



## RESEARCH ARTICLE

## Direct and Mediational Effects of Metacognitive and Interpersonal Skills on Teachers' Competency in Implementing Guided Inquiry Teaching Methods

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## ABSTRACT

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One of the promising approaches to overcoming students' poor performance in Biology is the effective integration of innovative and learner-centred instructional methods such as guided inquiry teaching methods in teaching Biology. Hence, this study investigated the direct and mediational effects of Biology teachers' metacognitive skills and interpersonal skills on Biology teachers' competency in implementing the guided inquiry teaching method. A correlational research approach was employed while seven hypotheses were tested. The sample comprised 67 purposively selected Biology teachers. Biology Teachers Metacognitive Skills Questionnaire (BTMSQ,  $\alpha=0.82$ ), Biology Teachers' Interpersonal Skills Questionnaire (BTISQ,  $\alpha=0.79$ ), and Biology Teachers' Competency Observational Rating Scale for the Implementation of Inquiry Teaching Method (BTCORSIITM,  $W=0.87$ ) were the measures for data collection. R Studio version 4.3.2 (R-Core Team, 2024) and lavaan package version 0.6-17 (Russel, 2012) were used for data analysis. The findings indicated that teachers' metacognitive skills and teachers' interpersonal skills had significant direct effects on Biology teachers' competency in implementing guided inquiry teaching methods. However, teachers' metacognitive skills and teachers' interpersonal skills had no mediation effect on the link between gender and teacher' competency in implementing guided inquiry teaching methods. In light of the findings, a conclusion and recommendations were made.

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## INTRODUCTION

There is a growing demand for teachers to embrace innovative teaching methods such as the use of guided inquiry in teaching students because of its potential to enhance students' performance (Orosz et al., 2023). However, there seems to be reluctance on the side of teachers, especially in Nigeria, to do away with traditional teaching methods, which accounts for the re-occurring students' low academic performance. Teachers' difficulties in implementing guided inquiry teaching methods may be the major reason they seem to shy away from using this promising teaching method. While there is evidence of the effectiveness of guided inquiry (Fatma & Sare, 2017; Mittlefehldt & Grotze, 2016) there is little or no study on the factors that influence teachers' competence in implementing guided inquiry teaching methods. Hence, providing evidence on the influence of Biology teachers' metacognitive and interpersonal skills on the teachers' competency in implementing guided inquiry teaching methods may steer more interventions for addressing the underperformance of students in Biology.

Biology is the study of life. In all the Nigerian senior secondary schools, Biology is a compulsory subject for all the science students. Biology is a practical-oriented subject that enables students to

acquire basic scientific skills such as observation, experimentation, prediction, conclusion, and inference among others. These skills are needed for innovations and inventions in science and technology (Nwagbo, 2017). Biology is an essential subject because of its role in preparing students for careers in Medicine, Agriculture, Pharmacy, Nursing, and many others. Biology is the most closely associated with life and this made it unique among the various science subjects offered at the senior secondary school level.

The primary goals of the biology curriculum are to equip students with the necessary skills to learn about agriculture, human and community health, adequate, meaningful, and relevant biological knowledge, and a reasonable, practical scientific mindset (Federal Ministry of Education, 2013). The biology curriculum emphasizes field studies, guided inquiry, laboratory procedures, skills, and conceptual attitude to accomplish the aforementioned goals (Federal Ministry of Education, 2013). Moreover, six objectives of teaching and learning Biology in secondary schools as stated via the West African Examination Council (WAEC) syllabus include: promoting the power of commentary, developing the ability to offer statements using example, capacity to narrate form to function, increasing the ability to apprehend standard characteristics of animals and flora, interpretation of facts which illustrate certain Biological ideas and to develop capacity to perform easy experiment and draw inferences from results (Agbowuro & Oriade, 2006). It gives the learners the simple capabilities and clinical method of problem-fixing. The information acquired through the manipulation of these primary abilities all through realistic paintings and reviews promotes long-term reminiscence (Nwakonobi & Okoye, 2010). Thus, a bad foundation in biology jeopardizes students' in-intensity expertise of the idea inside the concern and the acquisition of abilities which helps students to achieve higher academic records in both internal and external examinations. This, in effect, emphasizes the need for teachers to understand the teaching method (Inquiry) used in the classroom especially as stipulated in the curriculum to avert poor academic achievement.

The poor achievement in Biology has started decreasing in recent years according to the WAEC chief examiner's report but is not left without some major weaknesses which has not made it easy to record an excellent result in Biology (WAEC, 2016, 2017, & 2018). Some authors attributed the poor achievement to so many factors among which are teachers' incompetence in implementing the biology curriculum which deals with their knowledge of content and pedagogies (Madu & Orji, 2012; Oriaifo, 2012). Moreover, the WAEC chief examiner attributed the poor achievement in Biology to both teacher and student factors like lack of teachers' in-depth knowledge of the subject matter; misunderstanding of the questions by students; wrong spelling of scientific terms; poor expression in English Language; failure to adhere to the convention of writing scientific names, lack of basic psychomotor skills like non-conforming with scientific method of problem-solving and specifications in drawing biological diagrams (WAEC, 2016, 2017 & 2018). Others include students' lack of interest in biology as a subject; an unsatisfactory classroom environment and an inadequate supply of teaching and learning resources (Banchi & Bell, 2015 & Bilgin, 2013). With situations like these, it has become evident that it would be difficult for the objective of Biology as contained in the Biology curriculum to be achieved.

Additionally, researchers (Dike & Abimbola, 2010, Omatsa & Vincent, 2013), noted that students' poor achievement may be because teachers might have focused on developing mostly the cognitive aspect of the child and neglecting or giving less attention to developing the manipulative skills which has led to most of the weaknesses enumerated by the WAEC chief examiner's report. Ikwuanusi (2016) added that the 21st-century working environment calls for individuals with adequate content knowledge and skills in scientific and technological areas to proffer solutions to the mirage of economic, social, and personal problems in contemporary society. To sustain the recorded improvement in academic performance in Biology, the WAEC chief examiner's report for 2016, 2017, & 2018 emphasized the need to develop the students' psychomotor and affective domains. This can be achieved by engaging the students' activity using the inquiry teaching method.

## **LITERATURE REVIEW**

### **Guided inquiry teaching method**

Inquiry is a child-centered teaching method that involves hands-on, minds-on activity in the classroom. Inquiry is a learning method in which the teachers only serve as knowledge facilitators

while the students use multiple sources of information and brainstorming to solve a problem by reviewing and reconstructing their existing knowledge (Kuhlthau, Maniotes & Caspari, 2016). Inquiry involves a series of activities undertaken by both teachers and learners that are geared toward the learners' understanding of natural phenomena through generating and testing hypotheses and reviewing existing evidence (Martin-Hansen, 2014). One of the major objectives of inquiry is to inspire investigation in students. When secondary school students possess the skill to investigate natural phenomena, meaningful and relevant information is constructed and sustained. The inquiry instructional method has been classified into different types depending on the researchers. For instance, Secker 2012 and Bilgin (2013) categorized inquiry into two broad sorts, guided and unguided. More so, Okoli (2011) categorized inquiry into three types; guided, unguided/open, and heuristic inquiry. Martin-Hanson (2014) further categorized inquiry into 4 different types; confirmation, structured, guided, and open inquiry. Despite these various classifications, similarities exist within the exclusive techniques. It is worth noting that inquiry teaching techniques could be powerful in enhancing students' achievement depending on teachers' effectiveness and competency in designing and implementing guided inquiry-based learning. This study focused on teachers' competency in implementing guided inquiry

### **Teachers' competency**

Teachers' competency is the totality of the skills, proficiency, and abilities teachers have that enable them to adequately combine content and pedagogical knowledge for effective instructional delivery. Competency as used in this study refers to the ability of the biology teachers to be able to implement the Inquiry teaching method skillfully to achieve desired goals. According to Yusuf and Balogun (2010), competency is a set of know-how, abilities, and proficiency in developing a significant experience while organizing an activity. A competent teacher is expected to put into effect, the getting-to-know process, examine the learning effects, offer steorage and schooling, conduct research, expand and manipulate school packages, and feature expert competency (Gillian, 2017). When a teacher does not know what, how, and when to make use of a particular teaching method, students may or probably not be able to acquire and apply their knowledge of Biology where and when necessary. Competency in the use of inquiry goes beyond teachers' expertise in handling teaching methods and materials. Competency is the mastery of the basic techniques of applying inquiry teaching methods to effective teaching and being able to exhibit the basic characteristics therein. Effective implementation of inquiry teaching involves metacognitive activities as teachers are expected to involve all the students during lessons to enable them to acquire both cognitive knowledge and psychomotor skills in Biology which enhances better achievement of the objectives of the Biology curriculum.

### **Metacognitive skills**

Metacognitive activities are those processes that include thinking, knowing, judging, and remembering. Metacognition is one's awareness of ignorance and existing skills and how to apply the current skills in solving immediate and future problems (Okonkwo, 2013). Metacognitive skills as used in this study are those skills that help teachers to be aware of their strengths and weaknesses as teachers and facilitators of knowledge during instructions (Tanner, 2012). Metacognitive skill is of three major types namely the ability to: set learning goals, understand learning strategies, and evaluate one's learning (Okonkwo, 2013). These three types are considered in the cause of this study since teaching with inquiry involves learning how to be aware of oneself and thinking towards desired ends.

When teachers possess metacognitive skills, they may become aware of how they think, teach, and effectively implement guided inquiry teaching methods. Teachers with metacognitive skills, ask questions like: what are the tasks to be solved? What is my role as a teacher in facilitating the solving of the problem? How nicely am I doing as a teacher? And how can I do it higher the subsequent time in magnificence? (Okonkwo, 2013). Any manner wherein the teachers examine the approach that they to retrieve, increase, make bigger, and beautify teaching is deemed to be metacognitive because it includes evaluation. Most of the assessment strategies employed by teachers in the classroom are not metacognitive as they elicit verbal responses from the students, which always result from memorization. Teachers often stress recall processes rather than reasoning processes (Abugu, 2014).

Some questions that teachers could pose to arouse students' metacognitive skills include the following: how can the students apply what they learned in real life? What course of action would the students be expected to take when they get stuck while solving problems? (Nzeadibe, 2016) Therefore, teaching and learning methods employed by the teachers should be such that invoke the process used to arrive at the response rather than soliciting a correct answer based on the student's memory of the material. Hence, metacognitive skills could enhance teachers' competency in implementing guided inquiry teaching methods as well as interpersonal skills, also known as social skills, since inquiry involves learning in a social context.

### **Interpersonal skills**

Interpersonal skills are those skills that help one to efficiently communicate with other people both individually and in group. Interpersonal skills are part of the 21st-century social skills that are needed for effective interaction between individuals in and outside of the teaching field for survival in this life (Seyedeh, Elaheh & Narges, 2016). Also, Seyedeh et al, indicated that technical competencies are no longer sufficient for success in the world today because diversities in areas of life make interpersonal skills essential for solving people-related problems. Ten main types of interpersonal skills according to Will (2014) include v non-verbal communication skills, verbal skills, listening skills, problem-solving skills, questioning skills, communication skills, manners, self-management, responsibility and accountability, assertiveness, and negotiation skills. Five out of the ten types were considered in this study: listening skills, verbal communication skills, non-verbal communication skills, skills of assertiveness, and questioning skills. The justification for investigating the five skills are as follows: listening skills help both the teachers and students to be attentive to each other in class to acquire knowledge as the teacher teaches as well as to students' opinions in class. Communication skills (verbal and non-verbal) help both teachers and students to express themselves in class without which knowledge cannot be transferred or acquired. The skill of assertiveness helps the teacher to stand up for what knowledge the teacher is sharing with the students while the questioning skills help both the teachers and the students to know how well they have achieved their stated objectives after lessons. These skills enhance student-teacher interactions in the class.

To make interpersonal communication successful both the teachers and students must have an opportunity to interact one-on-one which is most experienced during classes, especially in Biology (Sng, 2012 & David, 2015). To develop excellent interpersonal skills, teachers must: try to talk to as many students as possible. This is necessary because, the more teachers talk to students, the more they will come to know about the rubrics of teaching and talking, hence teachers' interpersonal skills will be improved. The more teachers try to understand the background of the students, their interests, and the foundation, the easier it will be for teachers to communicate. Ikwuanusi (2016) believed that a greater percentage of people's success in the world of work today could be dependent on the ability to possess good interpersonal skills. If teachers lack metacognitive and interpersonal skills as opined by the researcher of this work, it could result in the incompetency of Biology teachers in implementing guided inquiry in the classroom, and in extreme cases make classes very boring irrespective of the teachers' gender.

### **Influence of gender on teachers' competency**

Gender is a state of ascribing roles and characteristics with strict regard to people's sex. Gender is a socially oriented concept that categorizes individuals into male and female with the associated roles, dress, and emotions that are expected of both males and females in society (Nzeadibe, 2016). Gender connotes the socially assigned roles, responsibilities, and expectations the males and females are expected to display (Keightley, 2011). Gender is seen as a socially ascribed attribute that differentiates females from males (Nnamani & Oyibe, 2016). It is not synonymous with sex in that sex is the biological difference between a man and a woman. The roles attached to gender differ from nation to nation. Evidence of gender bias and stereotypes abound in Nigeria For instance, vocations and professions such as medicine, engineering, and architecture are still being dominated by men while nursing, typing, catering, and teaching may be ascribed to females (Oludipe, 2012).

Studies have shown that there exist certain differences in the teaching competencies of male and female teachers. Opara (2015) and Obeka (2016) noted that females showed greater competency in

Biology teaching than males, while Nasr and Asghar (2013) were on the contrary. This may be a result of incompetency on the part of Biology teachers, irrespective of their gender in not being able to implement or utilize guided inquiry teaching methods as stipulated in the Biology curriculum. Other studies like Owolabi & Olugbenga, 2012 and Copriady, 2014 indicated no significant influence of gender on Biology teachers' competency while Chumba, 2011 & Ilokanulo, 2013, found a significant impact of gender on Biology teachers' competency. More so, Ogbu and Anyaegbu (2018) observed that gender did not influence teachers' mastery of new content in the mathematics curriculum. Hence, there a need to investigate how gender influences the metacognitive and interpersonal skills of Biology teachers in implementing inquiry. This is necessary since gender has been one of the variables from research evidence that influences teachers' competencies in teaching.

From the foregoing, competency is seen as an indispensable tool that every teacher needs to carry out teaching effectively in the classroom without which the objectives of teaching and learning especially in Biology, will not be achieved. In addition to this, some variables could influence teachers' competency in the implementation of guided inquiry teaching methods. They include teachers' qualifications, teachers' teaching experience, and teachers' gender. All these variables have been discussed in the course of this study and the researcher now seeks to find out the relationship between metacognitive and interpersonal skills on Biology teachers' competency in implementing guided inquiry teaching method.

Biology is the study of life. The knowledge of biology helps students to learn certain useful scientific knowledge, skills, abilities, and competencies that would enable them to contribute meaningfully, to their lives and the development of society. Notwithstanding, evidence has shown that poor achievement in Biology which has started decreasing in recent years according to the WAEC chief examiner's report is not left without some major weaknesses which has not made it easy to record an excellent result in Biology. Some authors attributed the poor achievement to so many factors among which are teachers' incompetence in implementing the biology curriculum which deals with their knowledge of content and pedagogies.

Moreover, the WAEC chief examiner attributed the poor achievement in Biology to both teacher and student factors like lack of teachers' in-depth knowledge of the subject matter; misunderstanding of the questions by students; wrong spelling of scientific terms; poor expression in English Language; failure to adhere to the convention of writing scientific names, lack of basic psychomotor skills; scientific method of problem-solving and not conforming to specifications in drawing biological diagrams. Others include: students' lack of interest in biology as a subject; unsatisfactory classroom environment and inadequate supply of teaching and learning resources. Efforts have been made by both teachers and students yet the problems still exist. In other words, there is a need to celebrate teachers' competence in inquiry teaching methods as a viable or possible solution to poor achievement in Biology. It is for this purpose this study is conceived. Hence, the purpose of the study posed a question: To what extent do metacognitive skills and interpersonal skills correlate with Biology Teachers' competency in implementing guided inquiry teaching methods? This study also investigated how teachers' gender, teachers' qualification, and years of teaching experience influenced their competency in implementing guided inquiry teaching methods.

### **Purpose of the study**

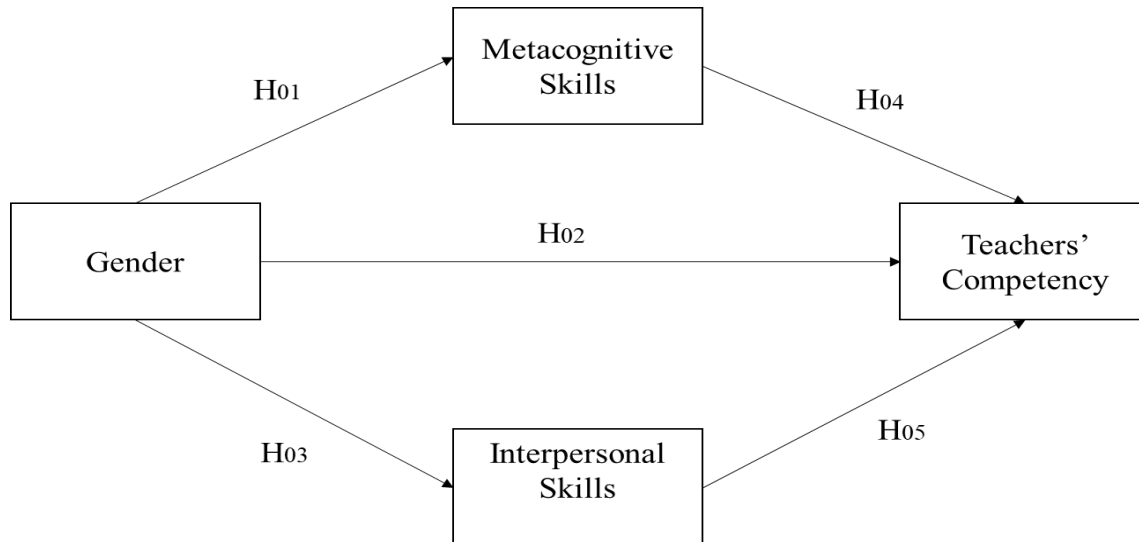
The specific purposes for this study were to determine:

1. The direct effect of gender on metacognitive skills of secondary school Biology teachers
2. The direct effect of gender on Biology teachers' competency in implementing guided inquiry teaching method.
3. The direct effect of gender on interpersonal skills of secondary school Biology teachers
4. The direct effect of metacognitive skills on secondary school Biology teachers' competency in implementing guided inquiry teaching method.
5. The direct effect of interpersonal skills on secondary school Biology teachers' competency in implementing guided inquiry teaching method.
6. The mediational effect of metacognitive skills in the link between gender and Biology teachers' competency in implementing guided inquiry teaching method.

7. The mediational effect of interpersonal skills in the link between gender and Biology teachers' competency in implementing guided inquiry teaching method.

**Research hypotheses**

Seven null hypotheses were generated for this study.



**Figure 2: Hypothesized path diagram (Sources: authors)**

- i. H01-H05 are shown in the Figure 2
- ii. H06: The mediational effect of metacognitive skills in the link between gender and Biology teachers' competency in implementing guided inquiry teaching method is not significant
- iii. H07: The mediational effect of interpersonal skills in the link between gender and Biology teachers' competency in implementing guided inquiry teaching method.

**METHODOLOGY**

**Design**

A correlational research approach was followed in this study. The study was conducted in the Obollo-Afor Education Zone of Enugu State. This zone is made up of three local government areas, they are Igbo-Eze North, Igbo-Eze South, and Udenu Local Government Areas. There are 50 Public Secondary Schools in the zone. Igbo-Eze North has 21 Secondary Schools, Igbo-Eze South has 11 Secondary Schools and Udenu has 18 Secondary Schools.

**Participants**

The participants were 67 Biology teachers in the study area which represented 50% of the entire population. All three Local Government Areas in the zone were used in this study, hence, sampling was not carried out LGA level. A simple random sampling technique (balloting with replacement) was used to draw 29 out of 50 public secondary schools in the zone. A purposive sampling technique was also used to include all 67 SS1 and SS2 Biology teachers (39 from SS 1 and 28 from SS 11) in the 29 schools. SS3 Biology teachers were purposively excluded to avoid interference with their WAEC and NECO examinations.

**Measures**

Instruments for data gathering in this study were three tools, namely: Biology Teachers' Metacognitive Skills Questionnaire (BTMSQ), Biology Teachers' Interpersonal Skills Questionnaire (BTISQ), and Biology Teachers' Competency Observational Rating Scale for the Implementation of Inquiry Teaching Method (BTCORSIITM). The Biology Teachers' Metacognitive Skills Questionnaire (BTMSQ) was adapted from Schraw & Dennison's (1994) Metacognitive Awareness Inventory. Originally, it had 52 items but was modified and reduced to twenty-seven items. This was done by

selecting items that suit the current study thereby discarding others. The instrument was used to elicit information from the respondents on the extent to which they possess metacognitive skills concerning their competency in implementing guided inquiry teaching methods. The questionnaire was made up of two sections: sections A and B. Section A was designed to provide background information from the participant demographic variables such as gender, qualification, and teaching experience. Section B was designed in three clusters A, B, and C (A-setting teaching/learning goals having 5 items, B-my own teaching strategies having 16 items and C- evaluating one's teaching having 6 items respectively) and is made up of 27 items which was used to elicit information from Biology Teachers on Metacognitive skills acquired by them about their competency in implementing guided inquiry teaching method. The second instrument was adapted from Skills You Need (2011- 2018). Originally, it had 44 items but was modified and reduced to 40 items. This was done by selecting items that suit the current study thereby discarding others. The instrument was used to elicit information from the respondents on the extent to which they possess interpersonal skills about their competency in implementing the guided inquiry teaching method. The instrument was also designed in clusters: A, B, C, D and E thus: A-Listening skills, having 8 items; B-Verbal communication skills, having 12 items; C- Non-Verbal Communication Skills, having 6 items; D-Skills of Assertiveness, having 5 items; and E- Questioning skills, having 9 items respectively with a total of 40 items used to elicit information from Biology Teachers on Interpersonal skills acquired by them also about their competency in implementing guided inquiry teaching method.

The third instrument was an observational rating scale for Biology Teachers titled: Biology Teachers' Competency Observational Rating Scale for Implementing Guided Inquiry Teaching Method (BTCORSIGITM). This was adapted by the researcher from Gillian, 2017. The items were modified based on the teacher's roles during inquiry-based learning to suit the current study. Originally, it had 16 items but was modified and increased to 29 items. This was done by increasing the items to suit the current study. The instrument was used to rate the respondents (teachers) as they teach on the extent to which they possess competency skills in implementing the guided inquiry teaching method. It is designed in two parts. The items were arranged in clusters (A-D) and contained statements covering the roles of a teacher in an inquiry-based classroom Clusters: A (Teachers' classroom interaction) has 8 items; B (Teachers' knowledge of content) has 3 items; C (Teachers' classroom management skills) has 12 items; while D (Teachers' questions/evaluation procedure), has 6 items.

The three instruments (BTMSQ, BTISQ and BTCORSIGITM) were subjected to face validity by three experts from the Department of Science Education, University of Nigeria. The experts were requested to ascertain the appropriateness of language used in the instruments, the clarity of statements, the suitability of words used, the adequacy of items of the instruments, and the capacity of the instrument to answer the stated research questions. Based on the recommendations of the experts, the first instrument (BTMSQ) which had 28 items initially was reduced to 27 items, the second instrument (BTISQ) with 35 items, finally now had 30 items while the last instrument (BTCORSIGITM) with 27 items was increased to 29 items. The reliability of the instrument was as follows: (BTMSQ,  $\alpha=0.82$ ), (BTISQ,  $\alpha=0.79$ ), and (BTCORSIGITM, inter-rater reliability index =0.87).

The researchers visited the selected schools with a letter of identification to establish a rapport with the schools. Three research assistants were used for this study from each school visited. Two research assistants helped in administering the questionnaires while the third research assistant observed and rated the Biology teachers as they teach in the class. Data were collected by direct administration of the two instruments (BTMSQ and BTISQ) while (BTCORSIGITM) to Biology teachers in those schools was used by the third research assistant to score each Biology teacher as they teach to ascertain their competency levels in implementing guided inquiry teaching method with the topics given them to teach with regards to the classes they taught (Cell and its environment in SSI and Irritability in plants and animals in SSII respectively). The research assistants were trained for two weeks by the researcher on how to carry out the observation and rating of the instruments which ensured safe handling, delivery, and return. During the training, the researcher explained the keys for the observational rating scale as follows: HC- Highly Competent, C- Competent, FC- Fairly Competent, and NC- Not Competent to the research assistants. The research assistants were also tested by the researcher to see if they understood the training and instructions given to them on how to administer and score the instruments accordingly before engaging them in the actual exercise.

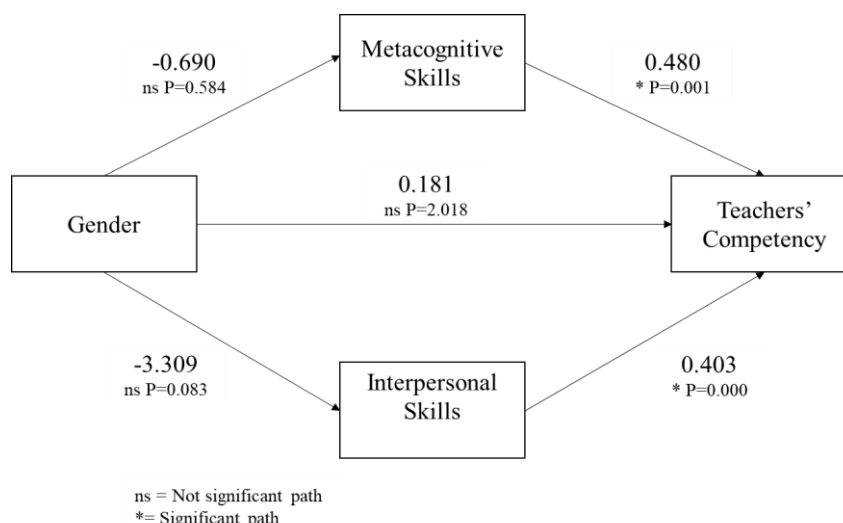
Data collected from the instruments were screened for accuracy and missing values. The assumptions of multiple regression were tested. Missing values were very few and were replaced with the mean value. Muti-collinearity was not violated. Outlier and normality were tested using histogram. Outlier and collinearity were not violated. Having screened the data, R version 4.3.2 (R-Core Team, 2024) and lavaan package version 0.6-17 (Russel, 2012) were used for data analysis.

## RESULTS

**Table 1: Direct and indirect effects of metacognitive and interpersonal skills on teachers' competency**

Regressions:					
		Estimate	Std. Err	z-value	P(> z )
Compet ~					
Metas	(b)	0.480	0.143	3.356	0.001
Gender		2.018	1.507	1.338	0.181
Inters	(d)	0.403	0.094	4.277	0.000
Metas ~					
Gender	(a)	-0.690	1.258	-0.548	0.584
Inters ~					
Gender	(c)	-3.309	1.908	-1.734	0.083
Variances:					
		Estimate	Std. Err	z-value	P(> z )
.Compet		35.293	6.098	5.788	0.000
.Metas		25.792	4.456	5.788	0.000
.Inters		59.341	10.253	5.788	0.000
Defined Parameters:					
		Estimate	Std. Err	z-value	P(> z )
Indirect1_ab		-0.331	0.611	-0.541	0.589
Indirect2_cd		-1.333	0.830	-1.607	0.108

Table 1 indicated that teachers' metacognitive skills had a significant effect on Biology teachers' competency in implementing the guided inquiry teaching method ( $\beta=0.48$ , Z-value=3.356, P=0.001). Similarly, teachers' interpersonal skills had a significant effect on Biology teachers' competency in implementing the guided inquiry teaching method ( $\beta=0.403$ , Z-value=4.277, P=0.001). However, gender had no significant effect on Biology teachers' competency in implementing guided inquiry teaching methods ( $\beta=2.018$ , Z-value=1.338, P=0.181). The results also show that the effect of gender on the metacognitive skills of Biology teachers was not significant ( $\beta=-0.690$ , Z-value=-0.548, P=0.584). Similarly, the effect of gender on the interpersonal skills of Biology teachers was not significant ( $\beta=-3.309$ , Z-value=-1.734, P=0.081). More so, the metacognitive skills of Biology teachers had no mediational effect on the impact of gender on teachers' competency in implementing guided inquiry teaching methods. Likewise, no mediational effect of the interpersonal skills of the teachers on the effect of gender on teachers' competency in implementing guided inquiry teaching methods. In the light of the results of the study, the null hypotheses 4 and 5 were therefore not rejected. However, the null hypotheses 2-3, 6, and 7 were rejected.





**Figure 2: Path diagram of the direct effects****DISCUSSION**

The findings of the study indicated that there was a significant effect of teachers' metacognitive skills on their competency in implementing the guided inquiry teaching method. This finding could be a result of the fact that inquiry involves one being creative and innovative in solving problems just like metacognitive skills which equally involve higher-order thinking. A teacher with a high level of metacognitive skills has the potential of possessing higher-order thinking ability and being able or competent in implementing guided inquiry teaching methods effectively. It could also be as a result that both inquiry and metacognition are among the characteristics that make one a good scientist. A good scientist cannot work effectively without a good metacognitive skill and inquiry ability. Both cannot exist without the other and this could have influenced the finding of the study.

This finding is in line with Onu, Ugwuanyi, and Agbo, (2010) and Sibel et al, (2016) who found that students with learning problems in English Language, Mathematics, Integrated Science, and Agricultural Science improved significantly when metacognitive strategies were used in lesson delivery. This means that a teacher with metacognitive skills stands a better chance of implementing guided inquiry teaching methods competently in class. Also, this result corroborates with the findings of Mittlefehldt and Grotzer (2016) and Agbowuro, (2018) which indicates that an increase in the level of metacognition promotes meaningful learning and registers high cognitive achievement. This implies that Biology teachers' possession of metacognitive skills invariably increases their level of competency in implementing guided inquiry teaching methods thereby enhancing the academic achievement of students in both internal and external examination. The result is also consistent with the findings of YuekMing and Latifah, (2014) on 'Assessing learning outcomes through students' reflective thinking. The findings also align with Nnadi, (2015) which revealed that students' achievement of learning outcomes and higher-order thinking skills were improved. However, since students' achievement of learning outcomes and higher-order thinking skills were improved through reflective thinking (metacognition), Biology teachers' metacognitive skills also correlated with teachers' competency in implementing guided inquiry teaching methods.

Furthermore, the findings of the study also indicated a significant effect of teachers' interpersonal skills on their competency in implementing the guided inquiry teaching method. Interpersonal skills are part of the 21st century social skills which are needed for effective interaction between individuals in and outside of the teaching field for survival in this life. This is one of those factors that determines the competency of a teacher because a teacher who cannot communicate very well with either the students or the laboratory attendants cannot implement the inquiry teaching method effectively.

This result corroborates with findings of Fan, (2012) and Seyedeh, Elaheh & Narges, (2016) which confirmed that interpersonal communicate abilities had an impact on the social development of experimental group students as evidenced in their post-test mean gain. In the identical vein, Ridwan, Marie-Christine, Perry, and Roel, (2011) and Lindsey and Rice (2015), revealed that scholars enjoy the time, schooling, revel in, and practice interpersonal talents in an internet environment. Inquiry in its nature can't take place without manipulation of things or devices within the lecture room and this cannot be effectively implemented without interplay between the teacher and the students. Thus, interpersonal abilities have a relationship with teachers' competency in implementing guided inquiry teaching techniques.

The findings of the study revealed that metacognitive skills and interpersonal skills had no significant mediation effect on the link between gender and Biology teachers' competency in implementing guided inquiry teaching methods. The reason for these findings could be that both male and female teachers have similar metacognitive and interpersonal skills. The findings are in disagreement with Yurt (2022) who reported that metacognition partially mediated the link between gender and reasoning skills of mathematics students. The findings are also in discordance with Maji (2022) and Out et al. (2023) who found that female teachers demonstrated more pedagogical competency as compared to their female counterparts.

## CONCLUSION

Poor academic achievement of students in Biology and the need to apply teaching method, such as guided inquiry in enhancing students' achievement necessitated the study. While guided inquiry teaching methods has been reported to influence students' academic achievement, low competency of Biology teachers in implementing the method has become a serious challenges to the potentials of guided inquiry. Hence, the role of teachers' gender, metacognitive and interpersonal skills in teachers' competency in implementing guided inquiry was explored in this study using correlational research approach. Therefore, in light of the findings of this study it is concluded that metacognitive and interpersonal skills were significant factors in Biology teachers' competencies in implementing guided inquiry teaching strategy. This implies that when teachers' metacognitive and interpersonal skills are high, they intend to possess adequate skills that enable them to implement guided inquiry strategy. Hence, Biology teachers should integrate metacognitive and interpersonal skills when teaching with guided inquiry teaching methods in Biology classrooms in senior secondary schools since such improves students' acquisition of skills that enable them to achieve better in both internal and external examinations. More so, the curriculum planners should emphasize the use of guided inquiry teaching methods in Biology teaching and specify appropriate skills needed by teachers to enhance students' academic achievement in Biology. In addition, the Ministry of Education, through the Science Teachers Association and other professional development bodies, should regularly organize workshops, seminars, and programs for the training of new biology teachers and retraining them on the appropriate application and utilization of guided inquiry teaching methods. This is because it is not enough only to justify its use in the biology curriculum. Gender played no significant role in Biology teachers' competency in implementing guided inquiry teaching methods. It is also concluded that while metacognitive and interpersonal skills are relevant in teachers' competency in implementing guided inquiry, the association between gender and teachers' competency in implementing guided inquiry teaching methods was not mediated by both metacognitive and interpersonal skills. This means that the effect of gender on teachers' competency in implementing guided inquiry was not dependent on teachers' metacognitive and interpersonal skills.

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