

Investigating the moderate effect of school location and gender on the relationship between school type and students' mathematics achievement

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ABSTRACT

This study aimed to investigate the moderating effect of school location and gender on the relationship between school type and students' mathematics achievement. The study was restricted to only senior high schools in the Ashanti region of Ghana. A quantitative research approach using a descriptive survey design guided the study. Proportional stratification techniques and simple random sampling using a lottery approach were employed in selecting the sample size and the participants for the study. A sample size of 398 students was used for the study. Two (one in rural areas and one in urban areas) of these schools were private, and the other two (one in rural and one in urban areas) were from the public schools. The questionnaire for the study was in two parts. The first part consisted of the demographic characteristics of the respondents, and the other part was a Likert-scale type of questionnaire on the students' mathematics achievement which was administered to the selected students. A structural equation modeling (SEM) analysis was conducted on the responses from the participants, and it was revealed that the moderating effect of school location and gender (more females) dampens the positive relationship between school type and students' mathematics achievement. In conclusion, it was implied that school location and gender have a negative effect on the relationship between school type and students' mathematics achievement. It was recommended that the government and the Ministry of Education should consider the location when setting up a senior high school and to bridge the social amenities and infrastructure gap that exists between the rural and urban schools to enhance the better mathematics achievement of all students in their final examinations, like the WASSCE.

Keywords: school location, gender, school type, moderating effect and students' mathematics achievement

INTRODUCTION

In many societies throughout history, mathematics has taken on a special and an important role. It has also been strategically important to the advancement of humankind. It is equally important for women to be aware of and have an overall knowledge of the significance that mathematics plays in everyday life as it is for men, for them to make responsible and informed decisions. It is actively critical to cultivate in students' minds a positive mindset regarding the acquisition of mathematical knowledge. Due to the confidence that comes from overcoming mathematical challenges, students will be able to take advantage of all the possibilities in mathematics. Students who display dissatisfaction and a lack of interest in mathematics may find it more difficult to study the subject at higher levels (AAT, 1991 cited by Asomah et al., 2018). Therefore, if students do not show a positive interest in the subject, the advantage of the understanding gained from studying mathematics for individuals, their communities, and across the country may be lost. Students with a strong understanding of mathematics and the ability to perform calculations have many more options and opportunities, which pave the way for a successful future.

For instance, in Ghana, failing the senior high school mathematics examination limits a student's ability to move on to the next level of their education (Ghana Tertiary Education Commission, 2020). This examination is given by the West African Examinations Council (WAEC) and is known as the West African Senior Secondary School Certificate Examinations (WASSCE). This explains the significance of mathematics education in Ghanaian classrooms. Accordingly, a lack of mathematical achievement will close many doors to a prosperous and fruitful future for those who do not possess it. Like in most other countries, mathematics plays a significant role in senior high school (SHS) curricula in Ghana. Every student at this level must take mathematics, in a sense, as it serves as a gatekeeper and an important filter for those who wish to pursue higher education in the country. Anamuah-Mensah and Mereku (2005) stated that it is a requirement to be enrolled in prestigious courses at Ghana's tertiary (universities, technical

universities, colleges of education, etc.) level of education. Fletcher (2008) asserted that having greater mathematical achievement increases one's chances of advancing in society. Despite its importance and wide-ranging relevance, students' achievement in this valuable subject has been problematic in the country (Anamuah-Mensah & Mereku, 2006; Bawuah et al., 2014; Butakor, 2015; Davis, 2008; Enu et al., 2015; Ghana News Agency, 2012; UNESCO, 2010; WAEC, 2022).

Mathematics achievement among students from Ghana has continuously lagged over time. WAEC data from the past suggested that students in senior high schools in Ghana achieved poorly in mathematics. The 2022 results of the West African Senior School Certificate Examination support this finding. The quality of mathematics education is still relatively low, even at the national level. According to Amenyo (2015) from the 2015 Programme for International Students Assessment (PISA) global educational rankings, Ghanaian students scored the lowest among students in 76 countries worldwide in mathematics achievement. Ghana's students continue to rank lower than average both in Africa and internationally for mathematics and science achievement, despite a significant improvement since TIMSS 2003 International Mathematics Report by authors Mullis, Martin, Gonzalez, and Chrostowski (TIMSS, 2004), according to a thorough international comparative study (TIMSS, 2007). The study conducted by the International Association for the Evaluation of Educational Achievement (IEA) supports this claim. Anamuah-Mensah and Mereku have once again documented the awful mathematical achievement of Ghanaian students, both domestically and worldwide (Anamuah-Mensah & Mereku, 2006).

Private schools and public schools are the two categories of educational institutions (school types). It goes without saying that different types of schools have different teaching facilities, which can have an impact on students' mathematics achievement. Emetarom (2004) defined educational facilities as the resources available in schools that support instruction and learning. When used properly, it provides spatial and physical facilitation in teaching and learning and improves students' mathematics achievement. School buildings, furnishings, water, electricity, libraries, and recreational spaces are a few examples of school facilities. Governments and families should take note of the disparities in mathematics achievement among students attending various kinds of schools. Fullarton (2002) stated that previous studies about school input have generally found that, overall, private schools used more superior materials because their owners or proprietresses are willing to spend money on obtaining high-quality inputs, while public schools are not willing to commit significant financial resources to education. According to Beach and Gary (2010), students' attending private secondary schools had greater access to social amenities than their public-school counterparts.

According to Abia (2005), the kind of school has an effect on how students are taught and learn which raises their level of mathematical achievement, in addition to the instructional resources given to schools. Achievement of students in mathematics at school is importantly affected by the school's location. Akinyele (2011) asserted that a child's socialization is greatly influenced by his immediate surroundings. According to him, a school's location can have an impact on students' mathematics achievement because most students find it more difficult to be on time for class in schools that are built on the outskirts of town, especially day students who face challenges when walking long distances to and from school. According to research by Davis and Hersh (2012), Klenfield (1985), Lambdin (2010), and others, the location of a student's school has an impact on their schoolwork, educational expertise, and standard of achievement. Although some researchers (Duedu, 2008; Wilmot, 2001) have started to examine the correlation between second cycle school location and students' mathematics achievement, the general conclusion of these studies is that students' attitudes toward the learning environment have an impact on their mathematics achievement, either positively or negatively. Very few of these researchers have investigated how Ghanaian students, particularly those in the highly competitive senior high school region of Ashanti, view their mathematics learning environments. The learning environments in mathematics classrooms have a big influence on students' attitudes toward mathematics, which in turn affects the students' achievement in the subject, according to research by Fraser and Kahle (2007) and Goh and Fraser (1998).

Gender is one of these variables whose effects on students' mathematics achievement are demonstrated in literature to be substantial. Concerns regarding the gender gap in mathematics achievement have been raised by teachers in several different countries. The question now isn't whether there is a mathematics achievement gap or not; rather, it's how much the gap is changing over time (Salisbury et al., 1999; Younger & Warrington, 2005). Based on the outcome of the West African Senior Secondary School Certificate Examinations (WASSCE), the students in the senior high schools in Ghana, including those in the Ashanti region, are currently achieving poorly or declining in mathematics (WAEC, 2022).

Irrespective of the Government of Ghana's efforts to raise students' mathematics achievement through various projects, programs, and amenities for the country's senior high schools, these students' mathematics achievement has consistently lagged (WAEC, 2022). It is against these backdrops that the study was hosted in Ghana's Ashanti region to investigate the moderating effect of school location and gender on the relationship between school type and students' mathematics achievement. This is because mathematics is a required subject for all senior high school students and is essential if they want to continue their education.

Statement of the Problem

Life remains centered around mathematics, and without it, life would essentially not be possible since it permeates all academic fields. Given this, researchers, both past and present, have never been able to ignore students' achievement in mathematics. The cited studies on the individual factors influencing the mathematics achievement of Ghanaian students have concentrated on the students' motivation, attitude toward the subject, anxiety, and perceptions, in addition to other variables like family and socioeconomic background and school-based factors (Asante, 2012; Butakor, 2015; Enu et al., 2015). The study conducted by Enu et al. (2015) focused on the personal and school-based factors that affect students. According to Mereku (2012), the WASSCE has revealed Ghanaian students' low mathematics achievement in recent years. Farooq and Shah (2008) posited that the debate surrounding the low achievement of mathematics in senior high school students in Ghana is heavily influenced by

student attitudes toward mathematics. Therefore, it is necessary to encourage a shift in how learners think of mathematics (Ghana Education Service, 2022).

Out of the 422,883 candidates who took the WASSCE in 2022, records disclosed that 28,116 students (6.73%) scored a D7 in mathematics. 27,696 (6.63%) of the candidates scored E8, and 43,767 (10.48%) of the candidates in mathematics scored F9. Furthermore, the results of 14.77% of the WASSCE candidates in 2022 who took the mathematics examination were not “accounted for.” To summarize, according to WAEC (2022), 23.84% of the WASSCE candidates failed the mathematics examination. This is a concerning statistic that requires careful examination.

According to Battey (2013), gender has remained a dividing status for researchers, which has an impact on the study of mathematics. While some studies (Preckel et al., 2012) indicated that boys achieve more than girls, other studies (Stevens & Gurian, 2007) indicated that girls achieve more than boys. However, other research (Lindberg et al., 2010; Mohamed & Waheed, 2011) has found no distinctions at all between boys and girls. Students’ achievement in mathematics has not improved despite increased funding and a number of intervention programs for mathematics education in Ghana (Akyeampong, 2009; Tamanja, 2016). Lubienski and Lubienski (2005) discovered no statistically significant distinction in the mathematics achievement of students attending public and private schools, which is in contrast to the findings of Kim and Placier (2004). When Ajayi (1999) looked into the correlation between the achievement of students in mathematics and the location of a school and discovered no statistically noteworthy variations in the two variables. Attending a second-cycle school in an urban or rural location has no bearing on a student’s mathematics achievement, as Yusuf and Adigun (2010) pointed out.

The literature mentioned above makes clear the conclusions reached by numerous researchers regarding gender, the type of school and the location of a school over the years and in the recent past. But in all, not much has been done considering school location and gender as moderating effects on the relationship between school type and the mathematics achievement of students. This is the gap that the researcher has found and therefore seeks to investigate the moderating effect of school location and gender on the relationship between school type and students’ mathematics achievement in the Ashanti Region of Ghana.

Objectives of the Study

The study aimed at achieving the following objectives:

1. To determine the moderating effect of gender on the relationship between school type and students’ mathematics achievement.
2. To find out the moderating effect of school location on the relationship between school type and students’ mathematics achievement.

Research Questions

The following research questions were raised to guide the study:

- RQ1** What is the moderating effect of gender on the relationship between school type and students’ mathematics achievement?
- RQ2** What is the moderating effect of school location on the relationship between school type and students’ mathematics achievement?

Significance of the Study

Governmental organizations working in their respective fields, including the Ghana Education Service and non-governmental organizations, can all benefit from the study. School heads and policymakers can use it to help them decide what measures to take to ensure that all students, regardless of gender or school location, succeed in mathematics. The findings can significantly contribute to removing the barriers imposed by school location and gender on the relationship that exists between the type of school and the mathematics achievement of students in the Ashanti Region and across the country, provided that appropriate strategies are recommended. It can also assist guardians or parents in determining what steps to take prior to registering their students’ attendance at school. The study’s findings may additionally help raise awareness about whether the locations of a school and gender have an effect on the relationship between the type of school and students’ mathematics achievement. It may even offer some evidence in favor of additional research studies.

LITERATURE REVIEW

Social Learning Theory and Self-Efficacy Theory

This study utilized the social learning theory and self-efficacy theory, which were introduced by Albert Bandura (1977, 1997), to examine the relationship between school type and students’ mathematics achievement. This theory focuses on the actions that individuals form in response to changes in their surroundings. While some behaviors may result in rewards, others may have negative consequences due to the process of varying reinforcement, which eventually leads people to select the most beneficial behavior patterns (Atkinson et al., 1997). The significance of learning by observation is further emphasized by Albert Bandura’s Social Learning Theory. He maintained that a lot of behavioral patterns are picked up through observing how other people behave and the results that follow. It highlights how important models are in passing along particular behaviors as well as emotional reactions. It also addresses issues like which kinds of models work best and what circumstances affect the likelihood that the behavior being modeled will be exhibited (Bandura, 1977). The self-efficacy principles, which maintain that individuals have an

opinion of their capacities for organizing and carrying out actions that are necessary to achieve any recognized kind of mathematics achievement, are the basis of Social Cognitive Theory. The basis for human motivation, wellbeing, and personal achievement is found in self-efficacy beliefs. This is due to the fact that people lack motivation to act or to persevere in the face of adversity unless they have faith that their efforts will result in the results they want.

Key claims made by Bandura (1977) regarding the concept of self-efficacy in how people function include the notion that ideas play a greater role in determining an individual's inspiration, emotional states, and action than what is objectively true. Considering this, people's beliefs about their own abilities often predict their behavior more accurately than their true capabilities. Perceptions of one's own efficacy also influence how people use the knowledge and abilities that they possess. This contributes to the explanation of why people's actions occasionally deviate from their true capacities and why, even in cases where individuals possess comparable knowledge and abilities, their behaviors may differ greatly. He goes on to say that while many gifted people experience frequent self-doubt about abilities they obviously possess, many individual students have confidence in their abilities despite having a limited skill set. It is rare for belief and reality to coincide exactly, and people's interactions with the outside world are usually shaped by their beliefs.

As a result, self-efficacy beliefs rather than prior accomplishments, knowledge, or skills are typically a better indicator of students' mathematics achievement. However, Pajares (2002) contended that the absence of necessary skills and knowledge precludes success from being achieved by any amount of confidence or self-worth, which is why the Social Learning Theory continues to be relevant to students' mathematical achievement. If students had to rely only on the results of their own actions to guide them, achieving mathematics success would be incredibly time-consuming and even dangerous. According to the Social Learning Theory, social contexts such as family, community, and larger society have an impact on both the learning environment and the mathematics achievement of students (Crosbie-Burnet & Lews, 1993). Social learning holds that several psychological and external circumstances have an effect on students' mathematics achievement. It shows how successful human social models are at persuading someone else to alter their behavior, attitudes, or beliefs, as well as their social and cognitive abilities. Therefore, in order to ensure that all students, no matter what kind of school they attend, achieve better results in the mathematics subject, teachers must take care to model appropriate behavior and avoid modeling inappropriate behavior.

Self-Determination Theory (SDT) and the Motivational Theory

Under the school location and students' mathematics achievement, two theories served as the foundation for the study: Maslow's Motivational Theory (first published in 1954, based on work from the 1940s) and Edward Deci and Richard Ryan's Self-Determination Theory (SDT), which was developed in 1985. Maslow's theory of motivation contends that human behavior's innate tendencies toward growth and development are largely driven by motivation. It highlights people's degree of self-motivation and determination. The self-determination concept of education places a strong emphasis on fostering in students a love of learning, a passion for education, and self-assurance in their own competencies. The motivational theory of Maslow (1954), states that students' objectives are influenced by how they approach their educational tasks. The will that students bring to work, their degree of attention, which influences their action, and their opinion of the reasons behind their achievement or failing are all factors in motivation.

According to Weiner (2004), students' motivations and feelings are influenced by their beliefs about what factors lead to success or failure in mathematics. For instance, when students notice that their lack of effort is the cause of their failure and that their efforts are within their control, they feel guilty and become more involved in school activities, which in turn improve their achievement in mathematics and in life in general. To convince and inspire students' for engaged learning in senior high schools in Ghana; schools should provide a friendly environment in addition to individual student motivation towards mathematics achievement.

Given that it takes longer to walk between home and school, students who attend schools that are located far from their residences tend to drop out. On the other side, since it would be challenging for parents to identify their students' learning patterns, students would become demoralized by insufficient support from parents or guardians, as evidenced by a failure to follow up with them. It would be simple to identify additional needs such as exercise books, the provision of transportation, and other needs of their wards through parents monitoring their students' learning progress. Deci and Ryan (1985) placed a similar emphasis on learner motivation as did Maslow (1954).

According to the Self-Determination Theory (SDT), teachers can help students transition from a motivation state that is created, controlled, and upheld by the teacher or classroom norms to one in which they are self-motivated. SDT contends that meeting a person's basic needs, transforms human behavior and is achieved through providing content that directly relates to and benefits students. It is imperative for educational planners and implementers to recognize that in the absence of suitable environmental factors, motivation cannot be taken for granted. These factors have the power to either reinforce or inhibit the natural inclination to act in order to satisfy needs (Deci & Ryan, 2002). Both theories highlight motivation as a powerful force that can push teachers and students to put in a lot of effort, no matter where the school is located, in order to meet the necessary mathematics goals, which makes them relevant to this investigation. In this instance, school locations are crucial because they draw students and instructors, who are important collaborators in helping high-achieving students to achieve in mathematics.

The Theory of Educational Productivity

For gender and students' mathematics achievement, Herbert Walberg's (1981) Educational Productivity Theory provided the basis for this study. Walberg's theory discusses the variables that affect learning and how those variables affect students' mathematics achievement. The study looked at the mathematics achievement of students, and Walberg used numerous

approaches to find out the variables affecting the students' mathematics achievement. Using input from various theorists, he integrated his research with more than 3000 studies and examined his theory.

One of the very few theories of students' mathematics achievement that has been empirically tested is Walberg's (1981) theory of educational productivity. According to Reynolds and Walberg's (1992) study, Walberg's theory of educational productivity holds that psychological traits of specific students as well as the social settings in which they reside have an effect on how well they do in school, including behavioral, cognitive, and attitudinal changes. Furthermore, according to Walberg's research, there are nine major factors that affect educational outcomes: Having access to mass media outside of school, atmosphere in the classroom, environment at home, peer group, age/developmental level, motivation, student ability/prior achievement, classroom quantity, and quality (Walberg et al., 1986). Ability, motivation, and age are the first three variables, and they represent the student's characteristics. The last four variables represent elements of the emotional surroundings: access to media, circle of friends, residence, and the atmosphere in the classroom, while the fifth and fourth variables reflect instruction (quantity and quality) (DiPerna & Elliott, 2002). He clarified that these factors have specific effects that, if improperly managed, could lead to issues with students' mathematics achievement. The importance placed on particular elements possesses an important effect on how well students achieve mathematics.

Numerous investigations have been conducted to pinpoint issues influencing students' achievement in mathematics. A multitude of socioeconomic variables that affect students' achievement in mathematics include the proportion of instructor to student in class, attendance, sex of student, family income, the educational background of parents, and school distance (Raychaudhuri et al., 2010). Any educational institution's most valuable asset is its student body. Measurement of students' mathematics achievement has drawn a lot of attention in the past because it challenges certain aspects of academic literature and because social, psychological, economic, environmental, and personal factors typically have an impact on students' mathematics achievement. These variables, which differ from person to person, possess an important effect on students' mathematics achievement (Irfan Mushtaq & Khan, 2012). Though they only make up a small part of the learning equation, student characteristics are undoubtedly significant for mathematics achievement of students.

Empirical Review

This section includes a variety of studies on the subject matter that have been done both domestically and internationally. The objectives of this current study were taken into consideration when organizing this presentation.

Iroko et al. (2024), examined the influence of gender and school location on the academic achievement in algebra among senior secondary school students. Their study revealed that gender and school location can influence students' academic achievement in algebra, with female students achieving more than their male counterparts in tasks that require problem-solving skills. Also, Efa and Frimpong (2023), investigated the effect of Gender on senior high school students' performance and perception of core mathematics in the cape coast metropolis in Ghana. Their research revealed significant gender differences in mathematics performance, with males generally achieving better than the females. Egbedi (2016), conducted a study on school location as a factor in students' achievement in senior secondary school mathematics. The study found out that students from rural schools achieved better in mathematics than students from urban schools.

Effect of school location on students' mathematics achievement

The school's geographic setting has a big impact on how well students succeed in mathematics. In Ghana, a rural school's problems usually include no laboratories, insufficient equipment, and a teacher shortage, among other things. Students' motivation and mathematics achievement are both severely impacted by these deficiencies. There is a lot of evidence to suggest that students in rural areas are less motivated to pursue higher education than students in urban areas (Arnold et al., 2005). According to Macmillan (2012), students in rural settings give their studies less importance which have an impact on their mathematics achievement. According to Adesoji and Olatunbosun (2000), there has been documented evidence of a correlation between a school's location and its students' mathematics achievement. Urban students achieved more than those in semi-urban and rural educational settings in terms of mathematics achievement (Adepoju, 2002; Ogunleye, 2002). Hu (2003) noticed that rural students typically have lower motivation for mathematics, low educational aspirations, and lower values placed on mathematics than do their urban counterparts. Students' mathematics achievement in rural and urban areas differed significantly, according to Owoeye's (2002) research.

Numerous studies have linked the location of secondary schools to low mathematics achievement among students. Onyeachu (1996) investigated how students' mathematics achievement in second cycle schools in Lagos State was impacted by their school's location. The study found a significant distinction between students' mathematics achievement and school location. The location of the school affects how well students achieve mathematics. Obe (1984) found that 480 second cycle finalist students from urban and rural areas achieved significantly differently in mathematics regarding the skills subtests of NCEE in Nigeria. After conducting a study on the tagged scholastic skill test, the conclusion drawn was that students from urban schools achieved more than their rural setting counterparts. It has been said that the Scholastic Achievement Test (SAT) is a broad-based indicator of mathematics achievement. According to Kemjika (1989), his research on the general differences between mathematics achievement in urban and rural settings revealed that the students' mathematics achievement is affected by the environment where the school is situated. Supporting the aforementioned, Ajayi (1999) discovered a substantial distinction between the mathematics achievement of the participants in his study living in urban and rural areas. His deduction was that their prowess in mathematics had to stem from the abundance of resources at their disposal, which were absent in the rural setting.

Several reviews of the literature suggested that urban settings students achieve more than their counterparts dwelling in rural settings on examinations. It has also been observed by others that, despite all obstacles, students in rural educational settings

achieve more than their urban counterparts. Some have provided their findings and conclude that since both urban and rural settings achieve the same levels of mathematics proficiency, neither can be considered superior to the other. Considine and Zappala (2002) conducted research on students in Australia and discovered that neither location nor school type substantially predicted a student's achievement in mathematics. When examining how school location affects students' mathematics achievement, Shield and Dockrell (2008), discovered that the setting of a school has a negative effect on the students' mathematics achievement.

Adell (2002), further contended that low mathematics achievement in schools is a global issue connected to students' low financial standing and the location of the school, both of which have an impact on mathematics achievement. Students' attitudes toward achieving mathematics are influenced by the school's location (Onouwodeke, 1995). According to Akinyele (2011), a child's socialization is greatly influenced by his immediate surroundings. He said that the achievement of students in mathematics can be impacted by the neighborhood in which a school is situated. Klenfield (1985), Lambdin (2010), and Davis and Hersh (2012) discovered that the caliber of a student's knowledge, skills, or educational target is influenced by the school's location. Additionally, students' achievement in mathematics reflects the distinction in instruction quality between urban educational settings and rural school type.

Many studies have found a connection between low mathematics achievement among students and the distance they walk to school; this is typically the case for students attending senior high schools in rural settings. Research by Engelbrecht et al. (1996), that looked into school locations found a good distinction between students' mathematics achievement and the distance they traveled from home to school. The researcher goes on to say that the majority of students were impacted by the distance, which caused them to spend more time traveling than studying. Walking distance, as noted by a number of researchers, seems to be a common factor in students' low mathematics achievement. According to Adeboyeje et al. (2003), poor mathematics achievement in students, especially in rural settings, is caused by a number of factors, including home-school distance through stakeholder involvement.

According to Onderi et al. (2014), students who walk a considerable distance to school are more likely to arrive late and with empty stomachs, which has a negative impact on their mathematics achievement. It was also explained that, in contrast to urban areas, where getting to school is much easier, walking longer distances causes students to become fatigued and hungry, which impairs their ability to learn. Galabawa (2002) found that students' mathematics achievement is negatively impacted by schools that are located far from their homes. This is because most students in rural areas have limited time to focus on their studies, whether they are at home or in school.

Eze Asogwa (2013) claimed that because rural schools lack the resources and personnel needed for academic success, they are usually inferior to the urban kind of schools. A student's ability to learn and achieve at the expected degree is affected by where he or she school is situated. According to Eze Asogwa (2013), students' mathematics achievement is affected by various aspects of the school environment, including both rural and urban settings. It can be seen from the above literature that many researchers think that students in urban settings achieve more than their rural counterparts in mathematics achievement, and it is for some of these reasons that this study has been conducted.

Effect of gender on students' mathematics achievement

Majority of studies have expressed concern about the impact of gender on students' mathematics achievement. This is due to the apparent strong influence "gender" has on learning. According to Orton (1987), mathematics is the key to all other sciences and is the gate to understanding the world and other sciences. Without a working knowledge of mathematics, one cannot understand other sciences or the world. From the above, women require a strong foundation in mathematics to succeed in the political and socioeconomic spheres of their home countries, as well as in their private and public lives (Cockcroft, 1994). He went on to say that mathematics is essential to the study of physical sciences and all forms of engineering, and that it is a strategically beneficial subject for the advancement of science and technology. Furthermore, according to van den Heuvel-Panhuizen (2003), mathematics is crucial for the growth of character, self-worth, and the emergence of creativity and curiosity. From the aforementioned statement, it can be inferred that mathematics is extremely important to everyone, regardless of gender, and that both men and women should take it seriously.

In education, gender distinctions in the achievement of mathematics are a controversial topic. In the 1970s, concerns about gender disparities in mathematics achievement first surfaced (Fennema et al., 1990). Studies conducted between the 1970s and the 1990s, according to Hyde (2005), showed that there were either very little or no gender distinctions in mathematics achievement during years in primary education. The idea that mathematics is a subject best suited for male students is widely held throughout the world (Fennema, 1990). They went on to support the following claims with evidence: That there are gender distinctions in mathematics education; that these distinctions become more noticeable as adolescence approaches; and that many well-known mathematicians have admitted these distinctions.

The Africa Academy of Sciences reported across the continent with regard to women's achievement in mathematics. Their conclusion holds true for Ghana and, by extension, for Ghanaian students enrolled in senior high schools. The disparities in mathematics achievement that arise in the early years tend to favor females, while the distinctions in mathematics achievement and attitudes that favor men tend to occur during the senior high school years. Gender distinctions in mathematics achievement also become evident at the second-cycle level (O'Connor-Petruso et al., 2004). Girls begin to show less assurance in their mathematical abilities at this point, and they achieve worse than boys on tasks requiring higher level mathematics and problem solving. According to a number of studies, boys' achieves vary slightly more than girls' (Hyde et al., 2008).

Indeed, there is less gender difference favoring boys in science and mathematics achievement and capability when comparing students with average versus highest levels of achievement and capability (Halpern et al., 2007). But this difference is still

negligible even at the highest levels (Hyde & Mertz, 2009). Hyde and Mertz (2009) have provided evidence that challenges the greater variability hypothesis. Girls and boys have achieved parity in mathematics achievement, as shown by these studies, which show that there is insignificant distinction in the average scores between the sexes (Hyde et al., 2008). The two sexes now have nearly equal low-end distributions of mathematics achievement scores (Hyde & Mertz, 2009). The greater variability hypothesis predicts differences at both, not just one, of the distribution's ends. According to Hyde and Mertz, there is a correlation between higher male variability and multiple measures of gender inequality, but this relationship is not universal when it comes to mathematics achievement.

In 2008, Weerakkody and Ediriweera conducted a comparative analysis of how gender affected mathematics achievement in students studying management and commerce (Weerakkody & Ediriweera, 2008). The two gender groups' mathematics achievement was compared and the findings revealed that there was substantial distinction between the boy and girl students in mathematics achievement. In accordance with Zaman's (2011) findings, male students outperformed female students in terms of average scores across all domains of mathematical thinking and achievement.

The Pekrun and Zirngibl (2004) and TIMSS in 2002–2003 both showed gender equality in the average scores of mathematics achievement for boy and girl secondary students in Australia and New Zealand. That is, according to Thomson and Fleming (2004), there were no appreciable gender gaps in the average scores of students in mathematics achievement. But three years later, the PISA (2006) results showed that boys in Australia and New Zealand achieved significantly better in mathematics than girls (OECD, 2007). The gender gap in Australia was higher than the OECD average, and the findings for each state and territory also showed a gender preference for men. Still, the total gender gap (14 points) was notably smaller than the 78 points that distinguished students' scores between high and low socioeconomic status groups (Thomson & De Bortoli, 2008).

Research on second-cycle school students revealed that males were more frequently found among the highest achievers in mathematics (Thomson & Fleming, 2004). Male counterparts achieve more than female ones in average mathematics achievement, according to Horne's (2004) statistically significant findings. Cox (2004) discovered in Victoria that, in the vast majority of senior secondary mathematics comparisons, females achieved more than males in terms of mean scores. Nevertheless, no inferential statistics were offered to corroborate these conclusions.

Many more boys than girls are found in the upper and bottom 5% and 1% of any assessment, according to the greater male variability hypothesis, because boys' results in mathematics achievement vary more than girls' do. This is observed in assessments that identify gifted mathematicians as well as in large international tests and US college entrance exams (OECD, 2014; Halpern et al., 2007). But this outcome varies over time, between countries, and between ethnic groups. According to the gender similarities hypothesis, boys and girls are similar in the majority of their abilities, including their aptitude for mathematics (Hyde, 2005). According to Hyde's (2005) review of meta-analyses, the gender similarities hypothesis is supported. There is no gender parity in mathematics achievement, according to Hyde et al. (2008). In general, boys and girls are similar in most fields of capability, including mathematics prowess, according to the gender similarities hypothesis (Hyde, 2005). Hyde (2005) found that the gender similarities hypothesis holds up well after reviewing meta-analyses.

As per Hyde et al. (2008), there is insignificant gender parity in mathematics achievement. However, some researchers have found such gender differences as early as primary school. According to research by Penner and Paret (2008), gender differences favoring boys in mathematics achievement are assumed to start at the start of high school. Even though these early gender gaps are smaller than those found later in school, Penner and Paret (2008) argued that their existence is important because they may lead to even larger gaps later on. Research on the kind and extent of gender disparities in mathematical achievement is therefore highly valuable.

Many countries have boys who achieve slightly better in mathematics than girls, but there is still a lot of variation across them. Köller et al. (2001) observed that males showed superiority in advanced mathematics courses, interest, and achievement compared to females in their research on gender parities in mathematics achievement. The general population did not exhibit gender parities in mathematics achievement, according to a meta-analysis carried out in the 1990s, as reported by Hyde et al. (2008). Not all facets of mathematics achievement are influenced by gender differences. In terms of fundamental mathematical knowledge, men and women achieve similarly well, with girls having superior computational abilities.

The biggest differences can be seen in mathematics achievement between reasoning and geometry (Fennema, 1990). According to Casey et al. (2001), there is a significant correlation between males' assurance in their mathematics capabilities and their success in the subject. Many female adolescents exhibit lower achievement and reasoning skills in mathematics, which has several educational implications and prevents them from pursuing certain majors in college and university (such as computer science, engineering, etc.). According to Halpern (2004), women are comparatively underrepresented in the ranks of those who seek advanced degrees in these fields. Tonah (2009) reported that there are still gender differences in high school mathematics achievement on complex cognitive tasks, but these differences appear to be closing.

Research on the connection between students' gender and mathematics achievement indicated that male advantage in mathematics achievement is a common occurrence (Mullis et al., 2000). Fennema (1990) found that although boys achieved better than girls in senior high school mathematics, the two groups differed in their attitudes toward the subject. An international study conducted by the IEA found that, on average, there was no distinction in mathematics achievement between both sexes in high schools across all countries (Mullis et al., 2004). The notion that there are insignificant distinctions in mathematics achievement between boys and girls is further supported by the findings of two international studies that were conducted in quick succession (TIMSS, 2004) in the Iranian educational system, which prohibits coeducation and assigns male teachers to boys' schools and female teachers to girls' schools. From the 1999 TIMSS, boys' mathematics achievement significantly decreased, while girls' achievement significantly rose over the same period. These studies' findings supported these findings. Boys achieve more than girls in mathematics in terms of both interest and achievement, according to Gallagher and Kaufman (2006). They did clarify that

they are unsure of the primary reason for these variations, though. Despite studies showing that boys achieve more than girls in mathematics, some research findings refute the notion that gender gap exists in mathematics achievement.

According to Ding et al. (2007) longitudinal study, they did not find a mathematics achievement gap between boys and girls. Thus, this accomplishment is independent of gender. This study showed that the two genders' growth trends in mathematics were the same during the study period. Since mathematics is a science, women should be able to produce the same amount of scientific knowledge as men if scientific inquiry is conducted with sufficient rigor, according to some gender-based scientists (Howes, 2002; Sinnes, 2006). Although closing the gender gap is seen as a crucial step toward achieving egalitarianism and advancing human development, gender inequality in mathematics achievement is an international issue. Boys and girls should be given equal chances and challenges. Therefore, it is seen from the review of related literature that opinions on how gender affects students' mathematics achievement are divided.

Conceptual Framework

Investigating the moderating effects of school location and gender on the relationship between school type and students' mathematics achievement is exemplified by the structural framework shown in **Figure 1**. With the conceptual framework developed for the study, there exist critical factors that could serve as a basis for predicting students' mathematics achievement. The type of school a child attends may not be the only factor influencing their mathematics prowess; the location of the school, in addition to the child's innate masculine or feminine gender, may also be related factors. The study investigated the relationship between the independent variable (school type), and the dependent variable (students' mathematics achievement), in addition to the moderating variables (school location and gender).

The overall model or pictorial view of the research study is represented by the diagram in **Figure 1**.

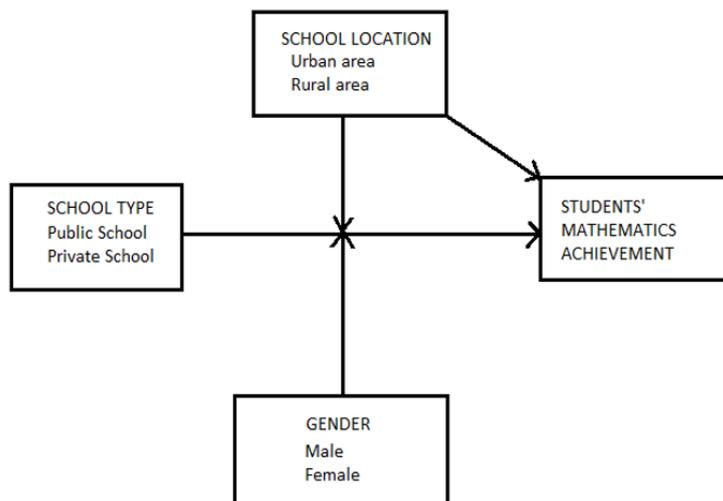


Figure 1. Conceptual framework (Field Survey, 2023)

MATERIALS AND METHODS

Research Design

The descriptive survey design was used in the research. According to Creswell (2003), a study design is an investigation's tactics, framework, and schedule developed to control variance and find answers to research questions. Typically, factual, quantifiable information required for decision-making is systematically gathered using the descriptive survey design. In light of the aforementioned characteristics, a descriptive survey design was picked for this research in order to collect descriptive information from chosen samples and extrapolate the results to the populations represented in the sample. The utilization of a descriptive survey facilitated the acquisition of precise, measurable data regarding the respondents' demographic attributes.

Population

The study's target population comprises all senior high school students in Ghana's Ashanti Region. Eighty thousand (80,000) students make up the average yearly student population (Ghana Education Service, 2023).

Sample and Sampling Techniques

A group, or subset of the entire population chosen for observation and analysis, is referred to as a sample (Best & Kahn, 1993). Sampling, as defined by White (2005), is the process of choosing units or elements for a study's samples from a sample frame. The study used data from four second-cycle schools in the Ashanti region of Ghana, two of which were public and two were private. Of the two public schools, one was chosen from the urban area and the other from the rural area. Additionally, a private school from the urban area was chosen, and another from the rural area was also picked. Using Taro Yamane's (1967) formula:

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

where n = sample size, N = population size and e = sampling error with $N = 80,000$ and $e = 0.05$, a sample size (n) of 398 students was used for the study.

The study employed a combination of proportional stratification techniques and simple random sampling using a lottery approach to determine the sample size and participants for the study. For the study, the researcher chose four senior high schools using simple random sampling. Out of the four senior high schools, two were settled in rural and urban educational settings and were classified as public educational institutions, while the other two were settled in rural and urban areas and were classified as private educational schools. Using the proportionate stratification technique, random samples from stratified groups were taken proportionately to the population. In order to account for the variations in sub-group characteristics, it sought a proportionate representation (Oso & Onen, 2005).

With simple random sampling using a lottery approach, each respondent was allowed to choose a “Yes” or “No” item, thereby offering each one the same chance of being considered for the study based on the lottery. The “Yes” option-choosing respondents were then offered the chance to take part in the research using a lottery-style simple random sampling method, and the sample size for the study is comprised of these respondents.

The estimated student population and sample size for each of the four senior high schools picked for the study are shown in **Table 1**.

Table 1. The estimated student populace and sample size for each of the four senior high schools picked for the study.

School type	Student population	Sample size
Adventist SHS (Public-Urban)	3126	169
Dompoase SHS (Public-Rural)	1849	100
Assemblies of God SHS (Private-Urban)	1165	63
Christ the King Catholic SHS (Private-Rural)	1221	66
TOTAL	7361	398

Source: Field Survey (2023)

Research Instrument

Questionnaires were the most successful tool for gathering data for the study. According to Gay (1992), questionnaires are best suited for use in surveys because they provide thorough solutions to challenging issues. The questionnaire’s items were arranged according to the research questions that were posed to direct the study. There were four constructs for the study, namely, school location, gender, school type and students’ mathematics achievement. There were two subdivisions under the Questionnaire. The first part comprised of the demographics characteristics of the respondents and was made up of five items which catered for the constructs: gender, school location and school type. The other part consisted of 10 items in all on the students’ mathematics achievement with a five-point Likert-scale format with responses ranging from Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD). These responses were assigned the following values; Strongly Agree-5, Agree-4, Neutral-3, Disagree-2 and Strongly Disagree-1 for positively worded statements. Without outside influence, the responders gave their free and informed answers (See **Appendix A, Section B**).

Data Analysis

For the variables, school location, school type and gender, whose response types were categorical, they were dummy coded. The variable gender was dummy coded as 1 for male and 0 for female, the variable “School Location” was dummy coded as 1 for Urban Area and 0 for Rural Area. The variable “School Type” was also dummy coded as 1 for Private school and 0 for public school. An Exploratory Factor Analysis (EFA) was done, and afterward, a Confirmatory factory analysis was done using AMOS version 23. Based on the factor loadings of the observed variables from the EFA, the observed variables that loaded on the component were selected, and all other analysis was done with these indicators for the construct (Students’ Mathematics Achievement). The Confirmatory factor analysis was done using the four constructs and the three variables all together.

RESULTS AND DISCUSSION

Demographics

Table 2 gives the frequency and percentage of the demography of the participants in the study.

Table 2. Demographics of students

Demographics	Frequency (N)	Percentages (%)
Gender	398	100.0
Male	259	65.1
Female	139	34.9
Age	398	100.0
10 – 15 years	10	2.5
16 to 20 years	387	97.2
21 years and above	1	0.3
School Type	398	100.0
Public	269	67.6
Private	129	32.4
School Location	398	100.0
Urban	157	39.4
Rural	241	60.6

Source: Field Survey (2023)

The study results summarized in **Table 2** have the full questionnaire provided in **Appendix A (Section A)**.

Descriptive Analysis

Descriptive analysis was also used in the study. After testing the exploratory factor analysis, this was employed to assess its normalcy on the questionnaire. The descriptive statistics of mean and standard deviation were used. The normality of this study is one of the core assumptions of multivariate statistics. Multivariate analysis dictates that each measuring item has a normal distribution and a mean score greater than three on a scale of 1 for strongly disagreeing to 5 for strongly agreeing (midpoint). **Table 3** displays the findings for each build component. The mean and standard deviation for each construct informed the researcher that the normalcy test was successful.

Table 3. Descriptive analysis

Variables	Mean	Std. Dev.
Gender	.6508	.47733
School Type	.6759	.46863
School Location	.3945	.48935
Students' Mathematics Achievement (ACH)	3.4464	1.0374
ACH3 I feel secure while attempting maths	3.42	1.311
ACH4 Mathematics doesn't scare me at all	3.24	1.308
ACH5 Mathematics is interesting and enjoyable to me	3.68	1.300

Source: Field Survey (2023)

Table 3 analyses the descriptive data for each of the constructs: Students' Mathematics Achievement, Gender, School Location, and School Type. The total mean score of students' mathematics achievement was 3.447, with a standard deviation of 1.037, according to **Table 3**. Among the three observed items that loaded under students' mathematics achievement, the statement "Mathematics doesn't scare me at all" ($M = 3.24$, $SD = 1.308$) had the lowest mean score, while the item "Mathematics is interesting and enjoyable to me" ($M = 3.68$, $SD = 1.300$) had the highest mean value. The descriptive means for the variables Gender, School Location, and School Type were 0.6508, 0.3945, and 0.6759, respectively. The study results summarized in **Table 3** are provided in **Appendix B**.

Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis was performed to analyze the connected factors in order to identify how the observable variables loaded on the latent variable (students' mathematics achievement). Suhr (2005) used this method to reduce or eliminate a number of observable variables on the questionnaire whose loading was not in the correct place of the latent variable. **Table 4** shows the final EFA, which depicts the observed factors that loaded well on the component.

Table 4's analysis identifies the observable variables loaded on the construct, students' mathematics achievement. The variables with observed loadings larger than 0.5 were used in the data analysis. Based on a Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) of 0.716, 0.527 was determined to be the coefficient of determination. The KMO indicated that the observable factors loading in the dimension on the latent variables were assumed to be 71% adequate. A 0.000 p-value was obtained from a Chi-Square of 252.906 and a degree of freedom of 3 using the Bartlett's Test of Sphericity. A Total Variance Explain of 63.403% was noted in addition to the EFA. **Table 4** shows the final EFA, which depicts the observable variables beneath the hidden variable, students' mathematics achievement. The observed variable with the least factor loading under the latent variable mathematics achievement was ACH3. "I feel secure while attempting maths" had a lower loading of 0.710, whereas ACH5 (Mathematics is interesting and enjoyable to me) had the highest factor loading of 0.869.

Table 4. Exploratory factor analysis (EFA)

Measurement Items	Component	
I feel secure while attempting maths (ACH3)	.710	
Mathematics doesn't scare me at all (ACH4)	.802	
Mathematics is interesting and enjoyable to me (ACH5)	.869	
Total variance explained	63.403%	
Kaiser-Meyer-Olkin measure of sampling adequacy	.716	
Bartlett's Test of Sphericity	Approx. Chi-Square	252.906
	Df	3
	Sig.	.000
a. Determinant	.527	

Extraction method: Principal component analysis

The study results summarized in **Table 4** are provided in **Appendix B (Table 1B, 2B and 3B)**.

Confirmatory Factor Analysis (CFA)

Amos (version 23) was employed for the CFA. The use of the CFA in multiple related studies indicates that it has a wider range of applications than other statistical analyses. This is because different statistical tests can be estimated by the CFA (Dogbe et al., 2020; Lahey et al., 2012). The results of the CFA analysis are compiled in **Table 5**. The observed variables from the rotated components were used for CFA analysis after EFA analysis. Factor loadings greater than 0.4 were used to analyze the CFA, and variables that were observed in the EFA but had loadings less than 0.5 were excluded.

Table 5. Confirmatory factor analysis

Model fit indices: CMIN = 5.217; DF = 3; CMIN/DF = 1.739; CFI = .988; TLI = .941; RMR = .015; RMSEA = .043; P-close = Std. factor loading .486	
Students' maths achievement AVE=0.566; CR=0.792; CA=0.707;	
ACH3 I feel secure while attempting maths	.659
ACH4 Mathematics doesn't scare me at all	.906
ACH5 Mathematics is interesting and enjoyable to me	.665

Source: Field Survey (2023)

The study results summarized in **Table 5** are provided in **Appendix B (Table 6B, 10B, 11B, 12B and 20B)**.

According to Hair et al. (2010), the definiteness of the model fit of the CFA in **Table 5** analysis should be discussed in terms of less than three CMIN/DF (chi-square value over the degree of freedom), RMR (root mean square residual) and RMSEA (root mean square error of approximation) values not exceeding 0.08, and TLI (Tukey Lewis Index) and CFI (Comparative Fit Index) values of at least 0.9. According to Hair et al. (2010), CMIN ensures the lowest discrepancy value, whereas RMR and RMSEA define the complete fit indices by evaluating the deviation from the model on the multiple hypotheses provided. On the other hand, TLI and CFI values on continuous data that ought to fit the reference line model are determined using normal theory. The model fit with the modification indices on Amos (version 23) produced a degree of freedom (DF) of 3 and a CMIN/DF of 1.739 from a CMIN of 5.217. The diagram for the confirmatory factor analysis is displayed in **Figure 2**.

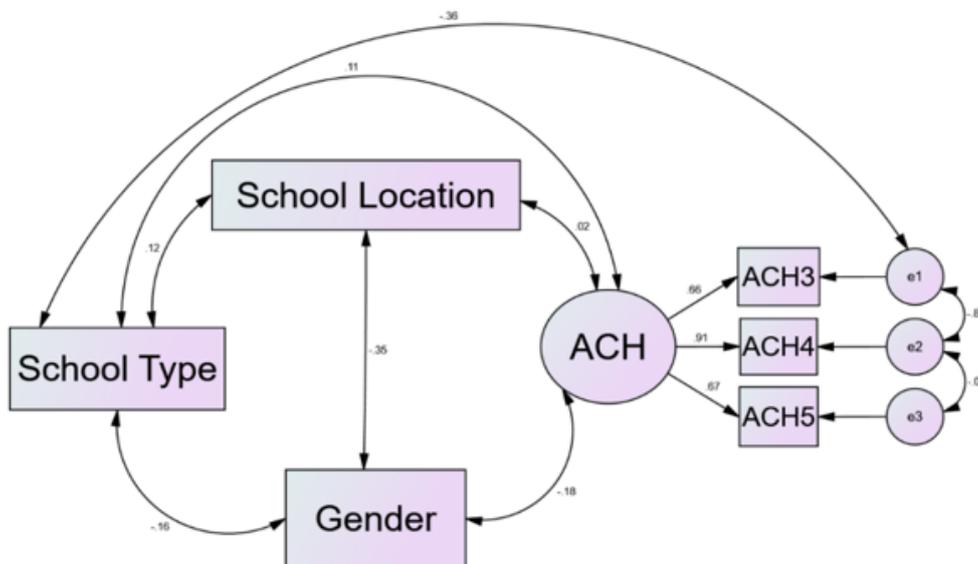


Figure 2. Diagrammatic presentation of confirmatory factor analysis (Field Survey, 2023)

Appendix B provides a detailed explanation of the **Figure 2**.

Discriminant Validity

To critically assess the convergent validity and reliability on the final observed variables that approximated the CFA, the average variance extracted (AVE) and composite reliability (CR) were determined. Convergent validity assesses how strongly each

observed item correlates with the other observed variables on the same concept (Trochim, 2001). The AVE and CR should have anticipated values of at least 0.5 and 0.7, respectively. The AVE and CR were computed for further analysis of the study and reaching convergence validity, and the results confirm at least AVE = 0.50 and CR = 0.735, which support the requirements for AVE and CR proposed by Fornell and Larcker (1981). Other studies, such as Arthur et al. (2021), indicated that discriminant validity is gained when AVE has a value greater than the correlation coefficient, and the coefficient values were created from the CFA output using covariances. **Table 6** compares the AVE to the equivalent correlation of latent variables.

Table 6. Discriminant validity

Variables	ACH
ACH	0.752
Gender	-0.086*
School Type	0.051
School Location	0.012

** ~ P-value significant at 1% (0.01); \sqrt{AVE} are bold and underlined

From **Table 6**, since \sqrt{AVE} is greater than the correlation values of the latent variable, with the highest correlation coefficient value as 0.051. This explains that discriminant validity is achieved. The study results summarized in **Table 6** are provided in **Appendix B**.

Path Estimates

Direct effect

In assessing the direct relationship between the variables, the model was reconstructed to show the conceptual framework (see **Figure 3**). The model indices indicate the new model's fitness. The CMIN/DF ratio was 1.73,9 while the CFI and TLI were .988 and .941, respectively. The RMR and RMSEA values were .015 and .043, respectively. The P-Close was .486. This indicates that the model has passed the fitness test. There was no significant relationship between school location and students' mathematics achievement and that was same for school type and students' mathematics achievement. However, there was a significant relationship between the gender of students and their mathematics achievement. The mathematics achievement of students' was inversely related with their gender. **Table 7** summarizes all of the relationship's coefficients.

Table 7. Direct effects

Path	Std. estimate	C.R.
Gender → ACH	-.181	-2.350*
School location → ACH	-.050	-.892
School type → ACH	.085	1.331

Model fit indices: CMIN = 5.217; DF = 3; CMIN/DF = 1.739; CFI = .988; TLI = .941; RMR = .015; RMSEA = .043; P-Close = .486

* ~ P-value significant at 5% (0.05)

Source: Field Survey (2023)

The study results summarized in **Table 7** are provided in **Appendix B (Table 10B, 11B, 12B, 20B, 21B and 22B)**.

The model used for testing the direct relationships between the constructs in AMOS is shown in **Figure 3**.

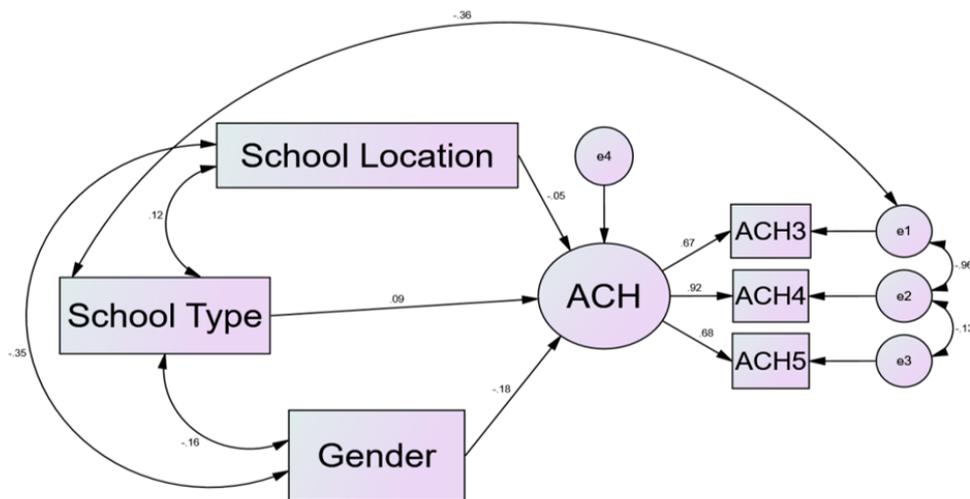


Figure 3. Structural paths (Field Survey, 2023)

Appendix B provides a detailed explanation of **Figure 3**.

Direct effects with interaction

A new model including interactions, moderators, and the independent variable was used to analyze the moderating effects of gender and school location on the effect of the independent variable, school type, on students' mathematics achievement. The result is presented in **Table 8** with the modification indices. The model indices evaluated to test fitness of the new model were

reported as; CMIN/DF was .920; CFI and TLI were 1.00 and 1.003 respectively. RMR and RMSEA were .015 and .000 respectively. P-Close was .899. This shows that the model passes the fitness test. The only direct effects on students' mathematics achievement in the path that were statistically significant were those related to gender and the interaction between school type and school location. It was an inverse relationship, though, between the product of school type and school location.

Table 8. Direct effects with interaction

Path	Std. estimate	C.R.
Gender → ACH	-.152	-1.133
School Location → ACH	.315	2.565*
School Type → ACH	.274	1.832
Gender * School Type → ACH	-.040	-.253
School Location * School Type → ACH	-.495	-3.624**

Model Fit Indices: CMIN = 6.442; DF = 7; CMIN/DF = .920; CFI = 1.00; TLI = 1.003; RMR = .015; RMSEA = .000; P-Close = .899

** ~ P-value significant at 1% (0.01)

* ~ P-value significant at 5% (0.05)

Source: Field Survey (2023)

The study results summarized in **Table 8** are provided in **Appendix B (Table 26B, 27B, 28B, 32B, 36B and 37B)**. The structural path showing the direct effect of the independent variables, moderators, and the interactions on perceive students' mathematics achievement is shown in **Figure 4**.

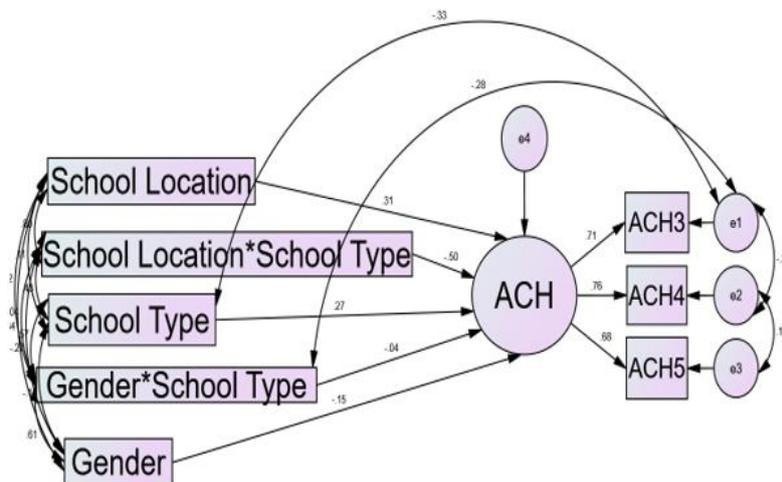


Figure 4. Structural paths with interactions (Field Survey, 2023)

The detailed explanation of **Figure 4** is provided in **Appendix B**.

The moderating effect of gender on the relationship between school type and students' mathematics achievement

To determine the moderation role of gender in the relationship between School Type and Students' Mathematics Achievement, the regression estimates of the independent variable, School Type, the moderator (Gender), and the interaction (Gender*School Type) on perceived students' mathematics achievement (ACH) presented in **Table 8** were used to plot a two-way interaction graph (see **Figure 5**).

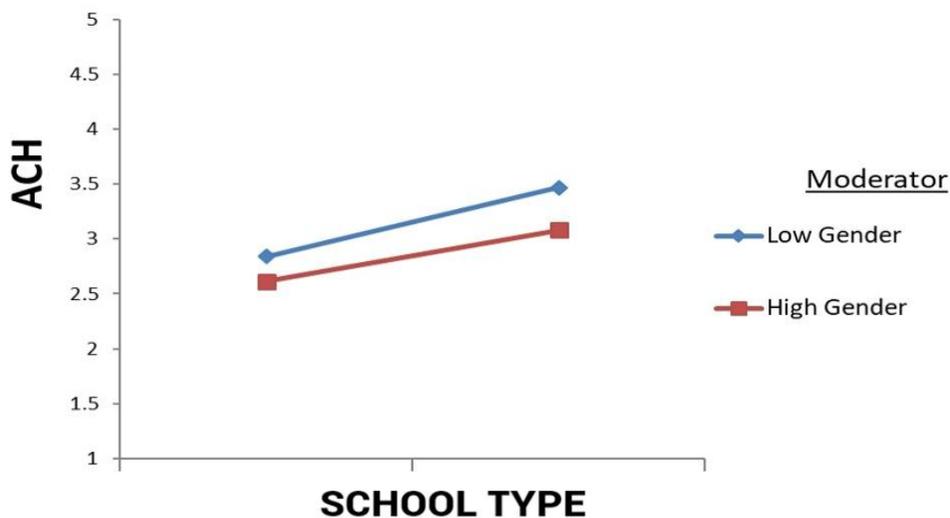


Figure 5. A two-way interaction plot of Gender on School Type and Students' Mathematics Achievement (Field Survey, 2023)

Figure 5 demonstrates that, the students' mathematics achievement of low gender (female) students in Public Schools is lower than that of students in Private Schools. Similarly, the Students' Mathematics Achievement of High Gender (male) students in Public Schools are lower than that of students in Private Schools. This means that both boy and girl students' mathematics achievement is higher for students in private schools as compared to those in public schools. The interaction impact of Gender on the effect that School Type has on Students' Mathematics Achievement is that it dampens the positive relationship between School Type and Students' Mathematics Achievement. The interpretation is that any positive relationship that exist between the Type of School of students and their mathematics achievement, that relationship is affected (reduced) by Gender (more females) of that school type (either private or public).

The data supporting **Figure 5** is provided in **Appendix B**.

The moderating effect of school location on the relationship between school type and students' mathematics achievement

In similar way, the moderation role of School setting on the relationship between School Type and Students' Mathematics Achievement was determined by plotting a two-way interaction plot for school location on the relationship between School Type and Students' Mathematics Achievement as presented in **Figure 6**.

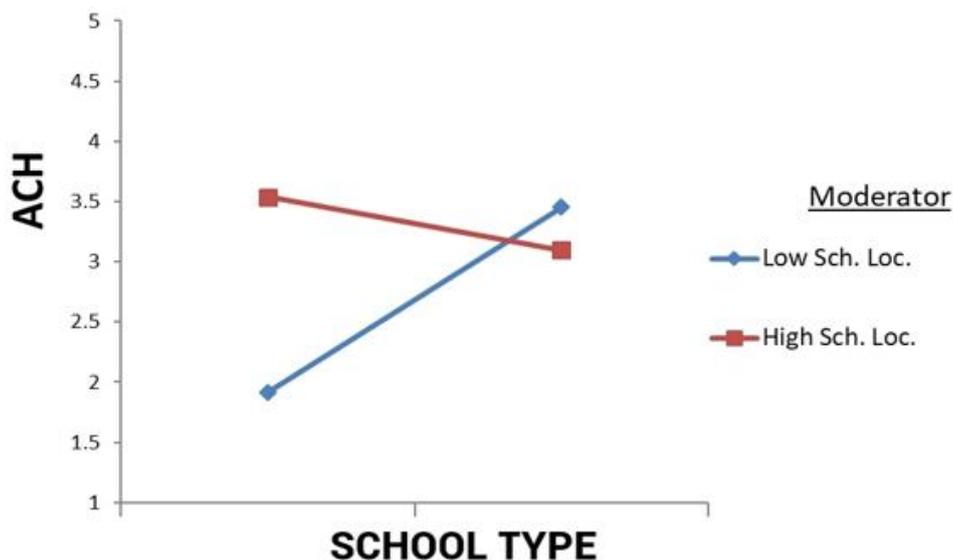


Figure 6. A two-way interaction plot of school location on school type and students' mathematics achievement (Field Survey, 2023)

The two-way interaction graph depicts that, the Students' Mathematics Achievement of Low school location (Schools in Rural Areas) students for Public Schools is lower than Private Schools students. However, the Students' Mathematics Achievement of High School Location (Schools in Urban Areas) students for Public Schools are higher than Private Schools students. The interactions effects of this relationship between public and private school students in Rural and Urban areas is that the location of a school (Rural or Urban Area) dampens the positive relationship between the type of school (Private or Public) and students' mathematics achievement. **Appendix B** provides the details for the outcome of the results.

DISCUSSION OF FINDINGS

The Relationship Between Gender, School Type and Students' Mathematics Achievement

Gender (therefore more female) dampens (reduces) the positive correlation between the kind of school and students' mathematics achievement, according to this study. Multiple studies have indicated that gender influences students' mathematics achievement. This conclusion is consistent with previous research (Baram-Tsabari & Yarden, 2011; Britner, 2008; Li et al., 2017), which demonstrated that students' gender had an influence on their arithmetic proficiency. Okyere (2019) discovered that male students do better in mathematics achievement tests than female students. This is also consistent with the findings of Pekrun and Zimgibl (2004) (cited in Preckel et al., 2008), who discovered that gender and mathematics achievement agree with the findings of Li et al. (2017), who discovered that significant gender gaps in mathematics achievement favoring male students exist in Chinese high schools. This is also consistent with the findings of Amoo (2013), Onuekwusi and Ogomaka (2013), and Osuji (1999), but differs from the findings of Kola and Taiwo (2013), who found no significant gap between boys and girls in mathematics achievement. The research findings also run counter to those of Nepal (2016) and Idris (2015), who found no significant gender differences in students' mathematics achievement.

The students' mathematics achievement in senior high schools, depending on school type, has been in favor of public senior high schools, which is quite the contrary when it comes to basic schools. This study also discovered that the type of school students attend has an influence on their mathematics achievement. Okyere (2019) discovered that the type of school attended had a substantial effect on the mathematics achievement of students in senior high schools. It was discovered that students from private

schools achieved the best on the mathematics test. The mission school students achieved more than local authority school students in Okyere's (2019) study when it came to their mathematics test scores. This study's findings are similarly compatible with those of Awofala (2017) and Howie and Plomps (2003). Hooda and Devi (2017) discovered that gender had a substantial impact on secondary school students' mathematics achievement. Akissani et al. (2019) discovered a substantial variation in students' mathematics achievement based on school location.

Gender (the predominance of females in public senior high schools) was shown to diminish the association between the type of school students attend and their mathematics achievement. Okyere (2019) discovered that the impact of gender on the relationship between school type and mathematics achievement was minor. Okyere (2019) discovered no interactional impact on students' mathematics achievement between school type and gender. This was viewed as having similar impacts on both boys and girls regarding self-assurance and mathematics achievement. This conclusion implied that school-related issues will affect both girls and boys equally. Okyere's (2019) conclusion and interpretation contradict the study's finding that female dominance dampens the relationship between school type and students' mathematics achievement. The lack of significant distinctions in the mathematics achievement of boy and girl students may be due, according to research by Akissani et al. (2019), to the interactions between boy and girl students in coeducational schools (school type). In this study, gender was employed as a moderating variable for school type and students' mathematics achievement.

The Relationship Between School Location, School Type and Students' Mathematics Achievement

The study found out that school location had significant effect on school type and students' mathematics achievement. According to the moderation study, utilizing school location as a moderator has a substantial influence on students' mathematics achievement. The two-way plot (shown in **Figure 6**) also demonstrated that school location dampens the relationship between school type and mathematics achievement of students. This is as a result of the evidence that students' attending private senior high schools in urban areas achieve less well in mathematics than students' attending private senior high schools in rural settings.

However, mathematics achievement among public senior high school students in urban settings is higher than their rural counterparts. This explains the reason a school's location dampens the relationship between school type and students' mathematics achievement. Other studies have shown a link between school location, school type, and students' mathematics achievement. Akissani et al. (2019) discovered that urban students fared more than rural students. Studies such as Amoo (2013), Igboegwu and Okonkwo (2012), Onuekwusi and Ogomaka (2013), and Owoeye (2002) confirmed this but contradict Kissau (2006) and Obioma (1985). The rationale behind this conclusion was that urban students receive superior instruction, better staffing, strong study habits, and a favorable learning environment than their rural counterparts, who receive inadequate staffing due to teachers turning down postings to rural schools. Most rural students are not exposed to good learning environments, strong instructional facilities, or good study habits, which was another contributing factor. Yara (2009) also claimed that urban students achieved more than rural students in mathematics and other fields. This study found that regardless of whether students attend a rural or urban school, their achievement in mathematics remains the same as long as a positive attitude is instilled.

The results of Ahiaba and Igweonwu (2003), Alordiah et al. (2015), and Nwogu (2010) whose studies showed the superiority of urban students, are consistent with the finding that school location has a significant positive relationship with students' mathematics achievement. However, it contrasts with the findings of Gana (1997) and Ntibi and Edoho (2017), who all found no significant difference in the mathematics achievement scores of students in urban and rural locations. Ntibi and Edoho (2017) found little evidence for Ibitoye's (2003) claimed that knowledge and achievement in mathematics are independent of geography, cultural affiliation, and family history. The current study's findings show that school location is particularly important since it dampens the relationship between school type and students' mathematics achievement.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Gender (therefore more female) was found to dampen the positive relationship between school type and students' mathematics achievement. However, its effect on school type and students' mathematics achievement was significantly negative. This is an indication that, if the gender characteristics of a mathematics classroom are not taken into consideration, the influence that the school environment may have on the outcome of the students' mathematics achievement might not be realized. The result of this study to the implication that the school factor or school type has a large effect on students' mathematics achievement. This indicates that the school environment may indirectly affect students' mathematics achievement. The negative insignificant relationship school location had on achievement of students' mathematics was found to dampen the positive relationship between school type and students' mathematics achievement. Thus, the mathematics achievement of students depending on their school type is influenced by the location in which the school is found (thus, either rural or urban). Based on the result from the analysis, it was concluded that:

1. The moderating effect of gender on the relationship between school type and students' mathematics achievement was that it dampens the positive relationship between school type and students' mathematics achievement
2. The location of a school (Rural or Urban Area) dampens the positive relationship between school type (Private or Public) and students' mathematics achievement.

Recommendations

The government and the Ministry of Education should consider the location when setting up a senior high school and bridge the social amenities and infrastructure gap that exists between the rural and urban schools to enhance the better mathematics achievement of all students in their final examinations, like the WASSCE. The management and authority of private schools should emulate the policy thrust of the Ghana Education Service by engaging education graduate teachers to teach at senior high schools. To make it easier for teachers and students to get to and from school, the communities surrounding senior high schools should help the government by supplying buses and taxis. It is imperative that all students, regardless of gender or level, receive equal opportunities and encouragement.

Limitations

The study was restricted to a single area, and that was the Ashanti region. All the country's senior high schools ought to be investigated for a more comprehensive report. Unfortunately, time and financial constraints prevented this from happening. The study did not address the opinions of all parties involved in the education sector because doing so would require a significant investment of time and funds. Due to their accessibility, the research was also restricted to second-cycle school students' only in the region of Ashanti. For this study, the researcher also had to juggle teaching and other obligations. Finally, the opportunity to respond to the research questionnaires was limited to a portion of students in second-cycle schools.

Contribution to Literature

Mathematics achievement is a critical aspect of students' academic goal, and various factors contribute to its variability. School type, location, and gender are among the factors that have been extensively studied. However, the moderating effect of school location and gender on the relationship between school type and students' mathematics achievement remain underexplored. Research suggests that school type (public or private) significantly influences the mathematics achievement of students. Private schools often achieve more than the public schools due to better resources and teaching quality. School location (urban or rural) also plays a role, with urban schools typically having an advantage. Gender differences in mathematics achievement have been reported, with some studies indicating males achieving better than their female counterparts. This study investigated the moderating effect of school location and gender on the relationship between school type and students' mathematics achievement. The findings revealed that gender (more females) were found to dampens the positive relationship between school type and students' mathematics achievement and the location of a school (Rural or Urban Area) dampens the positive relationship between school type (Private or Public) and students' mathematics achievement. The implication is that the location of a school and gender do have negative impact on the type of school and the mathematics achievement of students', and understanding this moderating effect can inform educational policies and interventions, and to also guide parents or guardians on measures to consider before enrolling their wards in schools.

In conclusion, this study contributes to literature by exploring the complex relationships between school type, location, gender and the mathematics achievement of students. The findings have implications for educational stakeholders seeking to improve the mathematics achievement of students' and also to target support for the public schools in rural areas or for female students in certain school types and to bridge the mathematics achievement gap among students in the various senior high schools in the Ashanti region of Ghana and the country a whole, and the global world. Further research could therefore be conducted using more variables to find out the factors responsible for the effect on school type and students' mathematics achievement.

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APPENDIX A

Students Questionnaire

Introduction

This research intends to investigate the moderating effect of school location and gender on the relationship between school type and students' mathematics achievement.

Kindly respond honestly and accurately to the questions listed below. Any information that you provide will be treated with utmost confidence and will not be used for any other purposes other than which pertain to this research. You don't need to indicate your name.

Thank you.

SECTION A: Background information

Please tick (✓) for your responses

1. Gender Male [] Female []

2. Age 10 - 15 [] 16 - 20 []
 21 and above []

3. Course General Arts [] Visual Arts []
 General Science [] Business []
 Home Economic [] Others []

4. School type Public School [] Private School []

5. School location Urban area [] Rural area []

SECTION B

Please tick (✓) in appropriate box for your responses using the following information based on the rated scales

Strongly Agree = SA; Agree = A; Neutral = N; Disagree = D; Strongly Disagree = SD

Table 1A. Students' mathematics achievement

S/N	Content Area	SA	A	N	D	SD
1.	I never get nervous during a mathematics test					
2.	I have a purpose in my life for learning mathematics					
3.	I feel secure while attempting maths					
4.	Mathematics doesn't scare me at all					
5.	Mathematics is interesting and enjoyable to me					
6.	When a question is left unanswered in maths class, I continue to think about it afterwards					
7.	It wouldn't bother me at all to take advanced maths courses					
8.	I do not enjoy learning maths					
9.	Being first in a mathematics competition would make me pleased					
10.	Even though I study hard, mathematics is difficult for me					

APPENDIX B

Table 1B. KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy		.716
Bartlett's test of sphericity	Approx. Chi-square	252.906
	df	3
	Sig.	.000

Table 2B. Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	1.902	63.403	63.403	1.902	63.403	63.403
2	.704	23.477	86.880			
3	.394	13.120	100.000			

Extraction method: Principal component analysis

Table 3B. Component matrix^a

	Component
	1
ACH3	.710
ACH4	.802
ACH5	.869

Extraction method: Principal component analysis; a. 1 components extracted

Estimates (Group Number 1 - Default Model)

Scalar estimates (group number 1 - default model)

Generalized least squares estimates

Table 4B. Reliability statistics

Cronbach's alpha	N of Items
.707	3

Table 8B. Correlations: Group number 1 - default model

		Estimate
School_Location_D	<-->	School_Type_D .116
School_Type_D	<-->	Gender_D -.159
ACH	<-->	Gender_D -.180
School_Location_D	<-->	Gender_D -.351
ACH	<-->	School_Type_D .110
ACH	<-->	School_Location_D .024
e1	<-->	School_Type_D -.363
e2	<-->	e3 -.053
e1	<-->	e2 -.885

Table 9B. Variances: Group number 1 - default model

	Estimate	S.E.	C.R.	P	Label
ACH	1.000				
School_Location_D	.235	.017	13.970	***	
School_Type_D	.218	.016	14.015	***	
Gender_D	.228	.016	14.088	***	
e1	.960	.322	2.986	.003	
e2	.304	.849	.359	.720	
e3	.930	.316	2.940	.003	

Table 5B. Regression weights: Group number 1 - default model

		Estimate	S.E.	C.R.	P	Label
ACH3	<--- ACH	.860	.193	4.450	***	
ACH4	<--- ACH	1.185	.362	3.275	.001	
ACH5	<--- ACH	.860	.189	4.541	***	

Table 6B. Standardized regression weights: Group number 1 - default model

		Estimate
ACH3	<--- ACH	.659
ACH4	<--- ACH	.906
ACH5	<--- ACH	.665

Table 7B. Covariances: Group number 1 - default model

		Estimate	S.E.	C.R.	P	Label
School_Location_D	<--> School_Type_D	.026	.011	2.372	.018	
School_Type_D	<--> Gender_D	-.035	.011	-3.114	.002	
ACH	<--> Gender_D	-.086	.030	-2.886	.004	
School_Location_D	<--> Gender_D	-.081	.012	-6.549	***	
ACH	<--> School_Type_D	.051	.029	1.795	.073	
ACH	<--> School_Location_D	.012	.025	.467	.641	
e1	<--> School_Type_D	-.166	.033	-5.021	***	
e2	<--> e3	-.028	.435	-.065	.948	
e1	<--> e2	-.479	.328	-1.460	.144	

Model fit summary**Table 10B.** CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	18	5.217	3	.157	1.739
Saturated model	21	.000	0	***	***
Independence model	6	202.711	15	.000	13.514
Zero model	0	1191.000	21	.000	56.714

Table 11B. RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.015	.996	.969	.142
Saturated model	.000	1.000	***	***
Independence model	.442	.830	.762	.593
Zero model	.717	.000	.000	.000

Table 12B. Baseline comparison

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.974	.871	.989	.941	.988
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 13B. Parsimony-adjusted measures

Model	PRATIO	PNFI	PCFI
Default model	.200	.195	.198
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

Table 14B. NCP

Model	NCP	LO 90	HI 90
Default model	2.217	.000	12.771
Saturated model	.000	.000	.000
Independence model	187.711	145.414	237.458

Table 15B. FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.013	.006	.000	.032
Saturated model	.000	.000	.000	.000
Independence model	.511	.473	.366	.598

Table 16B. RMSEA

Model	FMIN	F0	LO 90	HI 90
Default model	.013	.006	.000	.032
Saturated model	.000	.000	.000	.000
Independence model	.511	.473	.366	.598

Table 17B. AIC

Model	AIC	BCC	BIC	CAIC
Default model	41.217	41.863	112.973	130.973
Saturated model	42.000	42.754	125.715	146.715
Independence model	214.711	214.927	238.630	244.630
Zero model	1191.000	1191.000	1191.000	1191.000

Model fit summary**Table 18B.** ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.104	.098	.130	.105
Saturated model	.106	.106	.106	.108
Independence model	.541	.434	.666	.541
Zero model	3.000	2.724	3.294	3.000

Table 19B. HOELTER

Model	HOELTER .05	HOELTER .01
Default model	595	864
Independence model	49	60
Zero model	11	13

Table 20B. RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.043	.000	.104	.486
Independence model	.178	.156	.200	.000

Estimates (Group Number 1 - Default Model)**Scalar estimates (group number 1 - default model)****Generalized least squares estimates****Table 21B.** Regression weights: Group number 1 - default model

			Estimate	S.E.	C.R.	P	Label
ACH	<-->	School_Type_D	.160	.120	1.331	.183	
ACH	<-->	School_Location_D	-.089	.100	-.892	.372	
ACH	<-->	Gender_D	-.331	.141	-2.350	.019	
ACH3	<-->	ACH	1.000	***	***	***	
ACH4	<-->	ACH	1.378	.584	2.358	.018	
ACH5	<-->	ACH	1.000	.427	2.341	.019	

Table 22B. Standardized regression weights: Group number 1 - default model

				Estimate
ACH	<-->	School_Type_D		.085
ACH	<-->	School_Location_D		-.050
ACH	<-->	Gender_D		-.181
ACH3	<-->	ACH		.671
ACH4	<-->	ACH		.923
ACH5	<-->	ACH		.677

Table 23B. Covariances: Group number 1 - default model

			Estimate	S.E.	C.R.	P	Label
School_Location_D	<-->	School_Type_D	.026	.011	2.372	.018	
School_Type_D	<-->	Gender_D	-.035	.011	-3.114	.002	
School_Location_D	<-->	Gender_D	-.081	.012	-6.549	***	
e2	<-->	e3	-.065	.443	-.146	.884	
e1	<-->	e2	-.479	.328	-1.460	.144	
e1	<-->	School_Type_D	-.166	.033	-5.021	***	

Table 24B. Correlations: Group number 1 - default model

			Estimate
School_Location_D	<-->	School_Type_D	.116
School_Type_D	<-->	Gender_D	-.159
School_Location_D	<-->	Gender_D	-.351
e2	<-->	e3	-.135
e1	<-->	e2	-.955
e1	<-->	School_Type_D	-.358

Table 25B. Variances: Group number 1 - default model

	Estimate	S.E.	C.R.	P	Label
School_Location_D	.235	.017	13.970	***	
School_Type_D	.218	.016	14.015	***	
Gender_D	.228	.016	14.088	***	
e4	.735	.327	2.246	.025	
e1	.987	.312	3.158	.002	
e2	.254	.865	.294	.769	
e3	.904	.327	2.761	.006	

Model fit summary**Table 26B.** CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	29	6.442	7	.489	.920
Saturated model	36	.000	0	***	***
Independence model	8	743.737	28	.000	26.562
Zero model	0	1588.000	36	.000	44.111

Table 27B. RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.015	.996	.979	.194
Saturated model	.000	1.000	***	***
Independence model	.346	.532	.398	.414
Zero model	.553	.000	.000	.000

Table 28B. Baseline comparison

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.991	.965	1.001	1.003	1.000
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 29B. Parsimony-adjusted measures

Model	PRATIO	PNFI	PCFI
Default model	.250	.248	.250
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

Table 30B. NCP

Model	NCP	LO 90	HI 90
Default model	.000	.000	9.573
Saturated model	.000	.000	.000
Independence model	715.737	630.536	808.349

Table 31B. FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.016	.000	.000	.024
Saturated model	.000	.000	.000	.000
Independence model	1.873	1.803	1.588	2.036

Table 32B. RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.000	.000	.059	.899
Independence model	.254	.238	.270	.000

Table 33B. AIC

Model	AIC	BCC	BIC	CAIC
Default model	64.442	65.787	180.049	209.049
Saturated model	72.000	73.670	215.512	251.512
Independence model	759.737	760.108	791.629	799.629
Zero model	1588.000	1588.000	1588.000	1588.000

Table 34B. ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.162	.164	.188	.166
Saturated model	.181	.181	.181	.186
Independence model	1.914	1.699	2.147	1.915
Zero model	4.000	3.681	4.338	4.000

Table 35B. HOELTER

Model	HOELTER .05	HOELTER .01
Default model	867	1139
Independence model	23	26
Zero model	13	15

Estimates (Group Number 1 - Default Model)

Scalar estimates (group number 1 - default model)

Generalized least squares estimates

Table 36B. Regression weights: Group number 1 - default model

			Estimate	S.E.	C.R.	P	Label
ACH	<--	Gender_D	-.315	.278	-1.133	.257	
ACH	<--	School_Location_D	.640	.250	2.565	.010	
ACH	<--	School_Type_D	.585	.319	1.832	.067	
ACH	<--	Gender_School_Type	-.081	.319	-.253	.800	
ACH	<--	SchoolLocation_SchoolType	-1.082	.299	-3.624	***	
ACH3	<--	ACH	.937	.224	4.190	***	
ACH4	<--	ACH	1.000	***	***	***	
ACH5	<--	ACH	.894	.173	5.153	***	

Table 37B. Standardized regression weights: Group number 1 - default model

			Estimate
ACH	<--	Gender_D	-.152
ACH	<--	School_Location_D	.315
ACH	<--	School_Type_D	.274
ACH	<--	Gender_School_Type	-.040
ACH	<--	SchoolLocation_SchoolType	-.495
ACH3	<--	ACH	.708
ACH4	<--	ACH	.757
ACH5	<--	ACH	.681

Table 38B. Covariances: Group number 1 - default model

			Estimate	S.E.	C.R.	P	Label
Gender_D	<-->	School_Location_D	-.080	.012	-6.453	***	
Gender_D	<-->	SchoolLocation_SchoolType	-.058	.011	-5.168	***	
School_Location_D	<-->	Gender_School_Type	-.029	.012	-2.433	.015	School_Location_D
School_Type_D	<-->	SchoolLocation_SchoolType	.091	.011	8.040	***	School_Type_D
School_Location_D	<-->	SchoolLocation_SchoolType	.175	.014	12.309	***	School_Location_D
Gender_School_Type	<-->	SchoolLocation_SchoolType	.010	.011	.895	.371	Gender_School_Type
School_Location_D	<-->	School_Type_D	.026	.011	2.328	.020	School_Location_D
School_Type_D	<-->	Gender_School_Type	.129	.013	9.819	***	School_Type_D
Gender_D	<-->	School_Type_D	-.033	.011	-3.000	.003	Gender_D
Gender_D	<-->	Gender_School_Type	.143	.014	10.524	***	Gender_D
e1	<-->	e2	-.286	.176	-1.629	.103	e1
e1	<-->	School_Type_D	-.154	.031	-5.025	***	e1
e2	<-->	e3	.124	.211	.587	.557	e2
e1	<-->	Gender_School_Type	-.135	.029	-4.683	***	e1

Table 39B. Correlations: Group number 1 - default model

			Estimate
Gender_D	<-->	School_Location_D	-.345
Gender_D	<-->	SchoolLocation_SchoolType	-.271
School_Location_D	<-->	Gender_School_Type	-.121
School_Type_D	<-->	SchoolLocation_SchoolType	.434
School_Location_D	<-->	SchoolLocation_SchoolType	.801
Gender_School_Type	<-->	SchoolLocation_SchoolType	.044
School_Location_D	<-->	School_Type_D	.115
School_Type_D	<-->	Gender_School_Type	.568
Gender_D	<-->	School_Type_D	-.150
Gender_D	<-->	Gender_School_Type	.612
e1	<-->	e2	-.336
e1	<-->	School_Type_D	-.334
e2	<-->	e3	.153
e1	<-->	Gender_School_Type	-.275

Table 40B. Variances: Group number 1 - default model

	Estimate	S.E.	C.R.	P	Label
Gender_D	.227	.016	14.067	***	
School_Location_D	.235	.017	13.964	***	
School_Type_D	.214	.015	14.140	***	
Gender_School_Type	.241	.017	14.215	***	
SchoolLocation_SchoolType	.204	.015	13.900	***	
e4	.876	.376	2.327	.020	
e1	1.000	***	***	***	
e2	.726	.385	1.885	.059	
e3	.900	.131	6.888	***	