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SENIOR HIGH SCHOOL ELECTIVE MATHEMATICS STUDENTS' READINESS TO PURSUE ADVANCED MATHEMATICS AT THE UNIVERSITY LEVEL

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ABSTRACT: *This study primarily focused on senior high school students' readiness to pursue advanced mathematics at the university level. Data for the study was obtained from 317 senior high school students from three public senior high schools in the Cape Coast Metropolis in the Central Region of Ghana. The 317 students were final year elective mathematics students made up of 196 females and 121 males. Data for the study was collected through the use of questionnaires. The study adopted the descriptive survey as the main design and data collected was analyzed using simple graphs, percentages, descriptive and inferential statistics. Analysis of data revealed that students were ready to pursue advanced mathematics at the university level. Findings also revealed that there was no statistically significant difference based on gender. Also, no statistically significant difference was observed between single-sex female school students and that of mixed school students as well as that of single-sex male school and co-educational school students. However, a statistically significant difference was realized between single-sex female and single-sex male school students. Findings indicated that majority of the students reported to have come from a very good socio-economic backgrounds, which seems to have influenced their readiness to pursue advanced mathematics. The findings affirmed students' perceived positive readiness towards their interest in doing mathematics, competence in doing mathematics, school environment/culture, relevance of mathematics, and nature of mathematics. The implication of these findings is that senior high school students are well prepared and ever ready to pursue advanced mathematics. It also presupposes that much more students are willing to go into the sciences which would end up raising the productivity of the country.*

KEYWORDS: readiness, advanced mathematics, single-sex male, single-sex, female, co-educational, competence, socio-economic background

INTRODUCTION AND STATEMENT OF THE PROBLEM

The persistent decline in mathematics performance of students who transition into college is a phenomenon that continues to be global. For instance, plethora of studies in the United States have shown that many high school graduates, particularly ethnic minorities students, are academically under prepared for college mathematics and science courses (ACT, 2008). Green and Winter (2005) reported in a study that only 34% of 2002 graduating high school students had acquired the necessary skills for college-level work, and "only 23% of African-American students and 20% of Hispanic students left school college ready, compared with 40% of White students" (p. 7). In a similar study, the ACT (2008) calculated the benchmark of four score areas to determine the academic readiness of students by ethnicity. In Pennsylvania, the study found that 36% of White students met the ACT college readiness benchmark compared to 46% Asians, 20% Hispanics, and 5% Africa-American students. Factors associated with mathematics skill deficiency have been widely studied. Lewis (1998) acknowledged that many students are admitted to universities with low mathematics skills. More rigorous high school mathematics curriculum continues to show positive outcomes for student success in college mathematics courses, as well as overall college graduation rates. However, not all students, particularly underrepresented minorities attend high schools with equally rigorous mathematics curriculum. Yet many colleges use high school mathematics completion as a predictor for success in college. Although some entering college or university students may have completed similar levels of mathematics in their respective high schools, the rigorousness of the curriculum in each school may not be the same due to various factors such as the location and district of the high school, the quality of instruction received by students, and the pedigree of high school teachers. Students who did not attend high quality high schools may not have the opportunity to take advanced-level courses and typically are not ready for college-level mathematics (Boylan, 1995; Sterling, 2004). For such students, their needs for developmental-level mathematics become paramount at the college level.

Students' readiness to pursue advanced studies has been a hot topic for the last two decades. In the twenty-first century, more careers demand qualified employees hence more students seek higher education. However, a large number of first-year students are not prepared for college-level course work and University courses, specifically in mathematics (Bahr 2013; Bonham & Boylan 2012; Hoyt & Sorensen 2001; McCormick & Lucas 2011). Information gathered from the Colleges of Education Weekly Journal (2019), indicates that about four hundred and sixty (460) level 100 trainee teachers across the forty-six Colleges of Education in Ghana would be withdrawn for abysmal performance in the first year of the 4-year Bachelor of Education programme of which mathematics forms part. Similar cases had happened in our Universities, especially mathematics department, a lot of first years failed mathematics courses to the extent

that they could not continue the program. One may associate this to the inadequate preparation by students to study advanced mathematics at these levels. For instance, in the year 2014, University of Cape Coast admitted almost 300 first year students into the Bachelor of Education in Mathematics but at the end of the first year less than 200 students proceeded to the next level. Most of these people who stopped at the end of the first year re-applied into different programs. One may ask, were these students fully prepared to study mathematics at these higher levels? It is in the light of this that the current study sought to investigate the readiness of Senior High School[SHS] students to pursue advanced mathematics at the university level.

Conceptual Framework

A conceptual framework of the readiness of SHS students to pursue advanced mathematics at the University (Figure 1) was proposed and used to examine the data in the study.

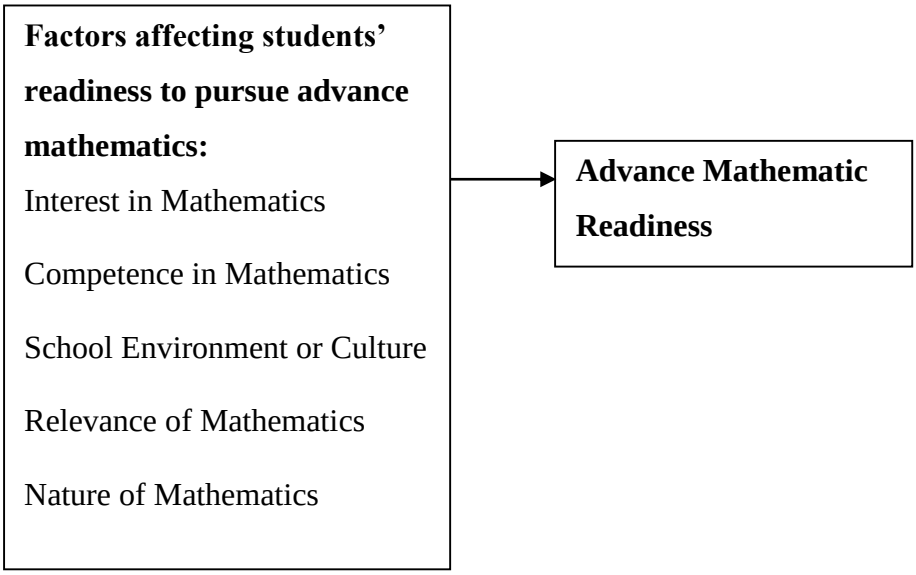

Figure 1: Conceptual framework of the study

The left of the model consists of factors affecting the readiness of SHS Students to pursue advanced Mathematics with the sub-categories: Interest in Mathematics, Competence in Mathematics, School Environment/Culture, Relevance of Mathematics, and Nature of Mathematics. The right side of the model labelled Advanced Mathematics Readiness is the output of the factors through the processes of data collection and analysis using questionnaires. The final output can determine the extent of students' readiness.

What is Mathematics Readiness?

Readiness to pursue advance study is a pivotal issue to several important groups. Senior High School teachers have heightened interest because as key players in a student's final preparation

prior to college and university, they are more likely to be held responsible when students graduate without skills necessary for post-secondary education.

A study on investigating children's readiness in Mathematics was conducted by Lee, Autry, Fox, and Williams (2011). According to them their findings indicated that children's Mathematics readiness depended not only on their demographic variables and pre-kindergarten experience, but also on their growth and development in all domains (e.g., language, social, physical, and emotional developmental domains) and their social/cultural context.

In the United States, a large number of students graduate high school unprepared for post-secondary education and ill-equipped for the labour force of the 21st century. Research on college readiness reveals the prominent role that mathematics preparedness plays in the fulfilment of hopes and dreams for a college degree. As requirements for post-secondary education and qualifications for the workforce merge, college readiness in mathematics is a significant factor in job opportunities and career choices. This calls for advancement in mathematics preparedness in the education of today's high school students (McCormick & Lucas, 2011).

Factors affecting the Readiness of SHS Students

Based on the numerous literature reviewed, the current study was guided to focus on these five factors considered to influence the readiness of SHS students to pursue advanced mathematics at the university level. These factors are discussed below:

Competence in Mathematics as a Factor

Factors associated with mathematics skill deficiency have been widely studied. Lewis (1998) acknowledged that many students are admitted to universities with low mathematics skills. More rigorous high school math curriculum continues to show positive outcomes for student success in college math courses, as well as overall college graduation rates. However, not all students, particularly underrepresented minorities attend high schools with equally rigorous math curriculum. The widening academic preparation and achievement gap between ethnic minorities and White students has been attributed among other factors to socioeconomic status of high school district and the quality of education students received (Sterling, 2004).

Mathematics readiness affects college admission and acceptance to many degree programs. Although many public two-year institutions of higher education have an open-door policy for admission, students often find they are denied access or have limited opportunities for enrolment in some four-year institutions or universities based on a lack of readiness for college-level mathematics (Huebner & Corbett, 2008). Even when admitted to higher education institutions, a deficit in a student's preparation in mathematics often limits choices of college majors and careers. In addition, there is a strong correlation between preparedness for college mathematics

and the actual completion of a college degree. Students who need remediation in mathematics are considered at risk for academic success and for retention and perseverance in their post-secondary education (Ali & Jenkins, 2002).

Students enter college underprepared in math for a number of reasons some did not take enough math in high school; some did not take the math they need for their college degree program; some did not master the math they took in high school; and/or some forgot the math they learned in high school (Fike & Fike, 2012). Additionally, students may feel frustrated or may struggle in their first math course in college because college placement exams are imperfect indicators of academic readiness; the exams misplace some students who are prepared for college math coursework into math remediation and misplace others who need additional support with basic math concepts into college-level coursework (Scott-Clayton, Crosta, & Belfield, 2012).

Corbishley and Truxaw (2010) surveyed 22 college mathematics instructors and concluded that those instructors perceived that first-year students were not ready for college mathematics. Another noticed was significant result that 'mathematical topics considered important for entering college by students mostly were often associated with perceptions of inadequate skills'(p.81). Therefore, based on the explanations stated above, a need to explore the perspectives of current college mathematics faculty regarding college readiness has emerged as a majority of the states have adopted and initiated the implementation of the Common Core State Standards (CCSS). Studies reveal a considerable misalignment between students expectations in relation to the secondary education and higher education (Abraham et al. 2014; Long, Iatarola, & Conger, 2009; McCormick & Lucas 2011). Merisotis and Phipps' (2000) study emphasizes the need for 'aligning high school requirements and course content with college competency and content expectations' (p. 80).

Interest in mathematics as a factor

In order to prepare new curriculum materials, to be used to enhance students' beliefs about the relevance of mathematics, we needed to set the mathematics in contexts that appeal to students with all kinds of interests. It was not likely that one context would appeal to all students. Students differed in many ways: e.g. their readiness to learn, styles of learning, their experiences but also their interests (Tomlinson, 2000). In their literature two types of interest have been identified as crucial: Personal interest, activated internally; and situational interest, environmentally activated and important in catching students' attention (Schraw, Flowerday, & Lehman, 2001). One of the strategies described by Schraw et al. (2001) to increase situational interest was offering students meaningful choices. The positive connection between choice and interest is widely recognized (Flowerday & Schraw, 2000), and can also be derived from the self-determination theory (Deci, Vallerand, Pelletier, & Ryan, 1991). The concept of offering choices did not guarantee a connection with students' interests. The offered options students could choose from had to be

meaningful to them if they were to be relevant to students' personal interests and goals, not too numerous or complex, yet not too easy, and they should be congruent with the values of the students' social background (Katz & Assor, 2007). There are number of students who most at times indicate that their programme are not at times challenging and according to Bean and Eaton (2000, p. 57) such students will revert to avoidance behaviour such as not going to class, not studying or doing poorly academically. These and other reasons were indicated by students during the interviews as the effect of the problem on their studies which eventually led to the students withdrawing from their studies (Bean & Eaton, 2000).

School environment as a factor

The sufficient evidence within and out of Ghana have showed that a number of students indicated insufficient interaction between lecturer(s) and the students. According to Bean (1980, 2005) the lack of substantial interaction decreases the subsequent commitment to the institution and influences students' decisions to withdraw. When academic staff is not supportive, the institution is perceived to be unsupportive and this leads to withdrawal behaviour as seen in this sample and in the literature (Bean, 2005). It is also in the school environment or culture that student in Senior Highs in our Ghanaian context receive guidance and counselling services as to which advance mathematics course they will pursue at the university. Readiness for university education fits within the broad and encompassing field of student retention and success. The most basic model to explain this framework is from Astin's (1970) model of student development which indicates three distinct components of a higher education institution, namely Input – Environment – Output. The inputs refer to the abilities, skills and expectations that students bring with them to the university. The inputs that Astin refers to are associated with the elements of readiness for university education as explained by Conley (2007).

The environment refers to all the elements of the institution that influences the learning experiences of students. According to Wend (2006), the student learning experience can be defined as the variety of experiences within the sphere of the University's responsibility that students come in contact with and which influences learning. The student learning experience is therefore all-embracing and includes matters such as curricula, methods of teaching, learning and assessment, learning environment and resources, student progress and achievement, and academic and pastoral support. Student outputs refer to the outcomes that institutions wish to influence, such as academic achievement, skills and attributes (Astin, 1970; Camara, 2005a). Academic success consists of many facets, such as knowledge and skills, motivation, leadership, communication and team work (Camara, 2005a).

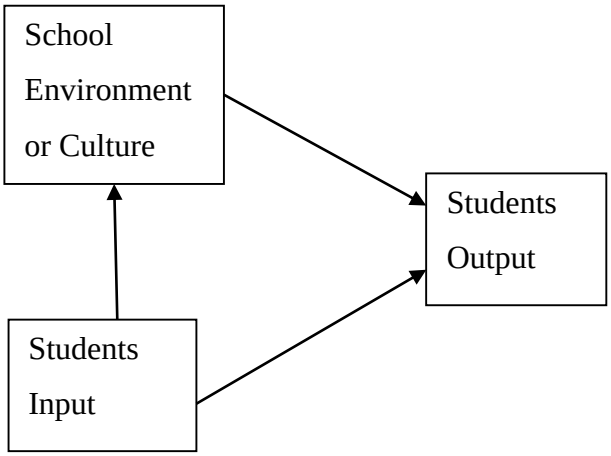

Figure 2: Adapted from Astin's model of student development (1970, p. 225)

Relevance of Mathematics as a factor

Previous studies on students' perceptions about the relevance of mathematics in general and for their own future study and career have been conducted predominantly with the aim to develop understandings of the perceived relationship with the mathematical performance of students in general (e.g. Farooq & Shah, 2008; Schoenfeld, 1989), or to explain gender differences (Meece, Wigfield, & Eccles, 1990). From these studies, it became clear that failing to see the relevance of mathematics was not only related to a negative attitude of students towards mathematics. Moreover, also motivated students questioned the relevance of mathematics. Hence, these studies showed that many students, and not just the disaffected ones, failed to see the relevance of mathematics and how it would be used in their individual lives (Musto, 2008).

Furthermore, Addae and Agyei (2018) conducted a survey to explore 210 SHS students' attitudes towards the study of mathematics and their perceptions on their teacher' teaching practices. Addae and Agyei found and reported that the overall attitudes (M = 4.01, SD = .89) of the students was highly positive, confirming the readiness of the SHS students towards the study of mathematics. They further established and reported that their findings revealed high perceived attitudes recorded in students' interest in doing mathematics (M = 4.13, SD = .87), usefulness of mathematics (M = 4.06, SD = .82), and confidence in doing mathematics (M = 4.49, SD = .89). They, however, found that SHS students were indecisive on perceiving mathematics as a male domain (M = 3.01, SD = 1.26) subject. In this current study, the researchers identified the factors explored by Addae and Agyei: "interest in doing mathematics", "usefulness of mathematics", and "confidence in doing mathematics" as "interest in mathematics", "relevance of mathematics", and "competence in mathematics" respectively.

Nature of Mathematics as a Factor

Mathematics is a unique subject and it is key part of the school system in Ghana. Knowingly or unknowingly, we are using mathematics in every facets of life. However, majority of students in Ghana and across the world dislike mathematics mostly due to its nature. One is likely to be confronted with student with statements such as; learning mathematics involves a lot of memorisation of facts difficult to grasp, Mathematics concepts are meaningless and not related to life, Mathematics reveals hidden patterns that help us understand the world around us, and Mathematics is primarily an abstract subject.

Scarpello (2007) reports that seventy-five percent of Americans stop the study of mathematics and stay away from many careers that related to mathematics. He identified mathematics anxiety (what the student can and cannot) as one of the main reason for this. Many college students suffer an increase in mathematics anxiety from when they were high school students. Perry (2004) claims math anxiety is "an extremely common phenomenon" (p. 321) in today's college mathematics classroom and cites the most common causes of math anxiety to include lack of preparation and fears of failure. Math anxiety can range from moderate to severe and is defined by Krantz (1999) as an inability by an otherwise intelligent person to cope with quantification, and more generally, mathematics. Math anxiety exists before students get to college but seems to become more intense in the college classroom.

Male and Female Students' Readiness to Study Advance Mathematics

In this study, the researchers use rich administrative data on three high schools comprising of single-sex male, single-sex female mixed-school students, hence, leading to the important role gender play to the work. The gender gap in the possibility of enrolling into courses especially in advance mathematics at the university level need to be studied. Dooley, Payne and Robb (2012) have shown that although not all students who enter a STEM program will graduate with a Science, Technology, Engineering and Mathematics (STEM) degree, attrition rates from STEM programme appears to be the same for both male and females. Moreover, most programmes have rigorous multi-year course sequence so students who do not enrolled into a STEM programme have little chance of graduating with a STEM degree. According to Kobrin, 2007; Long, Iatarola, and Conger, 2009 (as cited in McCormick & Lucas, 2011) in their studies revealed that female students are less likely to be prepared for college-level mathematics than their male counterparts.

According to Lee, Burkam, Chow-Hoy, Smerdon, and Geverdt, (1998) (as cited in Atuahene & Russel, 2016), found that Black and Hispanic students, low-income students, female students, and students who received lower grades in earlier math courses did not progress into more intensive math courses in high school as often as their counterparts who performed well academically (p. 14). The researchers argue that a constrained curriculum is more advantageous

to students than having a high school curriculum that offers a wide array of math courses. This wide math distribution unknowingly set the students up for later slow math progression.

Mathematics Readiness of SHS students based on School Types

Several studies have shown that some students are completing high school mathematics courses assuming that those courses are comparable to similar courses offered to other students in different schools. Missing from this data are comparison studies focusing on students' high school math completion and other high school background information, including the percentage of students considered math proficient and/or economically disadvantaged at each of the high schools and how that relates to remedial course completion in college. Students from low socioeconomic backgrounds tend to complete vocational curriculum more often than college-level curriculum (Atuahene & Russel, 2016).

Studies by May and Chubin (2003); Tyson, Lee, Borman, and Hanson (2007); and Perna, Lundy-Wagner, Drezner, Gasman, Yoon, Bose, and Gary (2009) (as cited in Atuahene & Russel, 2016) reported that students are more likely to attend high schools that do not offer advanced math and science courses, supporting the need for more federally structured high school curriculum requirements (p. 13). More so, some of these students attend high schools that offer vocational and technical training for easy entry into the job market. However, although vocational and technical curriculum are helpful with addressing high school students' career interests, most of these schools lack rigorous curriculum that academically prepares students for college-level work.

Lynch, Peters-Burton, and Ford (2014) have conducted detailed qualitative studies of eight exemplary Inclusive STEM High Schools (ISHSs) with high graduation and college admission rates and found that these schools provide students with a strong college preparatory core of STEM courses and emphasize the integration of STEM disciplines and real-world applications. Qualitative research by Eisenhart et al. (2015), on the other hand, describes urban schools that have taken on a STEM label without really offering students a STEM-rich programme of study (and therefore would not meet the definition of an ISHS used here). Both studies were descriptive in nature; while the first studied STEM schools of choice, the second examined neighbourhood schools that had been converted to academies, including one or more focused on STEM. Neither study was designed to disentangle the influences of student self-selection into STEM schools from the effects of school experiences per se.

Generally speaking, students who are academically and socially under-prepared for the challenges of the university are usually unable to make the transition to university and withdraw from their studies, irrespective of ability. These students are more frequently from under-resourced schools where students are frequently taught to use superficial learning strategies (Astin, 1975; Jones et

al., 2008). According to Jones et al. (2008), the quality of the high school is highly related to the academic preparedness of students.

Purpose of the Study

The focus of this study is to investigate into the factors that determine the readiness of senior high school students to pursue advanced mathematics at the university level. It also sought to determine if there exist any significant differences between students' readiness to pursue advanced mathematics based on their profile variables.

Research Question / Hypotheses

1. What factors determine the readiness of Senior High School students to pursue advanced mathematics at the university level?
2. There is no significant difference between gender and Senior High School student`s readiness to pursue advance Mathematics at the University.
3. There is no significant difference between the readiness of senior high school students to pursue advanced mathematics at the University level based on school-type.

Design and Instrumentation

The research design employed in this study was the descriptive survey design. This is because primarily the study sought to find readiness of SHS students to pursue advanced mathematics at the university level. This design was necessary because according to Cresswell (2012) it is one design in which the investigator administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviours, or characteristics of the subjects involved. The survey conducted in this study used a standard set of questions to get a broad overview of the group's readiness, demographic and background information (Onley & Barnes, 2008). Descriptive survey design enjoys the strength of explaining educational phenomena in terms of the conditions or relationships that exist, opinions that are held by students, teachers, parents and experts (Cresswell, 2012).

The data used for analysis was obtained through the use of a questionnaire. The questionnaire was used to illicit responses from students concerning their readiness to pursue advanced mathematics at the university level. The questionnaire consisted of 46 items grouped under two sections, A and B. Section A solicited information about the background of respondents. The items in section B solicited information in reference to the factors that determine students' readiness to read mathematics at the university. The section B had been grouped under five subscales to solicit information on the following: *interest in mathematics, competence in mathematics, school environment/culture, relevance of mathematics, and nature of mathematics* as perceived by the respondents. Likert scale was found to be the most popular in the literature on students' readiness

reviewed. In the light of this, Likert scale was used for this study. With the Likert scale, respondents are requested to say or indicate whether they strongly disagree (SD), disagree (D), neutral (N), agree (A), or strongly agree (SA) with statements as indications of their readiness toward objects, people, situation or inquiry.

Selection of participants

The primary purpose of the study was to investigate senior high school students' readiness to pursue advanced mathematics at the university level. As a result, the study purposively selected senior high school students pursuing elective(advance) mathematics in different programmes within the Cape Coast Metropolis in the Central Region of Ghana. The study comprised 317 students sampled from three selected SHSs. The 317 students comprise of 74, 182, and 61 single-sex male school students, single-sex female school students and mixed school students respectively. The respondents were drawn from their respective intact classes according to their programmes of studies: General Science (170 students), General Arts (96 students), Visual Arts (9 students) and Business (42 students).

The target population for the study was all SHS elective mathematics students in the Cape Coast Metropolis. However, the accessible population was all elective mathematics students of the schools involved in the study. The study employed the multi-stage sampling technique to obtain both the schools and the respondents who participated in the study. The Convenience, Purposive, and sampling techniques were used in selecting the schools, programmes and participants for the study.

Validity and Reliability of Instrument

The phenomenon of interests in this study was to investigate senior high school students' readiness to pursue advanced mathematics at the university level. The face and construct validities of the instruments were ascertained by colleagues in the area of mathematics education who are also experts in developing questionnaires, at the Department of Mathematics and ICT Education, University of Cape Coast and a peer review team. Their suggestions were adhered to before the final questionnaire development. Cronbach alpha reliability test conducted on the forty Likert scale question items yielded an alpha value of 0.906. The individual subscales as reported in this study also recorded the following Cronbach alpha reliability coefficient values: Interest in mathematics ($\alpha = 0.808$), Competence in mathematics ($\alpha = 0.880$), Relevance of mathematics ($\alpha = 0.739$), Nature of mathematics ($\alpha = 0.669$) and School environment/culture ($\alpha = 0.657$). The overall value of 0.906 is very good internal consistency reliability for the scale with the samples used in this study as argued by Pallant (2016).

Data Collection Procedure

To ensure high response rate of the items on the instrument administered as well as confidentiality, names of students who participated in the study were not recorded on the instrument. An initial visit was paid to the schools as well as the students, which were finally involved in the research. During the visit, audience was sought from heads of the schools as well as students who were going to be involved in the study. At the meeting, the purpose of the study, its duration, and potential benefits were explained to the heads and teachers as well as all other participants for their consent to participate in the study and also allow the study to take place in their respective schools. Also, at these meetings, decisions about dates and times for the administration of the instrument were taken.

Altogether, administration of these instruments lasted for six working days as two days were assigned to each school. In each school, questionnaires were administered to the participating students in their respective classrooms after the close of classes so as not to disrupt normal class hours. Each session lasted for about sixty minutes. The instruments were administered to all the 317 senior high school elective mathematics students in the selected schools. The administered instruments were supervised by the researchers. The completed instruments were then collected from the students and analyzed based on the phenomenon.

DATA ANALYSIS AND DISCUSSION

As already mentioned, data for this study was obtained from third year senior high school elective mathematics students in the Cape Coast Metropolis using a five-point Likert scale questionnaire. The responses to the five-point Likert scale questionnaire as provided by the respondents were first edited, coded and entered as required. Since data analysis is aimed at answering research questions that guided the particular study and testing the entire hypothesis made in the study, data analysis was done and organized according to the study's research questions and hypotheses.
Data was finally analyzed and discussed quantitatively using graphs, frequencies, descriptive and inferential statistics (mean, standard deviation and ANOVA) to answer the research question and to test the hypotheses posted in this study. In line with the work done by Addae and Agyei (2018), the scores were interpreted as follows: 1 was the lowest possible score, which represented unpreparedness, while 5 is the highest possible score which represented readiness of the students to pursue advanced mathematics at the university level.

Background Information of Respondents

The tables below show the biographic data gathered on students' readiness to pursue advance mathematics at the University. The results are presented as frequencies (F) and percentages (%).

Table 1: Gender of Respondents

Gender	F	%
Male	121	38.2
Female	196	61.8
Total	317	100.0

Source: Fieldwork (2019)

It can be deduced from Table 1 that the female respondents were the dominant representatives which amounted to more than one-half of the 317 students sampled in this survey.

Table 2: Programme of Study of Respondents

Programme	F	%
General Science	170	53.6
General Arts	96	30.3
Visual Arts	9	2.8
Business	42	13.2
Total	317	100.0

Source: Fieldwork (2019)

A cursory look at Table 2 indicates that the majority of the students are reading General Science as compared to the others; and exceeding more than one-half of the total number of students involved in the study. It also pointed out that there were fewer students reading Elective Mathematics who offered Visual Arts programme as compared to the others in this study.

Table 3: School Types of Respondents

School Type	Freq.	Percentage
Single-Sex Male	74	23.3
Single-Sex Female	182	57.4
Mixed-School	61	19.2
Total	317	100.0

Source: Fieldwork (2019)

Single-Sex Female School reported the largest number of students as revealed in Table 3, giving evidence to the fact that only 14 female students from the Mixed-School were part of the study. In a contrary way, Mixed-School recorded the least number of students as compared to the other schools as shown by the results.

Table 4: Educational Qualification of Respondents' Parents / Guardian

	Qualification	Freq.	Valid %
Mother	Professor	9	3.3
	Doctor (PhD)	16	5.8
	Postgraduate	74	26.8
	Graduate	67	24.3
	Post-Secondary	45	16.3
	Secondary School	58	21.0
	Others	7	2.5
	Total	276	100.0
Father	Professor	24	8.5
	Doctor (PhD)	40	14.2
	Postgraduate	111	39.4
	Graduate	51	18.1
	Post-Secondary	22	7.8
	Secondary School	27	9.6
	Others	7	2.5
	Total	282	100.0
Guardian	Professor	4	6.5
	Doctor (PHD)	10	16.1
	Postgraduate	14	22.6
	Graduate	23	37.1
	Post-Secondary	5	8.1
	Secondary School	6	9.7
	Others	-	-
	Total	62	100.0

Source: Field (2019)

It can be inferred from the results in Table 4 that there were great number of fathers who had educational qualifications above Secondary School Certificate than compared to either mothers or guardians as reported by the respondents. In the same manner, mothers recorded higher numbers in educational qualifications than compared to guardians from Post-Secondary School Certificate as revealed by respondents in this survey. The results also seem to claim that the great majority of the students lived under the guidance of their parents as compared to their guardians. The implication from this result is that many of these highly educated parents or guardians would have extremely greater tendency of influencing their wards to pursue advanced mathematics related courses at the university level.

Table 5: Employment Status of Respondents' Parents / Guardian

	Status	F	Valid %
Mother	Employed	130	42.9
	Self-Employed	161	53.1
	Unemployed	7	2.3
	Retired	5	1.7
	Total	303	100.0
Father	Employed	173	57.7
	Self-Employed	108	36.0
	Unemployed	4	1.3
	Retired	15	5.0
	Total	300	100.0
Guardian	Employed	30	52.6
	Self-Employed	22	38.6
	Unemployed	2	3.5
	Retired	3	5.3
	Total	57	100.0

Source: Field (2019)

There is an indication from the results in Table 5 that a vast majority of parents or guardians are still in active service of work. This seems to suggest that many of the students as indicated receive proper care for their education from their parents or guardians in order to prepare them ready to pursue further mathematics at the university.

Research Question

What factors determine the readiness of Senior High School students to pursue advanced mathematics at the university level?

The research question that guided this study was "What factors determine the readiness of Senior High School students to pursue advanced Mathematics at the University level?" To answer this research question, a descriptive statistic was computed on the students' advanced mathematics readiness composite scale scores. The results are reported and discussed in Table 6.

Table 6: Means (M) and Standard Deviations (D) for Mathematics Readiness Subscales of respondents

Subscale	M	SD
Relevance of mathematics	3.65	.697
Interest in mathematics	3.54	.776
School environment/culture	3.52	.679
Competence in mathematics	3.35	.871
Nature of mathematics	3.32	.694
Total Readiness	3.48	.568

Source: Field (2019); N = 317

A cursory look at Table 6 indicates that generally senior high school students involved in the study have high tendency (M = 3.48, SD = .568) to agree that they were influenced by the various factors which determine their readiness to pursue advanced mathematics at the university level. The results presuppose that these students are ever ready at any point in time to pursue advanced mathematics at the university level. The results highlighted that students have reported their highest opinion on the relevance of mathematics (M = 3.65, SD = .697); demonstrated high interest in mathematics (M = 3.54, SD = .776); reposed high hope and aspiration in school environment/culture (M = 3.52, SD = .679); depicted good competence in mathematics (M = 3.35, SD = .871); and confirmed least agreement to nature of mathematics (M = 3.32, SD = .694) as determinants of their readiness to pursue advanced mathematics.

The findings have established positive perceived overall readiness attitudes of SHS students towards pursuing advanced mathematics at the university level. The results have also demonstrated that students reported positive perceived readiness views in their interest in mathematics, competence in mathematics, school environment/culture, relevance of mathematics, and nature of mathematics. The findings of this current study is in line with a similar study conducted by Addae and Agyei (2018). In their survey that explored 210 SHS students' attitudes towards the study of mathematics and their perceptions on their teachers' teaching practices in the Cape Coast Metropolis, they confirmed quantitatively that the students exhibited positive perceived overall attitudes towards their readiness to study mathematics. They also established that students have high perceived attitudes regarding their interest in doing mathematics, usefulness of mathematics, and confidence in doing mathematics. Many other literature (Bean, 2005; Byrd & MacDonald, 2005; Conley, 2007; Eccles, 2007; Merisotis and Phipps, 2000; Lee et al., 2011; Tomlinson, 2000) that were reviewed also supported the findings of the current study. The literature asserted that when students have high perceived interest in mathematics;

competence in mathematics; relevance of mathematics; and supportive beliefs for their school environment/culture, they tend to be more thoroughly prepared for college/ university mathematics. It also favours the current findings that claimed that vast majority of the students have parents/guardians who are sufficiently sound socio-economically with higher educational qualification and still in active working service; and thereby, influencing the readiness of these students to pursue advanced mathematics at the university level. Notwithstanding all the many consistencies rendered by literature, the study of Corbishley and Truxaw (2010) contradicts the current study. In their study, Corbishley and Truxaw surveyed 22 college mathematics instructors and concluded that those instructors perceived that first-year students were not ready for college mathematics.

Research Hypothesis One:

There is no significant difference between the readiness of male and female senior high school students to pursue advanced mathematics at the university level.

The first research hypothesis which guided the study was, "There is no significant difference between the readiness of male and female senior high school students to pursue advanced mathematics at the university level". To answer this research hypothesis, data collected from third year elective mathematics students were used. To achieve this task, an independent-samples t-test was conducted on the students' composite readiness score for the gender variable. The results from the independent-samples t-test are presented in Table 7.

Table 7: ANOVA Test for Gender Difference in SHS Students' Advance Mathematics Readiness

Category	N	M	SD	t-cal	p-value
Male	121	3.27	0.47	-0.653	0.515
Female	196	3.30	0.34		

Source: Field (2019); N = 317, $>$ .05 : *No significant difference*

The independent-samples t-test as indicated in Table 7 was conducted to compare the readiness of male and female students to pursue advanced mathematics at the university level. Generally, results indicate that there was no statistically significant difference in scores for males (M=3.27, SD=0.47) and females

[M= 3.30, SD=0.34; t(315)= -0.653, p=.515]. The magnitude of the differences in the means was very small (eta squared = 0.0014)

The results depicted no statistically significant difference between male and female students in terms of their readiness to pursue advanced mathematics at the university level. This result is inconsistent with what was found in literature by researchers like Kobrin (2007) and Long et al.

(as cited in McCormick & Lucas, 2011) and Lee et al. (2009) (as cited in Atuahene & Russel, 2016). Their study revealed that female students were less likely to be prepared for college level mathematics than their male counterparts; and that female students also did not pursue intensive mathematics courses in high school as often as their male counterparts who performed well academically. The implication of this finding is that females are equally likely to pursue advanced mathematics at the university level given the right encouragements, environment and opportunities as their male counterparts. The results also imply that generally students are willing to pursue advanced mathematics at the university since that in itself would raise their reasoning ability and hence make astronomical impact on the economy.

Research Hypothesis Two:

There is no significant difference between the readiness of senior high school students to pursue advanced mathematics at the University level based on school-type.

The second research hypothesis that guided this study was, "There is no significant difference between the readiness of senior high school elective mathematics students to pursue advanced mathematics at the University level based on school-type. To answer this research hypothesis data from the 317 student respondents were used. The one-way ANOVA test was performed to measure the impact the three school types have made on the students' readiness to pursue advanced mathematics at the university level. The Levene's test of equality of variances ($P = .106 > .05$) was not violated. The result of the ANOVA test is presented in Table 8 regarding the readiness of elective mathematics students to pursue advanced mathematics at the university level.

Table 8: ANOVA test on Readiness of Elective Mathematics students to Pursue Advanced Mathematics at the University level based on School-Type

	M	SD	F-Value	p-Value	Eta Squared
Single-Sex Male	3.31	.646	4.849	.008*	.17*
Single-Sex Female	3.55	.527			
Mixed-School	3.47	.530.552			

Source: Field (2019); $N = 317, * p < .05, significant\ difference$

The results from the ANOVA test in Table 8 have given enough evidence which demonstrates that there existed a significant difference [$\mathrm{F}(2, 316) = 4.849, \mathrm{p} = .008 < .05, \text{eta squared} = .17$] between the school types based on students' advanced mathematics readiness as reported by the respondents in this survey. Using the proposed guidelines by Cohen (1988): .01 = small effect, .06 = moderate effect, and .14 = large effect as cited by Pallant (2016), this result suggests a very large effect size. To investigate further to ascertain where this large difference existed between

the school types, a Post hoc comparison test was conducted using Tukey HSD procedure. The results are presented in Table 9.

Table 9 : Post Hoc Test for SHS Students Readiness based School Types

(I) Sch. Type	(J) Sch. Type	Mean Difference (I – J)	P- Value	Effect Size
Single-Sex Female	Single-Sex Male	.24073*	.006	.17
Single-Sex Female	Mixed School	.08360	.573	.09
Mixed School	Single-Sex Male	.15713	.240	.05

Source: Field (2019); *Mean difference significant at the .05 level; N = 317

The overall results from Table 9 indicates that there was an appreciable difference between the Single-Sex Female and Single-Sex Male Schools based on readiness of the SHS students to pursue advanced mathematics at the university level. The two schools differ in mean readiness scores by .24073 ($p = .006 < .05$) which was observed as a very large effect size. It can therefore be inferred that Single-Sex Female school students were more inclined to have agreed to their readiness to pursue advanced mathematics at the university level as compared to their counterparts in the Single-sex male school. Also, results indicated that there was no statistically significant difference between students in the Single-sex female school and their counterparts in Mixed Schools regarding their readiness to pursue advanced mathematics at the university level with mean difference = .08360, $p = .573 > .05$ even though a moderate effect size was recorded. Similarly, the results also confirmed there was no statistically significant difference between students in Single-sex male and Mixed schools in terms of their readiness mean scores (Mean difference = .15713, $p = .240 > .05$).

The results revealed that Single-sex female school differ significantly from Single-sex male school based on students' readiness to pursue advanced mathematics in favour of the former. The literature reviewed for this study was based on sex, and therefore no literature was found to support these findings.

Finally, even though the results have revealed that Single-sex female school students reported more advanced mathematics readiness than Mixed school students, the difference was not significant. The same findings were demonstrated between Single-sex male school students and Mixed school students. This result is in line with what was found by Lynch, Peters-Burton, and Ford (2014) who have conducted detailed qualitative studies of eight exemplary Inclusive STEM

High Schools (ISHSs) with high graduation and college admission rates and found that these schools provide students with a strong college preparatory core of STEM courses and emphasize the integration of STEM disciplines and real-world applications.

The implications of these findings is that more females are willing and likely to pursue advanced mathematics at the university level than their male counterparts and suggest that the long tantrum that males are more capable of pursuing mathematics and doing better than females is a thing of the past. Another implication of this finding is the fact that students in Mixed schools have a relatively equal chance in terms of their readiness to pursue advanced mathematics at the university level as compared to their colleagues in the two Single-sex schools. This shows that interest in mathematics as a field of study is on the increase.

CONCLUSIONS AND RECOMMENDATIONS

Analyses of data from this study led to a number of conclusions. First, it is clear that senior high school elective mathematics students who were involved in this study generally possess high positive overall readiness attitudes towards pursuing advanced mathematics at the university level. It can also be concluded students' readiness to pursue advanced mathematics at the university level was influenced by their interest in mathematics, competence in mathematics, school environment/culture, relevance of mathematics, and nature of mathematics with the relevance of mathematics being dominant. It is, however, suggested that the study be conducted on a large scale to ascertain the general readiness of senior high school elective mathematics in pursuing advanced mathematics at the university level and possibly extend it to other levels of the educational ladder.

One other conclusion that can be drawn from the study's finding is that both male and female students are willing and ready to pursue advanced mathematics at the university level. This means that the old adage that mathematics is a masculine subject is a thing of the past. It is, however, suggested that a study be conducted to find out what factor(s) is/are contributing to this revelation especially on the part of the females' interest to pursue advanced mathematics at the university level.

Based on the fact that there exists statistically significant difference between Single-Sex female school students and their counterparts in the Single-Sex male school based on readiness to pursue advanced mathematics at the university level in favour of females presupposes that a lot of opportunities and measures have been put in place to encourage female students' pursuance of advanced mathematics at the university level. Also, the fact that there was no statistically significant difference between students in the two Single-sex schools and their colleagues in the

Mixed Schools regarding their readiness to pursue advanced mathematics at the university level indicates that overall both categories are ready to pursue advanced mathematics at the university level. It can also be concluded that interest in mathematics as a field of study is on the increase at the level in question.

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