0.86 using Cronbach Alpha and that of MFIAC was 0.69 using Phi coefficient. The MG was researcher-designed and all other mentors were trained on how to use it effectively. The findings showed that biology, chemistry and physics teachers' classrooms shifted from being lecture-dominated as recorded before mentoring to students' non-verbal activity-dominated especially in setting and washing apparatus, writing tests, and filling workbooks. Thus the reduction in interaction under direct teacher behaviour led to increase in interaction under students' non-verbal behaviour. The teachers' non-verbal behaviour equally reduced after mentoring since the classes became less teacher-dominated. Mentoring had significant effect on the attitude of science teachers exposed to it. The male teachers had greater change in attitude after mentoring compared to the females though this was not statistically significant. Mentoring was found to assist science teachers develop positive attitude towards the teaching profession. Both male and female science teachers enjoyed the mentoring relationship and indicated their willingness to become mentors to other teachers. Majority of the mentees prefer a longer (3 years and above) period for mentoring. Inadequate visitations by mentors as well as inadequate time for contacts were the major challenges. Reasons for recommending mentoring as one positive way to help science teachers grow were: For knowledge acquisition, improving teaching skills, building confidence in teachers and encouragement of hard work. It is recommended among others, that mentorship of beginning science teachers should be integrated into the state policy as done elsewhere outside Nigeria to guarantee its regularity, financing and effectiveness. As a gradual process, the duration of mentoring should be steadily increased until it comes to a time when it will be a policy matter in the state. Teacher training institutions as a matter of policy and in collaboration with government should ensure internship (or mentorship as may be called in this study) for all graduating teachers for one year before they go for national service (NYSC).

Keywords: Mentoring; mentees; attitude towards science; classroom interaction; teachers' verbal behaviour; teachers' non verbal behaviour.

1. BACKGROUND TO THE STUDY

Persistent poor performance, lack of interest and low enrolment in science in Nigeria especially at the secondary school level have put science educators on their toes in search of viable and sustainable solutions. A number of reasons have been adduced for such anomaly. What perhaps seems to be neglected thus far is how the teachers' behaviour in the classroom can be positively influenced. Wellington [1] and Ikeobi [2] emphatically suggested mentoring as one of the definite possible ways of tackling this science teachers' problem but studies are yet insufficient to establish the reality of such a suggestion.

Teachers do more than transmit knowledge. They shape the emotional, intellectual, physical, social and spiritual development of entire generations [3]. They have a daily influence on their students. A teacher stands in a good position to stimulate students to learn his/her subject. This could be made possible from the way he/she thinks about his/her profession, the kind of friends s/he makes, his/her knowledge of available modern methods and of the subject, and his/her personal decision based on conviction to make learners excel in the subject. Directly or indirectly these translate into a warm or dull classroom interaction.

A dull classroom interaction has negative effects on the learners' disposition to learn. This is because they may fall asleep, become distracted in the class, find something else to do or tune off completely. This becomes more serious in subjects like the sciences that are often dreaded by learners because of too many apparently abstract concepts which may be unappealing to them.

The question is, granted that secondary school science classes are dull usually as a result of poor classroom interaction, what can be done, as an interaction strategy, to bring about improvement in the learning of the subjects? Influence of peer pressure is quite real to most people and could be explored to advantage. For instance, most people adopt persons higher than them in knowledge, experience and perhaps social status as their role models. If such persons voluntarily become their peers in the same profession and discipline, or simply put, their mentors, to what extent could it influence their interaction in the classroom?

Mentoring is ordinarily a one-to-one personal relationship over a reasonable period of time and involves teaching, individualized instruction, sponsoring, encouraging, counseling, befriending, apprenticeship, among others. It can be formal or informal. This study adopted the formal mentoring type which is purposely planned, designated and focused to deliver the goods of helping younger science teachers to grow in attitude, knowledge and the profession. Daloz [4] defines mentoring as a relationship between a more experienced elder and a younger learner in which the mentor provides knowledge, skills, support, challenges and inspiration. Mentoring is relational and experiential which means that the mentee spends time with the mentor; the mentor models for the mentee how to teach; and the mentor instructs the mentee along the way. It is like saying, ‘watch me to see how I do it; say what I say, and do what I do’ [5]. If carefully designed with focus, an individual could mentor many people over a period of time. It is hoped in this study that such mentorship would bring about positive change in attitude towards the subject the teacher teaches, how he/she teaches and his/her expectations from the learners.

Uba [6] defines attitude as “a relatively stable and enduring predisposition to behave or react in a certain way towards persons, objects, institutions or events positively or negatively”. This definition seems to be in line with the reasoning of many social psychologists that attitude influences behavior and therefore it should be possible to predict one’s behavior if the attitude towards that phenomenon is known. Implicit in this statement is the speculation that science teachers are likely to adopt a positive attitude if they are influenced positively by mentors.

In Nigeria, the general attitude of people towards the teaching profession is negative [7,8]. This attitude has been subtly deposited into the fertile minds of the younger generation especially those in the secondary schools. This is evidenced in the applications made for admission into the Nigerian Universities and Colleges of Education. Piwuna and Mang [7] reported that in the 2004/2005 applications considered in the courses of study in the University of Jos, of the 6086 candidates that applied to the departments of Medicine, Accounting, Pharmacy, Law and Education; 2992 candidates applied to study Medicine, Accounting, 1558, Pharmacy 805, Law 592 and Education had only 139 candidates. Alarmingly, of the 139 that applied to the Faculty of Education, none applied to the science and technology department (Chemistry Education, Biology Education and Physics Education). Nobody wants to be a teacher and a science teacher for that matter!

Attitudes are inclinations and predispositions that guide an individual’s behaviour and persuade him to take an action that can be evaluated as either positive or negative [9,10]. Attitudes also develop and change with time. Attitudes may be formed from direct personal experience or they may result from observation. Social roles and social norms can have a strong influence on attitudes. According to the multi-component model of attitude, attitudes are influenced by three components [11]. These components are cognitive (beliefs, thoughts, attributes), affective (feelings, emotions) and behavioural information (past events, experiences).

Peer mentoring may be time consuming and perhaps an expensive option but it appears to be promising as it is both an attitudinal change strategy and a way of getting teachers acquainted with modern approaches of making science classroom highly interactive. The mentor and the mentee are expected to work cooperatively both seeing each other as a professional colleague. It is indeed a necessary structure within which close observation and support from the mentor leads to valuable feedback and appropriate advice needed for developing effective classroom interactive skills.

What a teacher in the class from the point of entry to the point of departure does matters a lot. At any point the teacher is either talking to the learners or the learners are talking to the teacher. In the absence of this, there is silence. The possibility that the teacher could dominate the talk or give much room to the learners to make contribution determines the tone of the class and hence the interaction pattern. A favourable interaction could lead to improved learning while unfavourable interaction could lead to poor learning. This study is precisely focused on how to utilize peer mentoring to bring about improved interaction in science classrooms in secondary schools in Benue State, and to find out if the interaction is gender dependent. Accordingly, what happens in the female teacher and male teachers’ classes was also of interest in this study.

1.1 Statement of the Problem

Informal mentoring goes on all the time, even in traditional settings. The result may go unnoticed and the method undefined and unrefined. The constant search for how to improve teachers' attitude is key to how well they relate to their students in and out of class. If an older teacher helping younger teachers is defined in such a way that is deliberate, planned and focused, it will introduce a system of formal peer mentoring.

The use of this intervention strategy is relatively new in this part of Nigeria especially the North Central geopolitical zone of Nigeria where Benue is situated. However, it is worth giving it a try because other methods have been tried out variously yet the problem of poor performance and low enrolment in the science still stares us in the face. Its application to the science has recently become popular in the Western nations [12,13] and also in the language studies in Nigeria [14]. At the moment, records of its application to the sciences in Nigeria are scarce.

As part of the strategy to improve science teachers' confidence in the classroom, relationship with older teachers and positive attitude to their work, the problem of this study is essentially on how peer mentoring could be explored to determine the extent to which it can influence teachers' classroom interaction and their attitude towards teaching.

1.2 Objectives of the Study

The main objective of this study is to improve output quality of secondary school science teachers in Benue State of Nigeria by making their classroom interactive and the learners giving due consideration to make inputs.

Specifically, the objectives of the study are to:

1. Determine the pattern of interactions in science classrooms before and after mentoring
2. Ascertain the nature of interactions in Biology, Chemistry and Physics classrooms before and after mentoring.
3. Find out the nature of interactions in male and female science teachers' classrooms before and after mentoring.
4. Determine the extent of the mean gain in attitude of male and female science teachers after mentoring.
5. Ascertain the extent of mean gain in attitude of Biology, Chemistry and Physics teachers towards teaching after mentoring.
6. Find out two things mentees enjoy in their mentor/mentee period of interaction.
7. Determine difficulties mentees experience during the mentee/mentor interaction period.
8. Determine what mentees think would have made the mentor/mentee relationship more useful to them.
9. Find out what new things about teaching their subjects do mentees learn from their mentors.
10. Ascertain the position of male and female mentees on each of the following:

    i. Enjoyment of my mentor,
    ii. Ready to be a mentor to another teacher, my suggested length of a mentoring relationship for teachers,
    iii. Complaints mentees have about the mentoring project,
    iv. Reasons mentees have for recommending mentoring as one positive way to help science teachers.

1.3 Research Questions

The following research questions guided the study:

1. What is the pattern of interactions in science classrooms before and after mentoring?
2. What is the nature of interactions in Biology, Chemistry and Physics classrooms before and after mentoring?
3. What is the nature of interactions in male and female science teachers' classrooms before and after mentoring?
4. To what extent is the mean gain in attitude of male and female science teachers after mentoring?
5. To what extent is there a mean gain in attitude of Biology, Chemistry and Physics teachers towards teaching after mentoring?
6. What two things did mentees enjoy in their mentor/mentee period of interaction?
7. What difficulties did mentees experience during the mentee/mentor interaction period?
8. What did mentees think would have made the mentor/mentee relationship more useful to them?

9. What new things about teaching their subjects did mentees learn from their mentors?
10. What is the position of male and female mentees on each of the following?

   v. I really enjoyed my mentor,
   vi. I am ready to be a mentor to another teacher,
   Here's my suggested length of a mentoring relationship for teachers,
   vii. Complaints mentees have about this mentoring project, and
   viii. Reasons mentees have for recommending mentoring as one positive way to help science teachers.

1.4 Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean pre- and post- attitude rating of science teachers towards teaching profession.
2. There is no significant difference in the mean gains in attitude between male and female science teachers that were mentored.
3. There is no significant difference in mean attitude gains among biology, chemistry and physics teachers that were mentored.

1.5 Theoretical Frame Work

The two theories briefly examined in this section are: the learning-behavior theory and Bruner's cognitive theory. One of the proponents of learning behavoiur theory is Doob. The theory is contained in Davidoff [15] who sees attitude as an implicit drive producing response considered socially significant in an individual's society. Thus, it portrays attitudes as implicit response, which occurs within the individual as a reaction to stimulus pattern affecting subsequent overt responses. This explanation has dual implications: one is that such a belief is an indication of the fact that an attitude is not an enduring disposition as posited by many. Secondly, the outgoing efferent decoding part of the intervening process is stressed and not the incoming afferent, perceptual or encoding aspects as most cognitive theorists do once proposed.

Cognitive theorists are more inclined to conceive attitude as templates through which one perceives reality. This precisely accounts for why they see attitude as a 'set', which selectively influences the perception of the attitude object. The present study adopts this theory because it lends support to the fact that attitude of science teachers to the teaching of their subject cannot be static; it does not have to persist but could change or could be un-learned depending on the circumstances and the interpretation given to it at a point in time.

Learning theories are of two broad categories. They are the Stimulus-Response (S-R) theory of Behaviourist family and the cognitive theory of the Gestalt field family. The major proponents of the cognitive theories include Ausubel, Bruner, Gagné, and Piaget. This study adopts the Bruner's theory.

Jerome S Bruner's cognitive theory (as in 16] which states that cognitive growth of a child takes place by his undergoing three successive stages:

i. Stage of Enactive representation. This implies that children at this stage identify the object not from nature of them but from actions evoked by them.
ii. Stage of Iconic representation. This is a representation of models and image of objects and things of concrete experience of the child.
iii. Stage of Symbolic Representation. This stage represents the external and the internal world of thought processes of the child through the medium of language symbols.

Bruner called his position 'theory of instruction' rather than theory of learning and by 1960 he became popular for his theory of learning by discovery. He further identified two types of discovery learning:

1. Discovery learning through assimilation. Here the learner spontaneously recognizes a new situation that is familiar to one of the elements in his existing structure of knowledge and easily assimilates it [17].
2. Discovery-learning through accommoda tion. Here the new situation is incompatible with the learner's existing structure of knowledge, he therefore restructures his cognitive framework so that the new learning materials can be accommodated [17].

Bruner's modified theory is called guided discovery. First, although emphasis of this theory is on children, but because we are training teachers who are expected to handle the children in the way that they will be involved in doing, thinking and discovering new ideas and thought patterns, the teachers would be made to be familiar and apply the theory in their classroom practices in the process of peer mentoring. Secondly, interaction as implied in this study connotes the use of guided discovery in the classroom which guarantees learners' active participation.

1.6 Status of Teacher Mentoring Outside Nigeria

The need to have pre-service teachers mentored to guarantee effectiveness may not be limited to Nigeria only though it is a developing nation. Therefore brief experiences in some other places such as New York, Boston, Durham and Chicago are examined in this section.

In 2004, the New York Board of Regents modified the teacher certification requirements mandating that all new teachers having less than one year teaching experience must receive a high quality mentoring experience in their first year of teaching [18]. As a follow up, researchers became more concerned about high attrition rates of new teachers and evidences from studies showing negative impacts of persistent teacher turn over on students. A report from one of the studies in Colombia revealed that students' achievement in both reading and math were higher among teachers that received more hours of mentoring than others.

In Boston, Massachusetts state has approved state regulations that require first-year educators to complete a one-year induction programme with a mentor. Guidelines encouraged districts to incorporate state standards into mentoring programmes including orientation, a trained mentor and son [18]. Presently, the state operates a full-time and part-time school based mentoring.

In Durham, North Carolina the state required that all first, second and third year teachers receive mentoring support. Districts received 1,000 US dollars per first and second year teacher to support mentoring. For many years the state board of education has recommended that full-time mentors' programme be funded in all districts [18]. According to North Carolina State Board of Education Policy Manual [19], a unique feature of North Carolina's policies is the acknowledgement of the working conditions of new teachers; including the tendency to assign beginning teachers the most difficult students, multiple preparations, and multiple extra-curricular assignments. This was meant to prepare the teachers for the most difficult task under experienced teachers' supervision. During the 2007-2008 school year teachers were posted on an inquiry process that engaged them in studying and collecting data on their programme, mentoring and their new teachers.

In 2005, the Joyce Foundation of Chicago supported the New Teachers Center in convening a summit to help three states- Illinois, Ohio and Wisconsin to assess and support high quality mentoring and induction. Following this step, the Chicago Public schools in partnership with Chicago New Teacher Center applied for and received funding for induction programmes in each year of the state grants [18].

As can be seen from these four states, they did not only make policy statements, they are currently modifying and implementing the policies. It is only in the teaching profession and in some developing nations like Nigeria that much significance is yet to be attached to apprenticeship or discipleship or mentoring as far as teachers' professional development is concerned. The focus of the present study could be considered to be "a stitch in time" especially as notable actions has not been taken, that "can save nine."

1.7 Review of Empirical Studies

Mentoring has gained much prominence in recent times. It is recommended for use in developing primary science teachers. For instance, Hudson and Skamp [20] recommended identification of factors and associated attributes and practices of mentoring primary science teachers in order to effectively develop pre-service teachers in primary science teaching; and that mentors need to model primary science teaching particularly in the areas of: enthusiasm, classroom management, rapport with students, science teaching, and effective science teaching designed lessons that include hands-on experience [21]. Though these studies emphasized on primary science teachers, the situation in secondary schools may not be significantly different.

Tripp and Eick [13] conducted a study in Alabama USA on match-making to enhance the mentoring relationship in student teaching. In the study, student teachers (mentees) were matched with cooperating teachers (mentors). The result shows that teaching dyads were most fruitful where primary or secondary temperaments were common, but not both. Also, all temperaments studied supported learning to teach science with unique strengths, and relational construct appeared necessary in mentor teachers for fostering relationship with ample support and communication. This study has implicated the need to mind the kind of relationship between mentors and mentees as well as learning to teach science with unique approaches, possibly with a particular kind of interaction in the class.

In yet another study by Stanulus and Russel [12] in USA on jumping in: trust and communication in mentoring student teachers, the findings revealed that mentees had a positive change in attitude, were more excited to teach and communicated better in class. Again, the revelation from this study, though not purely to a science group, has shown that interaction of mentors with the mentees has the potency of making the mentees become active, excited and communicate better in the class.

Eriba and Achor [22] in a paper on school type and sex of teacher as factors in classroom interaction pattern in integrated science made some striking revelations. The study was carried out in Kogi State of Nigeria. It was found among others that irrespective of school type, male teachers generally tended to praise and encourage learners more while the female teachers had higher records of accepting and using idea of the learners in their classrooms. Female teacher classrooms favoured higher records of student talk compared to male teacher classrooms while male teacher classes favour direct teacher talk compared with female teacher classes. Though this study examined the kind of interaction in some science classrooms in Kogi State, it is obvious that differences exist in what happens in the male and female classes. Though the present study is focused on the expected positive changes in the mentees after interacting with mentors, the likelihood that such changes may be gender dependent is there.

Nugent, Kunz, Levy, Harwood and Carlson [23] reported a study on the impact of field-based, inquiry-focused model of instruction on pre-service teachers' learning and attitudes in Nebraska, USA. The study sought to find out the effect of field-based, inquiry-focused geosciences course designed to provide pre-service teachers with opportunities for active, hands-on scientific investigation and for gaining skills in inquiry pedagogy. Results show that students in the field course scored significantly higher than students in the traditional course on measures of inquiry, confidence for teaching science courses, knowledge building, and cooperative learning. These findings seem to lend support to the fact that pre-service teachers and in our case, the mentee are likely to do better both in learning and perhaps imparting of the same knowledge in the area by using inquiry approach and in engaging in cooperative teaching and learning because they are activity-oriented.

2. RESEARCH METHODS

This study employs two research designs: the survey and the quasi experimental designs. The survey design was relevant in the determination of the kind of classroom interactions and identification of effective types as well as how to persuade the teachers to develop interest in associating with the Science Teachers Association of Nigeria. Quasi experimental design was needed and particularly the pre-test, post-test type to determine efficacy of the mentoring procedure.

All the secondary school science teachers in Benue State constituted the population for the study. However, because of the expensive nature of studies on mentorship, only 36 science teachers (12 each for Biology, Chemistry and Physics) were randomly selected using stratified random sampling technique. The strata were the subjects and gender. Accordingly, equal number of male and female science teachers (18 males and 18 females) formed the sample. Only 36 science teachers participated as mentees. There were 9 mentors, each was assigned 4 mentees. Four of the mentors were from the university while 5 others were experienced graduate teachers in secondary schools in the State. A total of 34 mentees actually completed the mentorship. This represents 94.4% of the actual sample. Two mentees unexpectedly dropped out midway to go back to school.

Four instruments were used in this study. They are the Mentoring Guide (MG), Mentees Attitude Questionnaire (MAQ), Modified Flander's Interaction Analysis Category (MFIAC) and Mentees Evaluation Comments Questionnaire (MECQ). The researchers developed the MG themselves and trained all other mentors on how to use it effectively. Similarly, MAQ was designed by the researchers and validated to ensure that it is reliable through a pilot testing. It is a 42-item Likert-type scale adapted from Fraser [24] Test of Science Related Attitudes (TOSRA). MFIAC was also adapted from Flander's well known instrument on classroom interaction. The instrument was developed by Neil Flander in 1959. It is an observational rating instrument which records the activities in the class every 30 seconds (in this study) until the lesson is over. However, inter-rater reliability approach was used to determine its reliability using Scott Phi coefficient to ensure that the raters are in agreement. Reliability of MAQ was found to be 0.86 using Cronbach Alpha and that of MFIAC was 0.69 using Phi coefficient.

The first phase in the study was a survey of all secondary schools in the state to determine the number of male and female science teachers. From these, 36 (18 males and 18 females) were randomly selected.

The next phase was the preparation of the Mentoring Guide and other instruments and their validation to be accompanied by pilot testing? Thereafter, 9 mentors comprising of 7 males and 2 females were engaged. A total of 36 sampled science teachers (or mentees) were pooled to a more central venue for interaction with the mentors soon after they were first observed in their classrooms using MFIAC and MAQ (administered) as pre-tests. The essence of pre-testing was to ensure the level of interaction and attitude at the commencement of the study and to enable determination of the level of improvement after the study.

After training at the first mentor/mentee meeting, all the teachers returned to their stations and thereafter the researchers (mentors) visited them in their respective schools to observe their classroom interactions as well as interact with them for a period of 4 months. The mentors also shared with the mentees their experiences in teaching and discussed their lessons and made suggestions to them.

The data collected from the three sources were collated and analyzed. The mean rating of MAQ was used to answer research questions 4 and 5. Similarly, data collected using MFIAC were subjected to matrix and thereafter converted to percentages. This was used to answer research questions 1, 2 and 3 while mean frequency was used to analyze data to answer questions 6 and 10. Hypotheses were tested using unrelated and related t-statistics and ANOVA.

2.1 Declaration of Known Problem with the Design

Studies involving mentoring are cumbersome and the use of two designs in this case makes it even more tedious. The implication is that it is expensive and time consuming. This explains the small sample size. Many previous studies have used sample sizes of between 8 and 24 [12,13,23]. The problem notwithstanding, the sample size of 36 in the present study is considered appropriate.

3. RESULTS

Presentation of result is by research questions and hypotheses.

> **Research question 1**: What is the pattern of interactions in science classrooms before and after mentoring?

Answer to research question 1 is on Table 1.

Table 1 reveals some changes or shifts in emphasis by the science teachers in their classrooms after being mentored. It is noticed generally that there was a wider spread of activities and consequently some had a reduction since the total must be the same for pre-observations and post-observations (70 per teacher and 2380 for the 34 teachers). Under indirect teacher verbal behaviour extent to which teacher accepts feelings of students and also praises them increased while time taken to ask many questions, take students' ideas reduced. In all, the activity in the sub-section reduced. Under direct teacher verbal behaviour the activities reduced greatly as lectures alone reduced from 515 to 86. The classroom shifted from being lecture-dominated as noticed before mentoring to being students' non-verbal activity-dominated as seen from the gain of 284 especially in setting and washing apparatus, writing tests, and filling workbooks. Thus, reduction in interaction under direct teacher behaviour leads to increase in interaction under students' non-verbal behaviour. The teacher non-verbal behaviour equally reduced after mentoring (by 41) since the classes have become less teacher-dominated. However, more silence and reflections (increased by 12), confusion and irrelevant behavioiur increased by 15 after mentoring.

Research question 2: What is the nature of interactions in Biology, Chemistry and Physics classrooms before and after mentoring?

Answers to the research question 2 are contained on Table 2 and Figs. 1, 2 and 3.

Table 1. Interaction patterns before and after mentoring in all the science classes

S/No	Categories of interactions	Pre-observ (%)	Post-observ (%)	% Diff (Post-pre)	Adjustment after mentoring
A	**Indirect teacher verbal behaviour**				
1	Accepts feelings	53(2.23)	65(2.73)	12	
2	Praises & encourages	106(4.45)	144(6.05)	38	
3	Accepts & uses ideas of students	106(4.45)	92(3.87)	-14	
4	Asks questions	327(13.74)	246(10.34)	-81	
5	Answers students' questions	98(4.12)	141(5.92)	43	-2 Less activity
B	**Direct teacher verbal behaviour**				
6	Lectures	515(21.64)	86(3.61)	-429	
7	Gives corrective feedback	119(5.00)	48(2.02)	-71	
8	Gives directions	95(3.99)	121(5.08)	26	
9	Critics or justifies authorities	52(2.18)	117(4,92)	65	-409 Less activity
C	**Students' verbal behaviour**				
10	Respond to teachers' questions	150(6.30)	88(3.70)	-62	
11	Asks teacher questions	68(2.86)	96(4.03)	28	
12	Do group work or discusses	64(2.69)	210(8.82)	146	112 Gained
D	**Students' non-verbal behaviour**				
13	Washing/setting up apparatus	42(1.76)	103(4.33)	61	
14	Doing practical work	85(3.57)	131(5.50)	46	
15	Writing/reading	88(3.70)	70(2.94)	-18	
16	Writing test	27(1.13)	104(4.37)	77	
17	Filling workbooks	49(2.06)	167(7.02)	118	284 Gained
E	**Teacher non-verbal behaviour**				
18	Cleaning the chalkboard	75(3.15)	112(4.71)	37	
19	Setting out materials/writing on the board	65(2.73)	73(3.07)	8	
20	Demonstrating experiments	97(4.08)	35(1.47)	-62	
21	Supervising students' work	55(2.31)	31(1.30)	-24	-41 Less activity
F	**Silence(non-functional verbal teacher behaviour)**				
22	Silence & reflection	28(1.18)	40(1.68)	12	12 Gained
23	Confusion & irrelevant behavior	16(0.67)	31(1.30)	15	15 Gained

Table 2. Interactions in biology, chemistry and physics classrooms

Categories of interaction	Biology			Chemistry			Physics		
	Pre obs	Post obs	Diff	Pre obs	Post obs	Diff	Pre obs	Post obs	Diff
Indirect teacher verbal behavior	163	143	-20	269	124	-145	134	258	124
Direct teacher verbal behaviour	245	168	-77	280	132	-148	221	256	35
Students' verbal behavior	91	82	-9	99	131	32	113	92	-21
Students' non-verbal behaviour	95	173	78	102	224	122	213	94	-119
Teachers' non-verbal behaviour	88	116	28	76	195	119	145	128	-17
Silence (Non-functional verbal behavior)	22	14	-8	8	12	4	9	9	0
Confusion & Irrelevant behavior	7	4	-3	6	22	16	5	3	-2

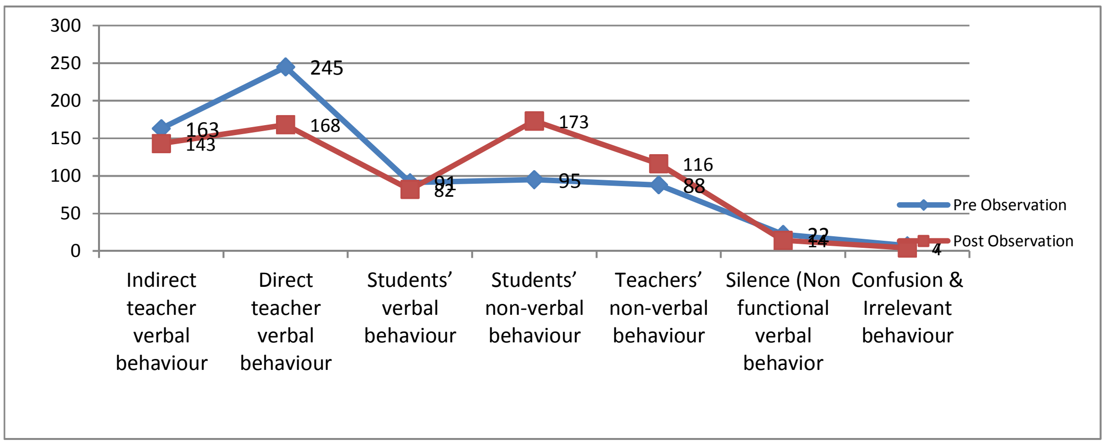

Fig. 1. Interactions in biology class room

As displayed by the line graph in Fig. 1, the interaction pattern in biology classroom shows clearly teacher dominated type before mentoring exercise took place while students' activities were less. However, after mentoring, there appears to be a reverse in the interaction as students' now dominated in the interactions as seen in students' non-verbal behaviour (173). The indirect and direct teacher behaviours reduced drastically as there was shift in emphasis. However, interactions under teacher non-verbal behaviour increased. Silence or non-functional verbal behaviour improved slightly (from 14 to 22) while the irrelevant behaviour during classroom interaction did not notice any appreciable change (i.e. the change from 7 to 4 is a reduction).

In chemistry classes the difference as seen in Fig. 2 is appreciable as indirect teacher verbal behaviour and direct teacher verbal behaviour reduced drastically (from 269 to 124 and from 280 to 132 respectively). Conversely, students' non-verbal behaviour and teachers' non-verbal behaviour increased (from 102 to 224 and from 76 to 195 respectively). Mentoring is therefore seen to have influenced secondary school chemistry classes from being a teacher-dominated to students-dominated kind of interactions. There was little increase in non-functional verbal behaviour (from 8 to 12) as well as irrelevant behaviour (from 6 to 22).

In physics classroom the pattern of interaction is generally the same but there was a slight shift in emphasis. For instance, the drastic reduction in level of interaction was more with indirect teacher verbal behaviour (from 258 to 134) compared to direct teacher verbal behaviour (from 256 to 221). In a similar manner students' non-verbal behaviour increased sharply (from 94 to 213) compared with teacher non-verbal behaviour (from 128 to 145). Noticeable changes did not occur in non-functional verbal behaviour and irrelevant behaviour.

Research Question 3: What is the nature of interactions in male and female science teachers' classrooms before and after mentoring?

Answers to research question 3 are provided on Table 3 and Figs. 4, 5 and 6.

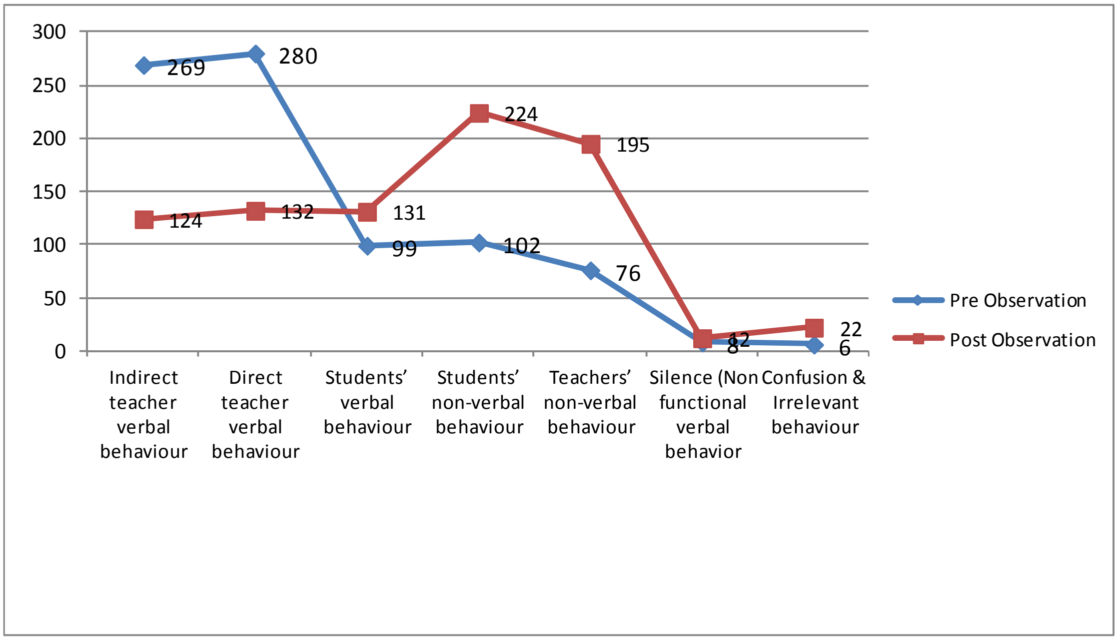

Fig. 2. Interactions in chemistry classroom

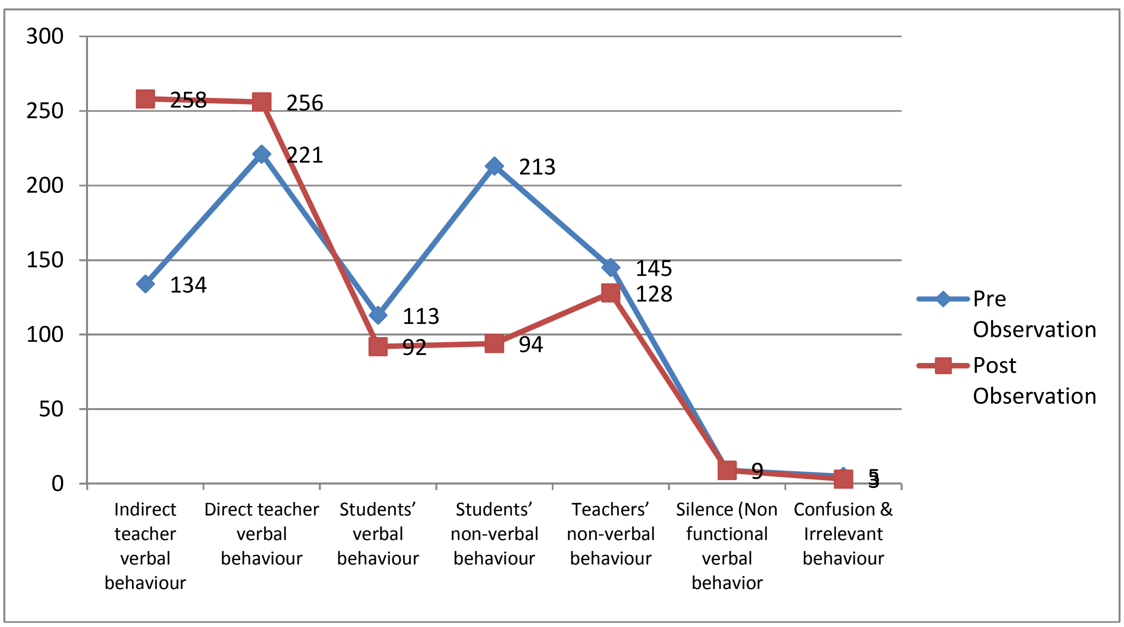

Fig. 3. Interactions in physics classroom

Table 3. Interactions in male and female science classes

Categories of interaction	Male			Female		
	Pre Obs	Post Obs	Diff	Pre Obs	Post Obs	Diff
Indirect teacher verbal behaviour	418	231	-187	272	170	-102
Direct teacher verbal behaviour	469	327	-142	312	194	-118
Students' verbal behaviour	179	188	9	103	138	35
Students' non-verbal behaviour	187	397	210	104	213	109
Teachers' non-verbal behaviour	188	282	94	104	173	69
Silence (Non functional verbal behaviour)	19	17	-2	9	18	9
Confusion & Irrelevant behaviour	10	27	17	6	4	-2

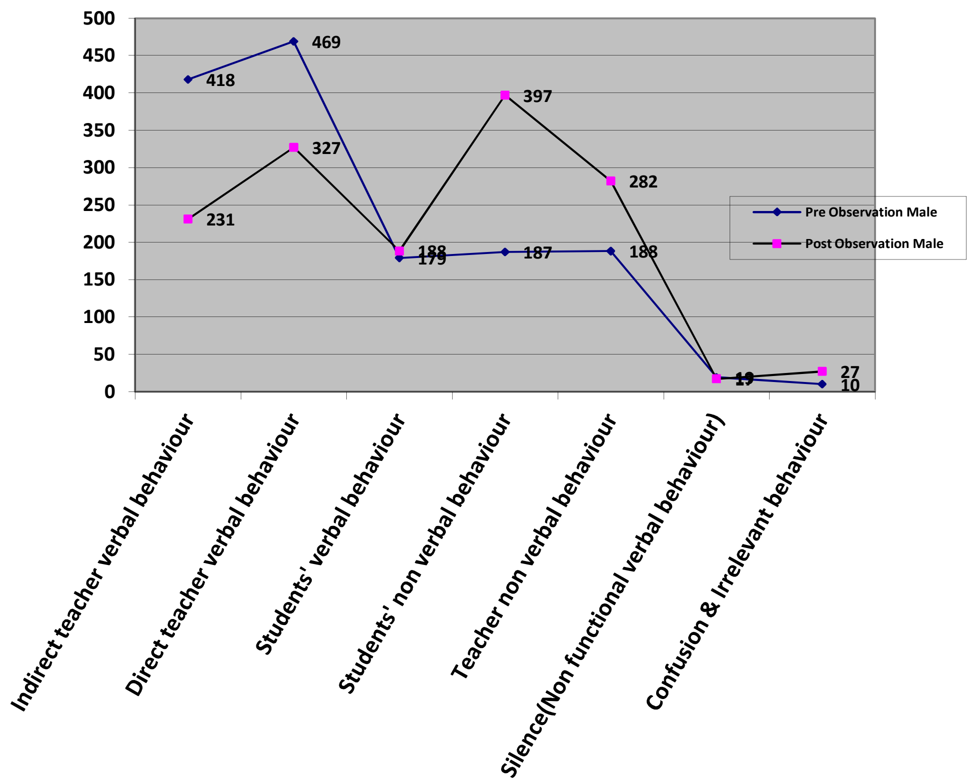

Fig. 4. Interactions in male science teacher classrooms

From Table 3 and Figs. 4, 5 and 6, the pattern of interactions in male and female science teacher classrooms indicate high activity under indirect (418 for males, 469 for females) and direct teacher (272 and 312 for females) verbal behaviours before mentoring took place. These changed or reduced to 231 and 327 for males while that of females is 170 and 194 after the mentoring exercise. Conversely, the interactions increased under students' non-verbal behavior (from 187 to 397) and teachers' non-verbal behaviour (from 188 to 282) for male science teachers while that of female science teachers increased from 187 to 397 for indirect verbal teacher behaviour and 188 to 282 for direct teacher non-verbal behaviour also. When the differences between pre-observations and post-observations were compared graphically both male and female science teacher classes witnessed reduction in both indirect and direct teacher verbal behaviours (-187 and -142 as well as -102 and -118 for males and females respectively). As usual, students' non-verbal behaviour and teachers' non-verbal behaviour witnessed positive increase interactions or activities as indicated by the difference (210 and 109 for males and 94 and 69 for females).

Research Question 4: To what extent is the mean gain in attitude of male and female science teachers after mentoring?

Information required to answer research question 4 is contained on Table 4.

Table 4 reveals that both male and female students had positive change in attitude (mean gain of 0.11 and 0.06 for male and female students respectively). Thus the male had greater change in attitude after mentoring compared to the females.

Research question 5: To what extent is there a mean gain in attitude of Biology, Chemistry and Physics teachers towards teaching after mentoring?

Table 5 has information for answering research question 5.

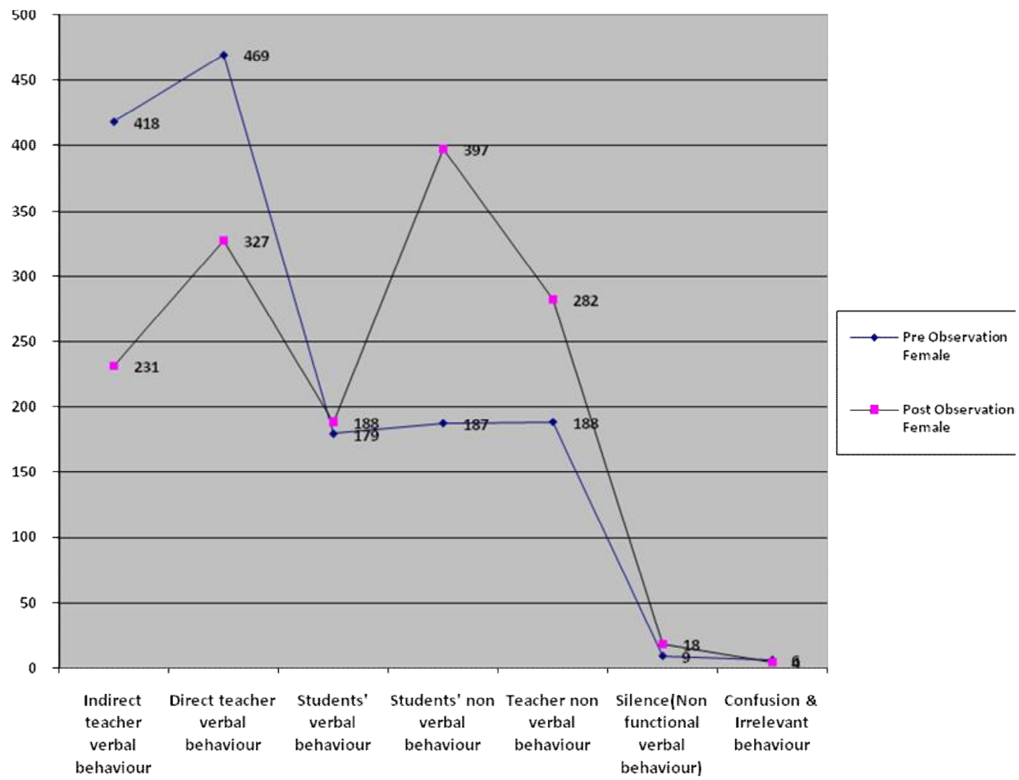

Fig. 5. Interactions in female science teacher classrooms

Table 4. Mean attitude of male and female teachers mentored

Gender		Pre-attitude	Post-attitude	Mean gain
Male	Mean	3.2583	3.3690	0.1107
	N	21	21	
	Std. Deviation	.15337	.16750	
Female	Mean	3.2077	3.2635	0.0558
	N	13	13	
	Std. Deviation	.19213	.17930	

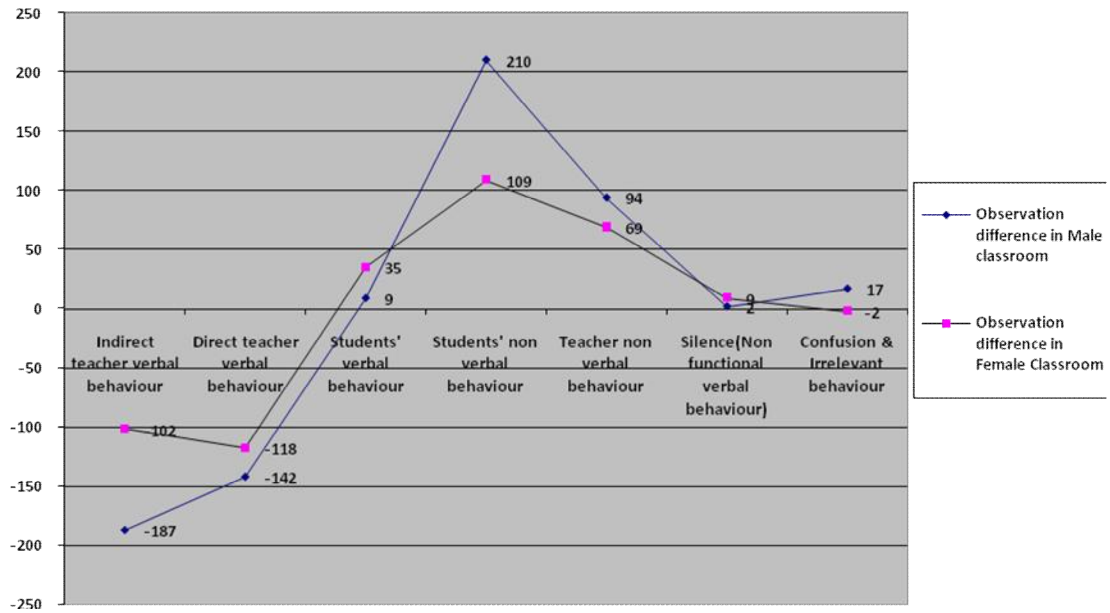

Fig. 6. Differences between pre and post mentoring interactions in male and female teachers' classrooms

Table 5 shows that biology, chemistry and physics had mean attitude gain of 0.08, 0.14 and 0.05 respectively. Chemistry teachers had the highest mean gain while physics teachers had the lowest.

> **Hypothesis 1:** There is no significant difference between the mean pre and post attitude rating of science teachers towards teaching profession.

Information used in testing hypothesis 1 is on Table 6.

Table 6 reveals that the paired sample t-test had t-value of 2.60 at df of 33 and p = 0.01 < 0.05. Thus there is a significant difference between mean pre and post attitude rating of science teachers towards teaching. We therefore reject the null hypothesis. Thus mentoring had significant effect on the attitude of science teachers exposed to it. Mentoring is therefore found to be a tool that could be used to make science teachers develop positive attitude towards teaching the profession.

> **Hypothesis 2:** There is no significant difference in the mean gains in attitude between male and female science teachers that were mentored.

Data for testing hypothesis 2 are contained on Table 7.

Table 5. Mean attitude of teachers mentored on the basis of subject area

Subjects		Pre-attitude	Post-attitude	Mean gain
Biology	Mean	3.1900	3.2725	0.0825
	N	10	10	
	Std. Deviation	.22460	.17458	
Chemistry	Mean	3.2729	3.4083	0.1354
	N	12	12	
	Std. Deviation	.13999	.18535	
Physics	Mean	3.2458	3.2958	0.0500
	N	12	12	
	Std. Deviation	.14335	.15478	

Table 6. Paired samples t-statistics

		X	N	Δ	Df	t	Sig. (2 tail)
Pair	Pre- Attitude	3.2390	34	.16823	33	-2.596	0.014
	Post- Attitude	3.3287	34	.17722			

Standard Deviation = δ ; X = mean

Table 7. t-test for male and female mean attitude rating

	Gender	N	X	Δ	df	T	Sig. 2tail
Attitude Gain	Male	21	.1107	.21717	32	0.718	0.448
	Female	13	.0558	.17623			

It is revealed in Table 7 that t = 0.72 at df =32, p = 0.45 > 0.05. This shows that there is no significant difference in mean gains between male and female science teachers that were mentored. Therefore the null hypothesis 2 is rejected. It therefore means that both male and female science teachers gained nearly at the same rate when mentored. By implication both male and female science teachers responded positively towards mentorship.

> **Hypothesis 3:** There is no significant difference in mean attitude gains among biology, chemistry and physics teachers that were mentored.

Relevant data for testing hypothesis 3 are contained on Tables 8 and 9.

From Table 8, it is revealed that $F_{2, 31} = 0.53$, p = 0.59 > 0.05. This means that there is no significant difference in mean attitude gains among biology, chemistry and physics teachers that were mentored. As a follow up, the null hypothesis is rejected. Thus biology, chemistry and physics teachers tended to acquire similar or had equal gain in attitude when exposed to mentorship. By implication, all science teachers are favourably disposed to mentorship. In addition, Table 9 shows that from the post hoc comparison, the difference in mean attitude gains between biology and chemistry teachers, between biology and physics teachers and between chemistry and physics teachers do not differ significantly. Thus the mean gains in attitude among biology, chemistry and physics teachers were almost the same or very close.

> **Research Question 6:** What did you enjoy in your mentor/mentee period of interaction?

Answer to research question 6 is found in Fig. 7. Fig. 7 reveals that most teachers enjoyed information on how to be successful in their field, followed by personal relationship and then encouragement from their mentors. However, academic gifts, new tips on trends and confidence gained as a teacher also came from a few teachers as what they enjoyed.

Table 8. ANOVA test on mean difference in attitude rating of biology, chemistry and physics teachers

	Sum of squares	df	Mean square	F	Sig.
Between Groups	.045	2	.022	.533	.592
Within Groups	1.296	31	.042		
Total	1.340	33			

Table 9. Post hoc comparison of mean differences in attitude among biology, chemistry and physics teachers

(I) Subjects	(J) Subjects	Mean difference (I-J)	Std. error	Sig.
Biology	Chemistry	-.05292	.08753	.834
	Physics	.03250	.08753	.934
Chemistry				
	Physics	.08542	.08346	.597

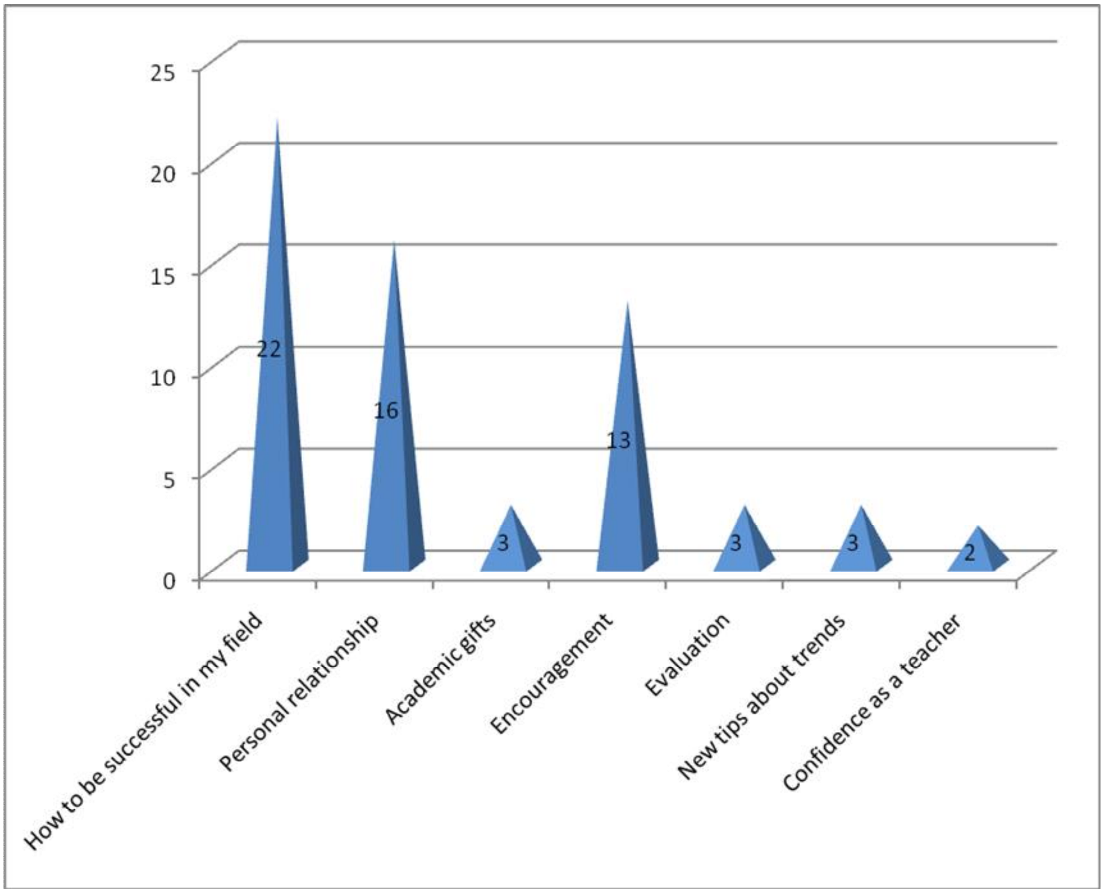

Fig. 7. Things enjoyed during mentor/mentee interaction period

Research Question 7: What difficulties did you experience during the mentee/mentor interaction period?

Information for answering research question 7 is found on Fig. 8. Fig.8 reveals that both male and female teachers saw inadequate contacts as well as inadequate time to meet with their mentors as their major difficulties. However, men were alone in the choice of discouragement from school authority, being nervous initially and difficulty in adopting new methods while the female teachers were alone in the choice of poor communication network.

Research question 8: What do you think would have made the mentor/mentee relationship more useful to you?

Necessary information for answering research question 8 is found in Fig. 9. Fig. 9 shows both male and female teachers seem to agree on the highest factor/activity of more/frequent contacts with mentors, mentors too far from mentees. However, males were alone in the choice of more cordial relationship, incentives, among others. Both male and female teachers needed more instruction/demonstration on teaching methods, mentors to be more committed and mentors to provide textbooks/equipment for the use of mentees.

Research Question 9: What new things about teaching in your subject did you learn from your mentor?

Refer to Fig. 10 for answer to research question 9. Fig. 10 shows that both male and female teachers agreed that they learnt how to use practical/demonstration to teach their lessons generally, involving students more during their lessons, planning well before coming to class as well as how to present lesson. Five other things learnt were on generally low percentage among both male and female teachers except for encouragement of team work (though low percentage) that was applicable to male teachers only.

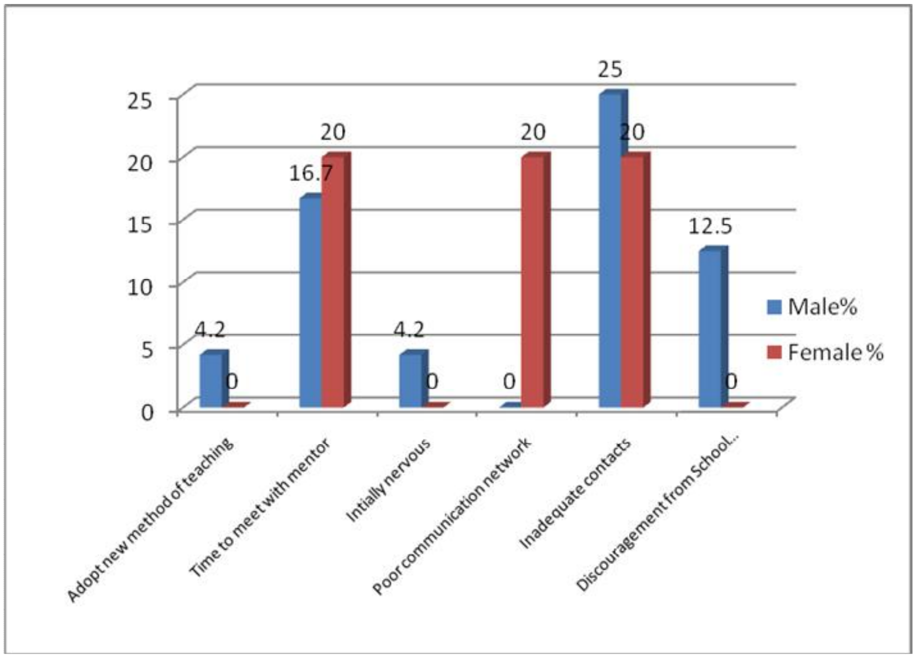

Fig. 8. Difficulties experienced during mentor/mentee relationship

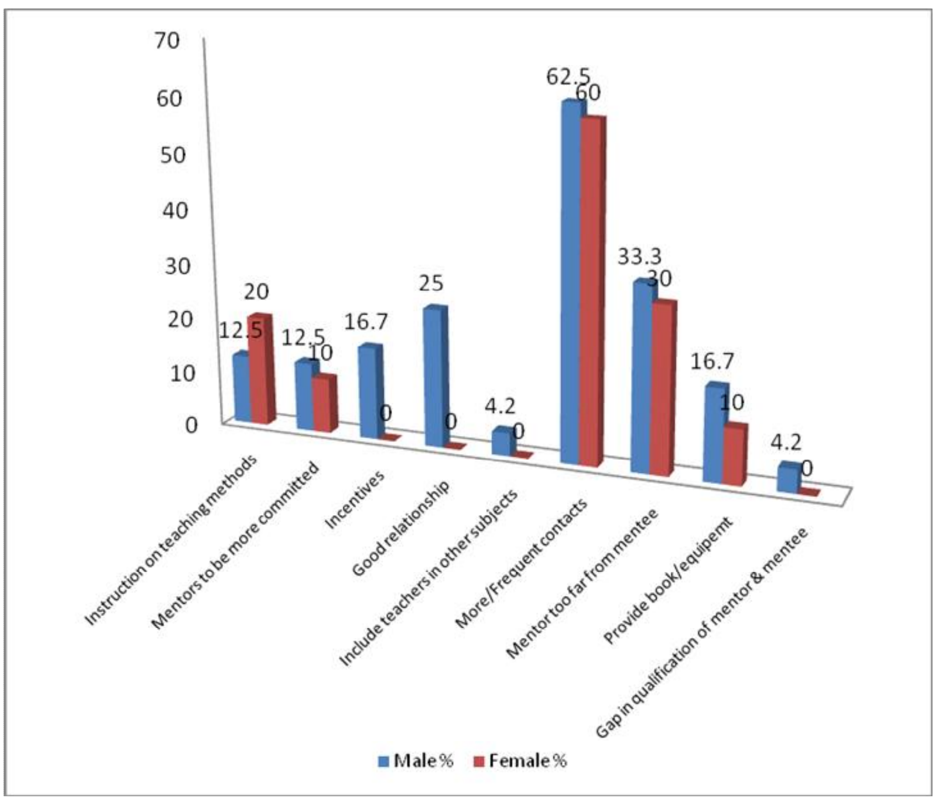

Fig. 9. Expectations during mentor/mentee's interactions that were absent

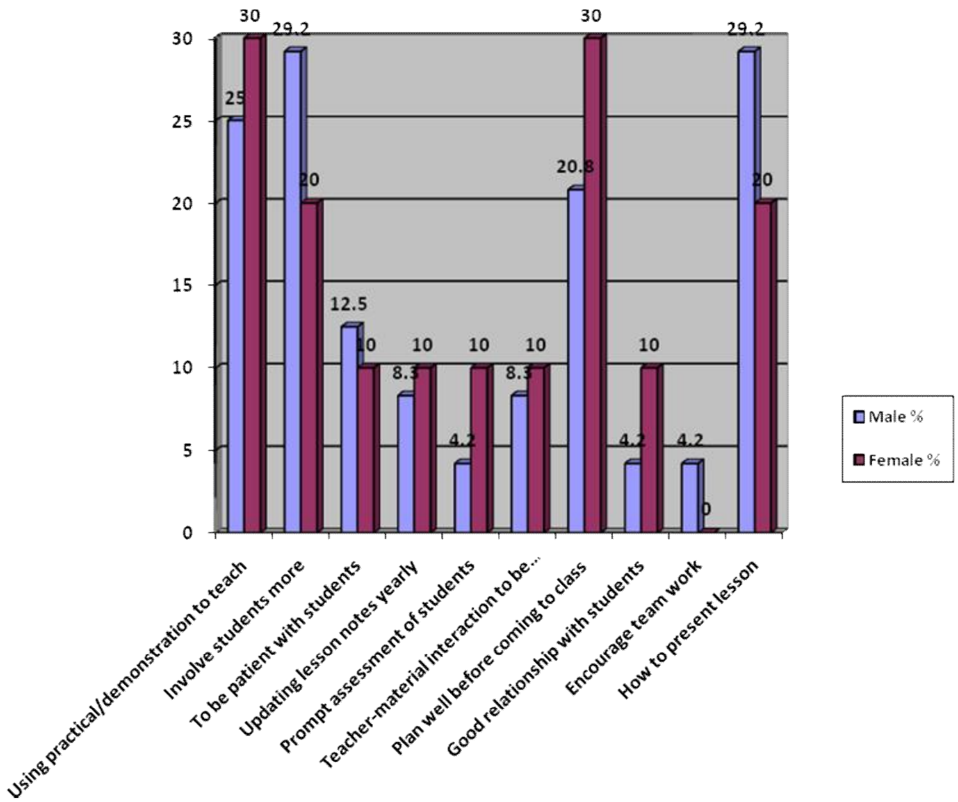

Fig. 10. New things learnt about teaching my subject during mentoring by gender

Research Question 10: What is the position of male and female mentees on each of the following?

1. I really enjoyed my mentor,
2. I am ready to be a mentor to another teacher,
3. My suggested length of a mentoring relationship for teachers,
4. Complaints I have about this mentoring project, and
5. My reasons for recommending mentoring as one positive way to help science teachers.

Bar graphs in Figs. 11, 12, 13, 14 and 15 addressed the 5 sub-questions in question 11.

Fig. 11 shows that 100% of both male and female science teachers claimed to have enjoyed the mentoring relationship in the study. Similarly 100% of female teachers and 91.7% of male teachers said they could be a mentor to another teacher. In Fig. 13, majority of male (66.7%) and female (60%) science teachers prefer 3 years and above for mentoring teachers while others (30% females & 16.7% males) prefer 2years mentorship. However, only 10% of the males said that one year could be okay for mentoring teachers. On their complaints about the project (see Fig. 14) 23.5% of the respondents identified inadequate visitation as well as inadequate time for contacts as major challenges. Also inclusion of all teachers was mentioned by 17.6% of the respondents (an expression of uniformity). Six other complaints were at a moderate level in terms of percentage of teachers that mentioned them. In Fig. 15, prominent among their reasons for recommending mentoring as one positive way to help science teachers grow were for improving teaching skills (47.1%), knowledge acquisition (38.2%), building confidence in teachers (17.6%) and encouragement of hard work (17.6%).

4. DISCUSSION OF FINDINGS

Discussion of findings in this study is done in line with the 3 major areas of focus: Observations made on interactions of male and female biology, chemistry and physics teachers, attitude of male and female biology, chemistry and physics teachers before and after mentoring as well as mentoring experience and desires of male and female science teachers (or mentees) used in the study.

4.1 Classroom Interactions of Male and Female Science Teachers

In this study, science teacher classrooms shifted from being lecture dominated as noticed before mentoring to students' non verbal activity dominated especially in setting and washing apparatus, writing tests, filling workbooks. Thus the reduction in interaction under direct teacher behaviour leads to increase in interaction under students' non verbal behaviour. The teacher non verbal behaviour equally reduced after mentoring since the classes become less teacher dominated. However, increase in silence and reflections as well as confusion and irrelevant behavioiur were observed after mentoring. It is apparent that whatever activity the teacher spends more time on in the classroom dictates the kind of interactions in that classroom.

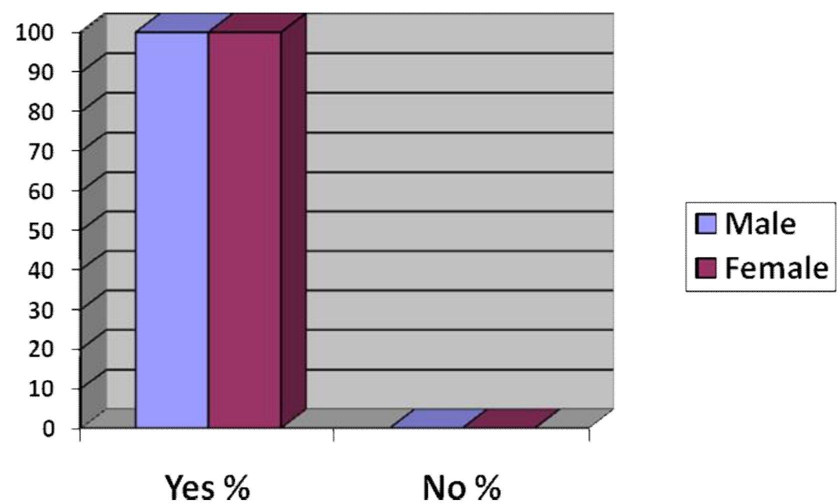

Fig. 11. Status of male and female enjoyment of the mentoring

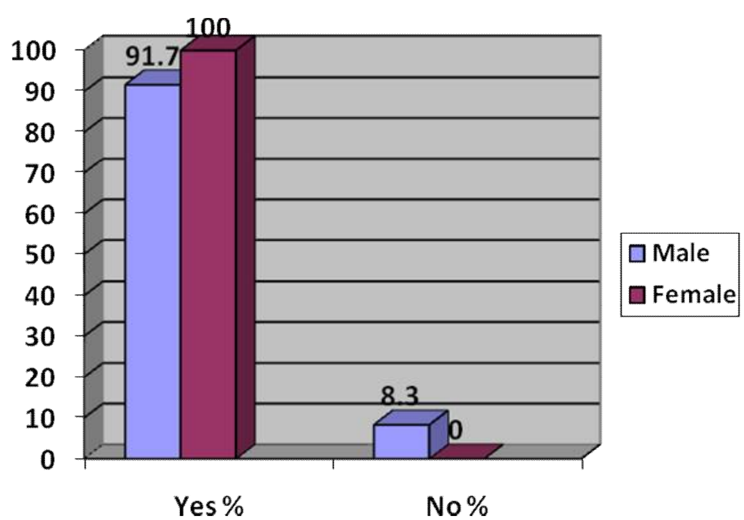

Fig. 12. I am ready to be a mentor by gender

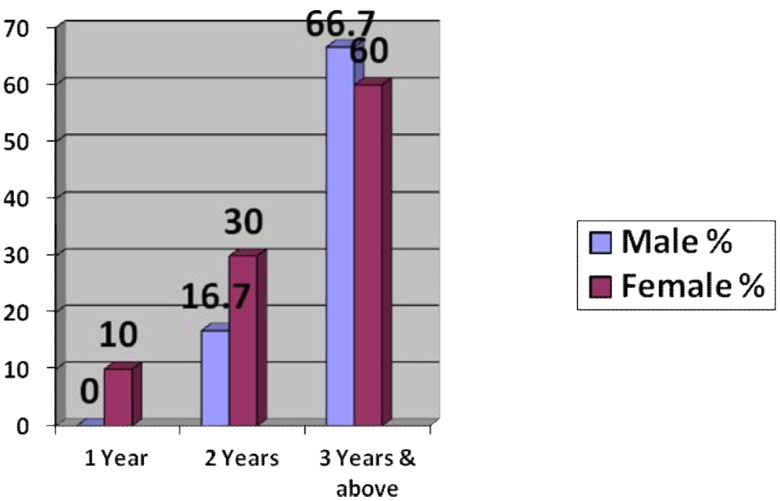

Fig. 13. Suggested length of mentoring relationship by gender

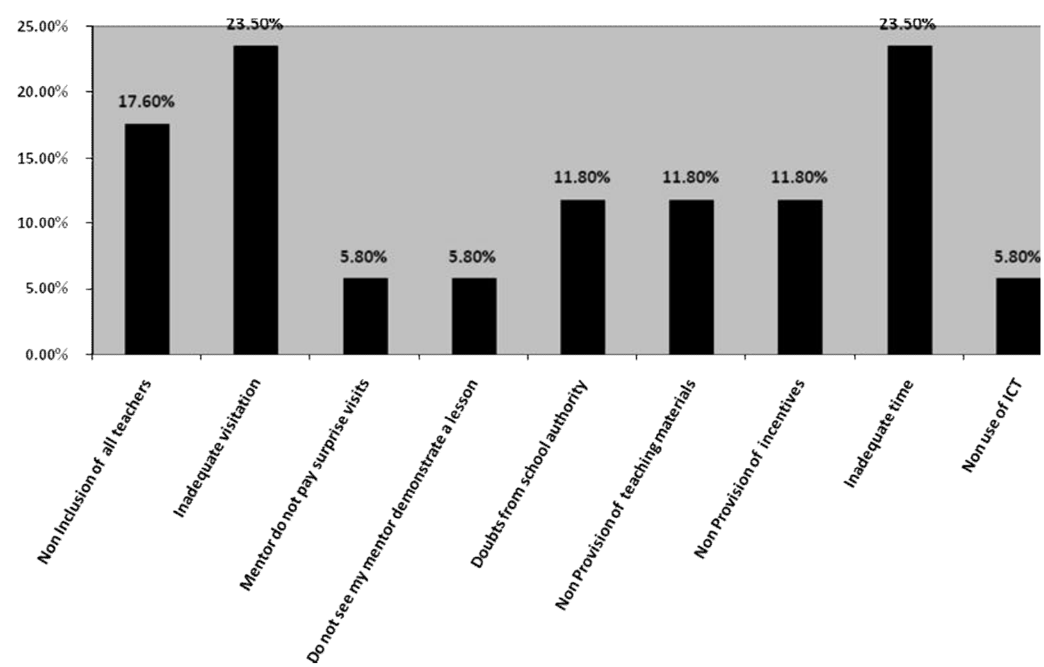

Fig. 14. Inadequacies of the programme as expressed by mentees

For a classroom to be dominated with activities that are students friendly, the teacher dominated activities have to be down played. Accordingly, increase in students' verbal and non verbal activities was a reflection of impact of mentoring exercise and consequent reductions in teacher activity especially lecture. Tripp and Eick [13] had similar findings in their study in Alabama USA on match-making to enhance the mentoring relationship in student teaching. In the study, student teachers (mentees) were matched with cooperating teachers (mentors). The result shows that teaching dyads were most fruitful where primary or secondary temperaments were common, but not both. Also, all temperaments studied supported learning to teach science with unique strengths, and relational construct appeared necessary in mentor teachers for fostering relationship with ample support and communication.

This study has implicated the need to mind the kind of relationship between mentors and mentees as well as learning to teach science with unique approaches, possibly with a particular kind of interaction in the class as done in the present study. In the present study the findings are strengthened by the fact that both mentors and mentees see each other as colleagues. For instance, teaching the same science subjects as it was, only biology teachers mentored other biology teachers and same thing went for chemistry and physics.

Interaction patterns in biology, chemistry and physics classrooms show clearly teacher dominated type before mentoring exercise took place while students' activities or involvements were less. However, after mentoring, there was a reverse in the interaction as students dominated in the interactions as seen in students' non verbal behaviour. The indirect and direct teacher behaviours reduced drastically as there was shift in emphasis. However, interactions under teacher non verbal behaviour increased. This was expected. One, no matter the extent of students' involvement in a lesson, the teacher has to guide the learners. By so doing he or she comes in with some non verbal behaviours that are necessary. Also, the consistency across biology, chemistry and physics classrooms was an indication of consistency of mentors adhering strictly to their mentoring guides as well as being a true reflection of what mentees experienced with regard to providing opportunity for the learners to participate in the lesson.

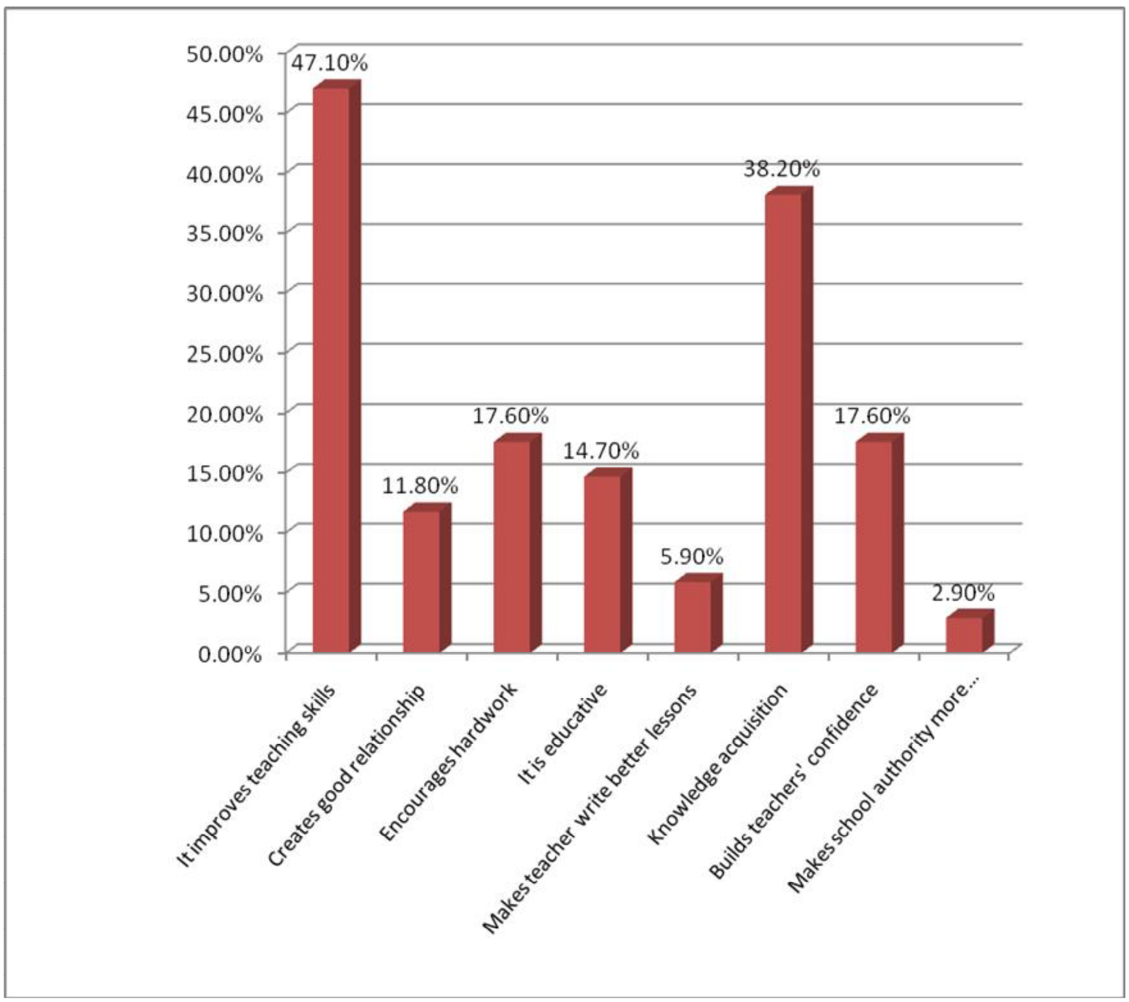

Fig. 15. Reasons for recommending science teachers to go through mentoring

The pattern of interactions in male and female science teacher classrooms indicate high level of activity under indirect and direct teachers' verbal behaviours before mentoring took place. These changed or reduced after mentoring exercise. Conversely, the interactions increased under students' non-verbal behaviour and teachers' non verbal behaviour for male and female science teachers as well as for indirect verbal teacher behaviour and direct teachers' non verbal behaviour also. When the differences between pre observations and post observations were compared graphically both male and female science teacher classes witnessed reduction in both indirect and direct teacher verbal behaviours. As usual students' non verbal behaviour and teacher non verbal behaviour witnessed positive increase in interactions or activities as indicated by the difference. The implication of this is that mentoring could be a good predictor of effective teaching. These findings are similar to what was found in previous studies even outside Nigeria. For instance, Wang and Paine [25] reported that a novice teacher attested to the fact that the collaboration between her and her mentor helped her change her ideas about the important focus in planning her lesson. The novice teacher maintained that through mentoring relationship, she came to concentrate on relationship between goals and content and teaching method rather than choosing between various teaching methods, thereby leading to effective teaching. Moir, Barlin, Gless and Miles [18] reported on one of the studies in Colombia which reveals that students' achievement in both reading and math were higher among teachers that received more hours of mentoring among others. Further, Wang and Paine [25] reported that the novice teacher has this to say after being mentored by a senior colleague:

When I started my teaching career I did not know how to plan a lesson. I always focused on methods and considered too much about what methods I was going to use. It was my mentor who helped me understand that I should think first about what my goals were and how they were related to the content of my teaching… now I will more likely plan my teaching methods according to the goals and purposes. I will think about what content should be included, in my first step of this lesson. What content should be included in my second and third steps. Then I will consider what methods I need to use. I use to consider the minor issues of teaching. I thought I need to learn all the different methods. The more varied and the more flexible my teaching methods were, the better my teaching. Now I began to see this was not right [24,25].

On the other hand, the findings do not seem to agree with what Eriba and Achor [26] found. In their study, they found among others that irrespective of school type, male teachers generally tended to praise and encourage learners more while the female teachers had higher records of accepting and using idea of the learners in their classrooms. Female teacher classroom favoured higher records of student talk compare to male teacher classrooms while male teacher classes favour direct teacher talk compare to female teacher classes. The probable difference in findings may be accounted for by the focus of the two studies. Observations on interactions in male and female science classes is not the same as observation before and after mentoring in male and female science teacher classes. What, however, is obvious is the fact that interactions in male and female science teacher classes can change depending on the dispositions of the teachers.

4.1.1 Mentoring and attitude of male and female science teachers

In this study, the male had greater change in attitude after mentoring compared to the females. Thus mentoring had significant effect on the attitude of science teachers exposed to it. Mentoring is therefore found to be a tool that could be used to make science teachers develop positive attitude towards teaching profession. It therefore means that both male and female science teachers gained nearly at the same rate when mentored. By implication both male and female science teachers responded positively towards mentorship. These findings are in line with that of Stanulus and Russel [12] in USA. In particular, the authors found that mentees had a positive change in attitude and were more excited to teach and communicated better in class. The corollary is that attitudinal disposition of science teachers do have influence in how they communicate in class. Thus the positive change in attitude should have a link to the improved interactions in all the classes in the study.

Further, the findings are consistent with those of Ingersoll [26] and Michael [27], that mentoring has a significant effect on pre-service as well as beginning teachers' attitude. For instance, Michael [27] found that participation in mentoring and support course experiences can change attitudes and beliefs, develop personal professional skills and cause changes in work relations. The opportunity given to the biology, chemistry and physics teachers to interact with experienced teachers could be responsible for the attitudinal change in the mentees. It does seem that mentoring can be a reliable tool for attitudinal change in science teacher education.

4.1.2 Mentoring experience and post mentoring expectations of science teachers

It was found that all male and female science teachers claimed to have enjoyed the mentoring relationship in the study and could be mentors to other teachers. Majority of male and female science teachers prefer 3 years and above for mentoring teachers while a few others prefer 2 years mentorship. There is consistency in what the mentees have expressed in this study. They did not only enjoy the mentorship but have gained to an extent that they are available for use as mentors to other science teachers. Similarly, many years of mentorship recommended was an indication of their rating of its necessity and acceptance. This appears to be in line with the experiences in other nations. For instance, Hudson and Skamp [20] recommended identification of factors and associated attributes and practices of mentoring primary science teachers in order to effectively develop pre-service teachers in primary science teaching. Hudson [21] said that mentors need to model primary science teaching particularly in the areas of modeling: enthusiasm, classroom management, and rapports with students, science teaching, and effective science teaching designed lessons that include hands-on experience. It is obvious that when mentoring is done with a view to making the mentee become enthusiastic, good classroom managers and build good rapport with students, teaching as a profession could become interesting. Relating with senior colleagues in the profession could also be a constantly desired event as expressed in this study.

Most mentees complained about inadequate visitation as well as inadequate time for contacts as major challenges. Also, inclusion of all teachers was mentioned as one of their major need. Prominent among their reasons for recommending mentoring as one positive way to help science teachers grow were for improving teaching skills, knowledge acquisition, building confidence and encouragement of hard work. What is interesting in this study is that these suggestions came from the mentees themselves, an indication of the fact that they were convinced on the workability of the programme and its propensity to bring about positive changes. Nugent, Kunz, Levy, Harwood and Carlson [23] in Nebraska USA found from a study on the effect of field-based, inquiry-focused geosciences course designed to provide pre-service teachers with opportunities for active, hands-on scientific investigation and for gaining skills in inquiry pedagogy that student in the field course scored significantly higher than students in the traditional course on measures of inquiry, confidence for teaching science courses, knowledge building, and cooperative learning.

Accordingly, what the mentees claimed they need is consistent with what obtains elsewhere and as found from previous studies also. Interestingly, the consistency across all questions on their experience and expectations is worth noting. For instance, many complained of inadequate contacts, inadequate time to meet and mentors being too far from mentees. In similar manner, they desired more years on mentorship and regular mentoring programmes. This has implications for the government of Benue State and future science teacher training and refresher courses.

5. CONCLUSION

Based on the findings and discussion, it can be concluded that biology, chemistry and physics teachers (male, female or combined) classrooms shifted from being lecture dominated as noticed before mentoring to students' non verbal activity dominated especially in setting and washing apparatus, writing tests, filling workbooks. Thus the reduction in interaction under direct teacher behaviour leads to increase in interaction under students' non verbal behaviour. The teacher non-verbal behaviour equally reduced after mentoring since the classes become less teacher-dominated.

The male had greater change in attitude after mentoring compared to the females though this was not statistically significant. Mentoring had significant effect on the attitude of science teachers exposed to it. Thus mentoring was found to be a tool that could be used to make science teachers develop positive attitude towards teaching the profession.

All male and female science teachers claimed to have enjoyed the mentoring relationship in the study and have indicated to be mentors to other teachers. Majority of male and female science teachers prefer 3 years and above for mentoring. Most mentees complained about inadequate visitation as well as inadequate time for contacts as major challenges.

Prominent among their reasons for recommending mentoring as one positive way to help science teachers grow were for knowledge acquisition, improving teaching skills, building confidence in teachers and encouragement of hard work.

6. RECOMMENDATIONS

Based on the findings and comments from the mentees, the following recommendations were made:

1. That mentorship of beginning science teachers should be integrated into the state policy as is found elsewhere outside Nigeria to guarantee its regularity, financing and effectiveness.
2. That because the period and contacts were inadequate, this has implication for cost if the duration must be extended to one year or beyond. As a gradual process, the duration of mentoring should be steadily increased until a time that it will be a policy matter in the state.
3. That Tertiary Education Fund, the sponsor of this research, should be encouraged to deliberately vote more funds for this area of research as it is found to have potentials to turn around the education system in Nigeria as found elsewhere outside Nigeria.
4. That Benue State government should keep track of mentees used in this study with a view to using them as subsequent mentors of other science teachers especially as they have indicated interest to do so.
5. That teacher training institutions as a matter policy and in collaboration with government should ensure internship (or mentorship as may be called in this study) for all graduating teachers for one year before they go for NYSC. This recommendation is not totally new but the fact that there is no implementation shows that its importance is slighted.
6. That for a better result, conclusion and usefulness, this project should be continued to remedy all the inadequacies noted by mentees, make it an on-going research until enough mentees are generated to serve the state in institutionalizing mentoring. Regular workshops (2 year) will help to establish this to its full effectiveness.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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