# The Academic Performance of Female Students in Integrated Science in Junior High Schools: Evidence from Aowin District, Western North Region of Ghana

**Abstract**

The study investigated factors responsible for the low performance of female students in integrated science in some selected Junior High Schools (JHS) in the Aowin District of Western North region of Ghana. The study employed descriptive research design to investigate the determinants of female students' poor performance in the subject. The sample size for the study comprised 375 JHS female students selected from five educational circuits in the Aowin district. A four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree) was developed and administered to the participants. Data collected were analysed using descriptive statistics, specifically, mean and standard deviation. Findings revealed poor psychological state, teachers' teaching practices/procedures and students' socio-economic background as possible factors responsible for female students' low academic performance in integrated science subject. It was recommended among others that the district education office should organize workshops and seminars on the state-of-the-art procedure of teaching science subjects in the basic schools with particular emphasis on how to create a good learning atmosphere for the female students.

*Keywords: Integrated science; low performance; female students; teaching practices socioeconomic factors, psychological factors.*



## 1. Introduction

Formal education offers the individual with many varied opportunities. The individual also gets the necessary training to make better-informed decisions and choices in life, which go a long way to improving his/her standard of living (Blakemore & Cooksey, 2017). Education systems throughout the world place importance on the teaching and learning of science, and a lot of resources are allocated to maintain and improve efficiency in these activities. According to Eisner (2017), science is important because the study of the subject is associated with more academic and or career opportunities. Thus, science study relates the importance of science to the scientific, industrial, technology, and social progress of a society.

Unequal access to quality education among the gender divide has become topical among scholars (United Nations Division for the Advancement of Women [UNDAW], 2010). In Sub-Saharan African (SSA), empirical studies and statistics have shown that women continue

to lag behind men in education in general and specifically in Science, Mathematics, and Technology (SMT) education (Schön, 2017; UNDAW, 2010). Education stereotyping continues to be an issue in SSA, where women tend to enrol in programmes that prepare them for so-called “women’s” occupations such as nursing, secretarial jobs, and social work. In contrast, the men continue to dominate in engineering, physics, and the so-called "hard sciences" related jobs (Schön, 2017). Since formal education remains the vehicle for socio-economic development and social mobilization in any society, equity is paramount to grant citizens quality education (Apple, 2017; Cars & West, 2015).

The inadequate attention given to science and technology education has brought about the low state of science and technology education in Ghana (Avgerou & Walsham, 2017; Coleman, 2015). Consequently, this has harmed the country's economic and social development. The National Development Planning Commission (NDPC) lamented the low state of science education in Ghana, especially among females (Langer et al., 2015). Studies have shown that there is inadequate attention to science and technology education in Ghana, especially at basic levels (Avgerou & Walsham, 2017; Coleman, 2015). This is evidenced by students' poor performance in science-related subjects at all levels of education with basic schools in particular (Ghana Education Service [GES], 2017). For example, statistics in Ghana show that 25% of students had scores above average in Integrated Science during the 2012 Basic Education Certificate Examination (BECE) (Snyder, de Brey, & Dillow, 2016). The statistics revealed that the percentage of boys that passed the 2012 BECE was 61% while that of their counterpart females was 39%. The situation was not too different in 2014 as 24% of students had scores above average in integrated science. With this figure, only 21.1% of females had scores above average (Snyder et al., 2016).

The situation is worse in the deprived districts of Ghana, of which Aowin district is no exception. In 2010, 53% of females failed in integrated science; whiles 47% of males failed. In 2011, 51% of females failed in the subject against 49% of males (Mills & Mereku, 2016). In 2012, the situation improved a bit, where 45% of females failed in science while 55% of males failed. The 2013 BECE results showed a 54% failure of females in integrated science against 46% of males' failure. The 2014 BECE statistics showed that 58% of females failed in science, while 42% of males failed. In 2015, 57% of female students failed in integrated science as against 43% for males. In 2016, 60.90% of female students failed, while 39.10% of males failed in the subject (Snyder *et al*., 2016). The picture painted by the statistics above only present cause for concern. Meanwhile most studies such as Akyeampong (2017),

Ansong et al. (2018), Atinga et al. (2015) and Bruce (2016), all focused their studies in Senior High Schools (SHS) leaving a dearth of information in the Junior High Schools (JHS) which forms the basis of the subject for further studies in the SHS and above.

Moreover, studies conducted on the determinants of females' performance in SMT subjects at SHS level are not well conceptualized (Musau1, Migosi, & Muola, 2013). The sufficient knowledge of these determinants and their influence would militate against the country's aspiration to achieve the 'vision 2030' and the Millennium Development Goals (MDGs). This is because SMT subjects contribute to industrialization, environmental conservation, medical research, food management, and improved agricultural production. Therefore, there is a need to investigate the determinants of females' performance in an integrated science subject at the JHS level in the Aowin District.

## 2. Purpose of the Study

This study was designed to examine the determinants of female students' performance in integrated science at the JHS level at the Aowin District. The study was necessitated by the low performance of females in the subject, which became an issue of concern for parents, teachers, government, and other stakeholders. For this reason, the study sought to investigate the determinants of female students' performance in integrated science, including psychological factors, socio-economic factors, and teacher-related factors. The following research questions were therefore posed to guide the study:

- What psychological factors affect the performance of JHS females in integrated science?
- What socio-economic factors affect the performance of JHS females in integrated science?
- What teacher-related factors affect the performance of JHS females in integrated science?

## 3. Literature Review

The challenges of female students in SMT education in Ghana emanate from several dimensions, such as cultural, political, social, and economic (Donkor & Justice, 2016). Several contributing factors have also been advanced for females' poor performance in SMT and declining interest in science-related subjects during their school careers (Ary et al., 2018). Studies have suggested that there exist potential factors such as psychological, socio-economic, teacher, and student-related factors and among others that hinder effective science

and technology education for females. The review discusses the psychological, socio-economic, and teacher-related factors contributing factors for female students' low performance in science.

### 3.1 Psychological factors

Psychological factors of the study are particularly about the students' mindset toward the learning of science as a discipline and their motivation to succeed in the science program. For example, Apple (2017) reported that self-concept, attitude towards learning and motivation, are all related to students' achievement in science. In line with this thought, Adetula (2015), in a study, reported that positive self-concept has a direct link to improved performance of students in any subject, including science. The child who views himself and his abilities positively are the ones who can maximally benefit and achieve excellent results in school learning experiences. Further, locus of control of students as a psychological variable also has a hand in telling who performs in a science subject. Brook and Willoughby (2015) confirmed that both internal and external locus of control is an essential predictor of students' academic achievement. Also, Ifamuyiwa and Akinsola (2008) in her study discovered that there is a significant influence of locus of control on JHS year three students' performance in science and that locus of control is a significant factor in students' classroom learning. Sampa (2017) examined locus of control, interest in schooling, and self-efficacy as predictors of academic achievement of JHS students. The results indicated that locus of control, interest in schooling, and self-efficacy jointly and relatively contribute significantly to the prediction of academic achievement. Moreover, Amuaful (2011) suggested test anxiety as a psychological factor can cause females to have low performance in science. This phenomenon is believed to be developed when students fail to prepare adequately for evaluative programs. Within the social context, test anxiety might also emanate from parents, friends, and teachers' suggestions and expectations of students' tests.

### 3.2 Socio-economic factors

Students' performance particularly in science, is also believed to be partly associated with parents' educational level and income level. According to Evensen, Lyngstad, Melkevik, Mykletun (2016), parental education and income have been the most significant source of disparities in female students' performance. This is evident in the Third International Mathematics and Science Study (TIMSS) tests, where female students from economically disadvantaged families had systematically performed worse than other students. Moreover, Coleman (2018) also opined that parent who were more educated appear better to provide

their children with academic and social support important for educational success compared to parents with less education. Furthermore, Ayyar (2017) believes that poverty and unwillingness to bear the educational cost of books, uniforms, and other expenses have been a bane and have contributed to lower participation of females in science education. Abbott (2017), in a study among students in Ethiopia, indicated that educational costs, such as fees, uniforms, and books, often deter parents from educating females. When it happens this way, their male counterparts will outperform them in any subject, including science. In synopses, those mentioned earlier bring to bear that indeed, socio-economic backgrounds contribute to the low performance of female students in science in schools.

### 3.3 Teacher-related factors

In discussing issues that hinder students' excellent performance in core subject areas, including science, most scholars have reference to teacher-related variables as a contributing factor. For example, teacher qualification has been found as a potential variable that impacts students' performance (Darling-Hammond, 2000; Darling-Hammond & Baratz-Snowden, 2005; Darling-Hammond, Berry & Thoreson, 2001). That is to say that qualified teachers in science unequivocally stand a chance to bring about excellent performance than those who are less qualified. In a study by Durlak (2015), it was revealed that there was a deficit of about 40% qualified teachers in the school, as reported by the head of school, where the high deficit of science teachers brought about poor performance among students. Aside from the qualification of teachers, Badura (2014) intimated that the teaching styles adopted by science teachers could aid or inhibit effective learning. An excellent teaching strategy will promote learning while a poor teaching method will inhibit learning, make the lesson boring, uninteresting to the students, and possibly lead to poor performance. In an idea that seems to be supportive of that of Badura's assertion, Kolb (2014) reported that lack of a proper method of teaching and attitude of teachers towards science instruction is part of the contributing factors of students' low performance in science.

In summary, related studies suggest that there are psychological, socio-economic, and teacher-related factors paramount in explaining students' performance in the reading of most core subjects, including science.

## 4. Methods

The study employed descriptive research design. As indicated by Gay (2009), the purpose of descriptive research is to gather data to test hypotheses or answer research regarding the

current state of the research topic (Gay, 2009). Due to the complexity of the problem, data must be gathered using self-report measures, and significant volumes of data must be collected in a short period of time, hence the design was deemed acceptable for the study.

All the JHS female students (approximately 15,000 students) in the five educational circuits in the Aowin district served as the target population. The accessible population was students from five selected educational circuits of the Aowin district. A multistage sampling technique was adopted to select 375 female students for the study. The average age of the female students was 15 and their grade level was JHS 2 and JHS 3 respectively. The schools were first stratified into seven strata, representing the seven circuits in the district. A simple random sampling was then used to select five circuits from which participants for the study were selected. The 375-sample size was guided by the table of estimating sample size from a given population developed by Krejcie and Morgan, as cited in Sarantakos (2005, p. 175).

A four-point Likert scale questionnaire ranging from 1 (strongly disagree) to 4 (strongly agree) was developed and administered to the participants. The questionnaire was a multidimensional type with four dimensions. The first dimension measured respondents' demographical details. The second dimension measured respondents' perception of psychological factors responsible for low performance in integrated science. The third dimension was used to measure respondent's perceived socio-economic factors responsible for low performance in the subject. The fourth dimension centred on teacher-related factors that affect that might have contributed to the female students' poor performance in the subject. The questionnaire was pilot tested in the Agona West district in the Central Region, where JHS students in this district have similar characteristics as those in Aowin district that were used in the main study. The Cronbach alpha reliability co-efficient for the entire scale was 0.87 which is acceptable for research purposes (Cohen, Manion & Morrison, 2007; Pallant, 2007; Field, 2009).

The authors visited the selected JHS to administer the questionnaires. In each of the school visited, the purpose of the study was explained to the female students before questionnaires were administered. Also, informed consent was sought and the respondents were assured of confidentiality, privacy, and anonymity. All questionnaires administered to female students were collected by the authors on the same day. Data collected were analysed using mean and standard deviation. Inferences were drawn from the data for interpretation purposes.

## 5. Results

### 5.1 Psychological Factors Affecting Performance of JHS Female Students in Science

Table 1: Psychological Factors Responsible for Low Performance of Female Students in Science

| Sn | Statements | Test Value=2.50 | | Rank Order |
|---|---|---|---|---|
| | | Mean | Std.D | |
| 3 | Science is known to be a difficult subject to do | 3.36 | 0.98 | 1st |
| 8 | I find it difficult understanding science concepts so I usually perform low in it | 3.28 | 1.05 | 2nd |
| 4 | I fear science as a subject | 3.13 | 1.04 | 3rd |
| 7 | I don't get any interest from doing science so I don't rely on it | 2.99 | 0.94 | 4th |
| 6 | I don't think I can make good grades in science, so I don't consider it doable | 2.85 | 0.95 | 5th |
| 1 | Science is known to be for boys and not for females | 2.43 | 0.73 | 6th |
| 10 | I don't like school in general so I don't care about subjects like science | 2.42 | 0.70 | 7h |
| 5 | I find it difficult solving science questions so I am always frightened anytime there is science test | 2.27 | 1.06 | 8th |
| 9 | I think science is not the only subject that can help me so I don't pay much attention in it | 2.19 | 1.09 | 9th |
| 2 | I don't think I have the power to do science so I don't force myself on it | 2.01 | 0.97 | 10th |
| | Mean of means (MM)/Std.D | 2.51 | 0.85 | |

Source: Field Survey, (2020)

Results from Table 1 show that respondents agreed (MM =2.5, SD=.85) that the low performance of female students in science could to be psychological factors as such science as a difficult subject (M=3.36, SD=.98), difficulty in understanding most of the science concept (M=3.28, SD=1.0), the fear for science as a subject (M=3.13, SD=1.0), lack of interest for the science (M=2.99, SD=.94) and the perception of not getting good grade in science (M=2.85, SD=.95). On the other hand, the psychological indicator, "science is known to be for boys and not for females," was not found to be a psychological factor responsible for low performance of female students in science in the Aowin District (M=2.43, SD=0.73).

**5.2 Socio-economic Factors Affecting Performance of JHS Female Students in Science?**

Table 2: Socio-economic Factors Responsible for Low Performance of Female Students in Science

| Sn | Statements | Test Value=2.50 | | Rank Order |
|---|---|---|---|---|
| | | Mean | Std.D | |
| 6 | I am not able to meet all demands of science because I help my mother at home with chores sometimes during schooling days | 2.98 | 0.99 | 1st |
| 3 | My parents are not concerned about my education, so I also feel the same way and do what I feel is good for myself in school | 2.89 | 1.02 | 2nd |
| 4 | My community culture and beliefs place less value on education among females, which goes against my performance in science too | 2.82 | 0.97 | 3rd |
| 2 | Because my parents are poor, they cannot buy me the science that textbooks to aid my learning | 2.57 | 1.13 | 4th |
| 1 | Because my parents are not educated, they help me with science-related information | 2.33 | 1.15 | 5th |
| 5 | Because my siblings are many, concentration is on the males than the females that is why I am not able to perform in science and others in school | 1.89 | 0.93 | 6th |
| | Mean of means (MM)/Std.D | 2.58 | 1.03 | |

Source: Field Survey, (2020)

The results, as indicated in Table 2, show that generally, the low performance of female students in science in the Aowin district could be a result of some socio-economic factors (MM=2.58, SD=1.0). Socio-economic issues relating to parents not showing much concern (M=2.89, SD=1.0), students having problems with house chores (M=2.98, SD=.99), issues of culture, and believes about girl child education (M=2.82, SD=.97), among others were constraining the performance of females in science. However, parents' low level of education (M = 2.33, SD = 1.15) and the number of siblings (M=1.89, SD=.93) were not constraining female students' performance in science.

### 5.3 Teacher-related Factors Affecting Performance of JHS Female Students in Science

Table 3: Teacher-related Factors Responsible for Low Performance of Female Students in Science

| Sn | Statements | Test Value=2.50 | | Rank Order |
|---|---|---|---|---|
| | | Mean | Std.D | |
| 9 | The workload on teachers seems to be too much, which goes against effective teaching in science, hence low performance among the females | 3.54 | 1.11 | 1st |
| 7 | My science teacher canes a lot when you get something wrong so I don't have an interest in that subject | 3.26 | 1.10 | 2nd |
| 4 | My science teacher is always shouting on us, so I feel afraid and don't have an interest in his subject | 3.16 | 1.12 | 3rd |
| 1 | It looks as if my teachers are not qualified to teach us and so it affects my understanding of science and eventually, I perform low | 2.99 | 1.10 | 4th |
| 5 | My science teacher is always unfriendly and frowns his face, so I usually don't attend classes and performance is always low | 2.79 | 1.01 | 5th |
| 2 | The science teachers in my school are not many so they are not able to teach all of us and this affect our performance | 2.56 | 1.07 | 6th |
| 10 | It is sometimes boring teaching science and this affects teacher output, hence low performance among students | 2.28 | 1.10 | 7th |
| 3 | The way my science teacher teaches is boring, and it makes me feel unsatisfied, which in turn affects my performance | 2.15 | 1.03 | 8th |
| 6 | My science teacher doesn't allow us to contribute in class, so it makes the class boring | 1.91 | 1.06 | 9th |
| 8 | My science teacher like the males than the female so it makes me feel like I am not of science I don't put in much effort in the science subject | 1.91 | 1.07 | 10th |
| | Mean of means/Std. D | 2.65 | 1.07 | |

Source: Field Survey, (2020)

Results from Table 3, show that several teacher-related factors accounted for the low performance of female students in science. Notable among them as generally agreed (MM=2.65, SD=1.0) by respondents included the fact that teachers have too much workload (M=3.54, SD=1.1), teachers' usage of cane in class as a corrective measure (M=3.26, SD=1.1), teachers shouting at students in a class (M=3.16, SD=1.1), the unfriendly attitude of teachers to female students (M=2.79, SD=1.0), among others. This is to say that generally,

students (i.e., JHS females) perceive the learning environment within which they are situated to be unfriendly and hostile, which tends to affect their performance in science.

## 6. Discussion and Conclusion

The authors' prime motive for the study was to explore factors (i.e., psychological, socio-economic, and teacher-related) that account for low performance in integrated science among JHS female students. By this, the first research question sought to identify the psychological factors that account for low performance in science among female students. Findings showed that, psychologically, females have the perception that science is a difficult subject. Females have the belief that science topics are difficult to understand, and for that matter, it is not easy having good grades. As a result, they tend to have little interest in the study of the subject. The findings support similar claims in the literature that psychological factors such as those that are related to subject interest, their self-concept and attitude toward the subject could jeopardize good performance in science (Adetula, 2015). Our results support prior study, which established a high psychological effect on female students' academic achievement in science than male students (Sampa, 2017). Again, our finding relates to research that found that allowing a high cut-off grade for science-related subjects has developed a mentality that those subjects are difficult and for a few intelligent students (Kihwele, 2014). The heightened perception puts fear in female students and demoralizes them, leading to their low performance. It is therefore suggested that parents, teachers, government, counsellors, and all educational stakeholders should put in more effort to motivate and encourage female students to improve upon their self-concept and negative conception in science-related subjects. In a developing country like Ghana, where there is seemingly no clear support and facilities for teaching and learning of science in the basic schools, the Ministry of Education should do more to promote STEM education among female students especially at the basic levels.

Secondly, the study further explored the socio-economic factors that work against female students when it comes to studying science subjects in JHS. Findings revealed that parents are not showing much concern in their females' education in the district, females are being burdened with house chores, and other related issues such as cultural beliefs about girl child education that the place of a woman is the kitchen are some of the socio-economic factors constraining females' performance in the science subject. In addition, parents' weak financial strength accounts for the drifting away from attending to their ward's education (especially the girl child education). In other words, most parents in the district are low-income earners and for that reason they are unable to afford books, uniforms and other relevant educational

materials for their wards hence, they tend to demonstrate more interest in the girl child education having in mind after all, she will come back to the kitchen. The findings corroborate with Abbott (2017) assertion that, educational costs such as fees, uniforms, and books are often deterring parents from concentrating on their females' education as expected. Furthermore, the low educational background of parents in the district has also been a constraining factor for parents not showing so much concern for their wards education when they are not formally educated. These findings are in line with several studies in the literature. For instance, absence of educated parents, poor nutrition, high daily attendance, enrolment in private tutoring classes, absence of exercise books, electric lighting, and poor supervision of children's work books at home appear to lower females' performance in science-related subjects (Evensen, et. al, 2016; Coleman, 2018). Again, our findings relate well to findings that socio-economic factors have a significant effect on students; science-related achievement and achievement in science. Students belonging to strong financial status perform better than those who face problems in finance and parental education boosts up their children's performance (Azhar, Nadeem, Naz, Perveen, & Sameen, 2014). Similarly, our study confirms other results that gender, cultural factors, parents' educational attainment, ethnicity, student age, and housing type are all statistically significant variables and predictors of females' low academic performance in science (Bayat, Louw, & Rena, 2014). The findings support the believe that the 'social' and the 'economic' components of the socio-economic factors have unique and separate influences on educational outcomes. However, our study results disagree with the other finding that family structure, the main source of family income and education, does not significantly predict females' performance (Considine & Zappalà, 2002). Financial assistance to needy schools and families in need is important. Policies and programs that assist low-income parents in providing appropriate psychological and educational support for the study of science among female students (Marks, Cresswell, & Ainley, 2006).

Finally, the study investigated teacher-related behaviour that affected female students' performance in science subjects at Junior High School. Findings revealed that respondents think their teachers have too many tasks to attend to, so it affects them as students. Again, respondents indicated that their teachers have an attitude of always caning them whenever they (teachers) want to correct them in class. Respondents further noted that their teachers do not give them a welcoming face in class; that is, many are not friendly. These behaviours of teachers, among others, affect their learning and hence their low performance in science. The

findings support that Kolb (2014) reported that lack of proper teaching methods and teachers' attitudes towards science instruction are the main contributors to students' behaviours in science. Teachers are to create a good atmosphere such that students feel less tensed to learn (Bandura, 2014). Again, our finding supports prior study that teacher factors influence students' performance in a science subject (Jayawardena, van Kraayenoord, & Carroll, 2020). The study revealed that if science teachers do not have too much workload, they will have some time to provide support in different ways to the students which will improve their low performance. Some of this support is developing students' note-taking, study skills, and discussing past examination papers, prepared model question papers, and conduct after-school classes to prepare students for the examinations. Besides, the teachers may organize science-related learning programs such as science competitions, exhibitions, and trips. Similarly, our results collaborate with previous findings that the teachers' job group had a significant and positive relationship with students' academic achievement in schools (Kimani, Kara, & Njagi, 2013). Teachers' weekly teaching workload, evaluation of students' Continuous Assessment Test (CATs) results, administration of students' classroom assignments and provision of individualized attention to weak students, time of completion of syllabus, and setting performance targets significantly affected students' academic achievement.

**Consent**

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

## Recommendations

Based on the findings from the study, the following recommendations have been suggested:

- Guidance and counselling coordinators and the science departments at the various basic schools in the district should be resourced to organize science sensitization programs for learners, especially, female students to overcome their fears and weird perception about science as a core subject.
- Parent Teachers Association (PTA), head teachers and teachers in the district should continuously sensitize parents on the need for them to take their wards education seriously and ensure that house chores are reduced for girls at home to attend to their books.

- The Ghana Education Service should organize workshops and seminars on the state-of-the-art procedure of teaching science subjects in the basic schools with particular emphasis on how to create a good learning atmosphere for the female students.



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