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LEARNING OUTCOMES OF THE SENIOR HIGH SCHOOL STUDENTS OF GHANA IN CORE MATHEMATICS: AN ANALYTICAL STUDY

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Abstract

This study examines and analyses the Core Mathematics learning outcomes of Senior High School students in Ghana. Data was downloaded online from the West African Examination Council (WAEC) website. The data consisted of published provisional WASSCE Core Mathematics results for 2017 to 2022. The data were analysed using descriptive statistics (Frequencies and percentages). Graphs were used for clarity of the analyses. It was realised that, though there has been an improvement in the results of candidates in recent years, many students still fail to achieve the necessary grades for tertiary education admission. It was also revealed that the improvement in the results of candidates in recent times might stem from malpractices on the part of schools and students during the examination.

Keywords: ***Core Mathematics, Mathematics Education in Ghana, Mathematics Learning outcomes, Senior High School Mathematics***

1. INTRODUCTION

Mathematics education is relevant to the development of students. The importance of Mathematics education is an accepted claim worldwide due to its vital contributions to the academic development of learners. According to Hodaňová and Nocar (2016), Mathematics promotes holistic human growth and is helpful in everyday life. The authors further stated that Mathematics impacts students' and pupils' education regarding a specific field of knowledge (Mathematical knowledge) and moral education.

Nature, technology, architecture, machinery, the building industry, the banking business, research, mapping, etc., all have Mathematics applications. Genetics and the use of Mathematics in nature have a lot of fascinating applications. The testing of hypotheses in genetics is done using Statistical techniques. We can develop Statistical descriptions of quantitative relations using Mathematics. We require arithmetical diameter, scattering, standard deviation, and other terms while processing research data. These stated Mathematics applications prove the importance of Mathematics in all disciplines and the need to ensure quality Mathematics education at the school level since knowledge of Mathematics will be needed in training in various fields during higher education.

Teaching and learning Mathematics in Ghana has its challenges. Rays (2010) listed ten challenges to Mathematics teaching: some of these challenges, according to the author, are Mathematics teacher content knowledge, teacher understanding of student learning and effective teaching strategies, Mathematics teachers shortage, teacher preparation programs, evaluation of teaching effectiveness, and student interest in and motivation to learn Mathematics. Over the years, learners' performance at the school level in the West African Examination Certificate Examination (WASSCE) has not met expectations, encouraging the scrutinisation of the various factors contributing to learners' performance. According to the Ministry of Education (2018), the West African Senior Secondary Certificate Examination (WASSCE), particularly in 2015, had unsatisfactory outcomes in terms of performance for both Core and Elective Mathematics subjects. Students' performance has to be scrutinised to know how well they are doing regarding

mathematics at the school level. The 2021 WASSCE chief examiners' report stipulates a decrease in students' performance in Mathematics (WAEC, 2021). This study examines the performance of final-year Senior High School students in the WASSCE.

Conceptual Framework

Learning outcomes regarding teaching and learning are vital as they are significant indicators of what learners are bound to achieve at the end of an academic program. Learning outcomes serve as instruments for instruction that direct students toward the course's intended results. Also, learning outcomes from the teachers' point of view are followed, and the teachers inform the students of the outcomes they might expect from the course. Learning outcomes are declarations of intended learning results that make it evident how assessment can be accomplished, as the language suggests. As a result, learning outcomes are a foundation for assessing and summarising student achievement (Popenici and Millar, 2015).

The learning outcomes of the academic activity guide stakeholders on the path to follow to achieve the desired results as stipulated. Regardless, other factors can directly or indirectly influence the outcomes of a program. In the case of the learning outcomes of the teaching and learning of Mathematics, factors such as the teachers' content knowledge, students' IQ, teaching methodologies, students' background, learning environment, and teacher characteristics can influence students' learning outcomes. Tella (2007) outlines various factors that influence students' Mathematics performance. The factors mentioned include the context of learning and individual traits like IQ, cognitive preferences, and personality. The author mentioned other elements, such as individual students' personal qualities, learning styles, self-esteem, and motivational orientations.

In Ghana, the expected learning outcome of teaching and learning Mathematics at the SHS level includes students attaining the required grades to progress to tertiary education. Students must make at least a C6 at the end of their study in Mathematics to progress to higher education. Failure to achieve this owning to any factor must be investigated and eliminated. Bruce (2016) outlined that the implications of the low performance in core Mathematics in the WASSCE are mammoth, as candidates who make D7 and below are denied progress to tertiary education. The author further stated that such candidates need to rewrite to attain credit or better (C6 or better) for the opportunity to have tertiary education.

Review of Literature

Mathematics education in Ghana

The importance of Mathematics to the academic development of learners is evident worldwide. Mereku (1999) stated that mathematics is one of the crucial foundational subjects that make up the core curriculum for basic (i.e., primary and secondary) education in nations worldwide. Mathematics is taught at all levels of school education in almost all countries worldwide. HOW and Butler-Adam (2017) stated that understanding mathematics's importance in all its forms is a beneficial exercise and a crucial component of a country's social and economic growth. In Ghana, Mathematics is highly regarded at the school level.

To progress to the next level of education, learners must pass Mathematics in internal and external examinations. Learners write two external examinations at the school level to move to higher education. The Basic Education Certificate Examination (BECE) is written to complete Junior High School (JHS) (primary (class 1-6), JHS (JHS 1- JHS 3)). The West African Senior High School Certificate Examination (WASSCE) is also written to complete Senior High School (SHS) (SHS 1 – SHS 3). The West African Examination Council organises the BECE and WASSCE, an international examination body that oversees external examination in five (5) West African countries (Ghana, the Gambia, Liberia, Nigeria, and Sierra Leone). "The West African Examinations Council (WAEC), a non-profit-making organisation, with its headquarters in Accra, Ghana, was established in 1952 after the Governments of Ghana (then Gold Coast), Nigeria, Sierra Leone and The Gambia enacted the West African Examinations Council Ordinances in 1951. Liberia became the fifth member of the Council in 1974" (The West African Examination Council, 2022).

Although learners are not required to obtain a specific grade in Mathematics to gain placement in SHS, a good pass in Mathematics increases learners' chances of being placed in one

of the best SHS in Ghana. The total marks earned in the four core subjects (English, Mathematics, General Science, and Social Studies) and the top marks from the remaining courses constitute the School Placement Raw Score for the 2021 BECE (GhanaEducation.org, 2022). At the SHS level, learners must obtain a score of at least C6 in Core Mathematics to be admitted to tertiary education. Mathematics achievements of learners at the school level have not been as expected. Students' performance during the WASSCE has not been encouraging, which results in many learners writing private WASSCE examinations to augment their passes to gain admission to tertiary education. Primary stakeholders are concerned about Ghana's Senior High School's (SHS) abysmal mathematics performance (Ansah, Quansah and Nugba. 2020). Smith (2021) stipulated that from data issued by the WAEC, 45.89% of students who took the WASSCE in 2021 did not achieve the required score in fundamental mathematics, falling between D7 and F9. Candidates for higher education should have scores ranging from A1 to C6 in Core Mathematics. According to the Statistics, out of 446,352 candidates, almost 204,831 will be unable to pursue further education due to poor Mathematics performance.

Learners' performance is tied to classroom practices, which are undoubtedly influenced by teacher quality. The quality of Mathematics teachers has a lot of influence on learners' performance. From their findings, Ambussaidi and Yang (2019) stipulated that teacher quality positively impacts student Mathematics achievement. In Ghana, a Mathematics teacher at the school level should have a diploma in basic education for a teacher at the basic level (Primary and JSS) and a Mathematics degree in education for teachers at the Senior High School (SHS). After acquiring the required school certification, all teachers must have a professional licence to practice in Ghana. Teachers write licensure exams to obtain the necessary licence to teach at the school level in Ghana. According to the Education Regulatory Bodies Act 2020 (Act 1023), the National Teaching Council (NTC), a Ministry of Education (MOE) organisation, is responsible for advancing teacher professionalism in Ghana. One of the mandates of the NTC is to conduct a teacher licensure examination to license teachers in Ghana (NTC, 2022).

One of the elements determining students' academic performance at the school level in Ghana is the calibre of the Mathematics teacher. Abreh, Owusu and Amedahe (2018) cited the lack of enough qualified teachers as one factor affecting learners' Mathematics achievement. Stakeholders must put in measures to ensure that teachers recruited with the responsibility of imparting mathematical knowledge are of the required quality. The quality of the Mathematics teacher influences his subject knowledge and pedagogical skills to sustain students' interest in the Mathematics classroom. Sirait (2016) concluded that teacher quality affects students' achievement.

The WAEC grading system ranges from A1 to F9 where A1 – Excellent, B2 – Very Good, B3 – Good, C4 – Credit, C5 – Credit, C6 – Credit, D7 – Pass, E8 – Pass and F9 – Fail. Candidates must attain a grade of at least C6 in Core Mathematics to qualify for admission to tertiary education. Table 2.0 below is a table of the WASSCE grading system.

Table 1.0: WAEC Grading System for Examinations

Marks	WASSCE grade	Remarks
100-80	A1	Excellent
79-70	B2	Very Good
69-65	B3	Good
64-60	C4	Credit
59-55	C5	Credit
54-50	C6	Credit
49-45	D7	Pass
44-40	E8	Pass
39 and below	F9	Fail

Source : (Opoku-Asare and Siaw , 2015)

Challenges of Teaching Mathematics in School Education

Teaching and learning mathematics come with challenges for both the teacher and learners. The quality of delivery in the Mathematics classroom is dependent on some factors. One such factor is the quality of the teacher in terms of content and pedagogical knowledge. Learners'

interest in the subject also affects the teaching and learning process as it determines their active participation in the classroom.

One challenge that affects the teaching of Mathematics is the teachers' content knowledge of the subject. Without maximum control over the content delivered, teachers struggle to make learners understand what they are trying to impact. The teacher needs to have a firm understanding of what he wants to teach to help his students understand the concept he is trying to explain. Appiahene, Opoku, Akweittey, Adoba and Kwarteng (2014) cited the lack of competent teachers as one of the problems of Mathematics teaching in the Kumasi Metropolis of Ghana.

Another challenge to teaching Mathematics is the lack of teaching-learning materials to practicalise Mathematics in the classroom. Mathematics is seen by many as an abstract concept, which makes it difficult for learners to comprehend. To make Mathematics feel tangible and practical, teachers need to involve teaching and learning material during lessons to ease the subject's abstract nature. Most of the time, this is not the classroom situation due to the absence of teaching-learning materials (TLMs) or teachers' unwillingness to involve them in the teaching process. As such, learners see Mathematics as an abstract concept, decreasing their interest in the subject. Ameyaw (2019) concluded that teachers should employ teaching and learning resources in the classroom during and before the delivery of a lesson to aid students in comprehending the concept that teachers want them to grasp.

Limited time for Mathematics classes on the schools' timetable is also a challenge for teaching and learning Mathematics. In Ghana, the GES stipulates a specific time for teaching subjects at the school level. With such restrictions, teachers find it challenging to involve the necessary tools and procedures at the right pace to enable learners to comprehend concepts gradually with less difficulty. Also, teachers are forced to teach mathematical concepts hurriedly to prepare their students for their final exams. The lack of enough time also deprives teachers of the ability to involve teaching-learning materials in the teaching process since using these materials demands a lot of time. The involvement of ICT tools is also affected by the limited time for teaching Mathematics, although it can improve understanding of concepts. Appiahene, Opoku, Akweittey, Adoba and Kwarteng (2014) stated that the lack of time also challenges Mathematics teaching.

Students' interest and motivation to learn Mathematics is another challenge facing teaching Mathematics. The teacher is responsible for teaching, and the learner is responsible for learning. When learners are less interested or motivated to learn a subject, it is challenging for the teacher to impact them. When students are not interested in what is being taught, they are not motivated to learn, making it difficult for the teacher to make them active participants in the classroom. According to Reys (2010), president of the Association of Mathematics Teacher Educators (AMTE.), one of the challenges to Mathematics education is students' interest in and motivation to learn the subject.

Poor supervision is another challenge of Mathematics teaching in Ghana. Supervision is always essential as it puts teachers on their toes to perform to expectations. Masao (2017) concluded that supervision of effective teaching and learning activities leads to higher academic achievement among students than ineffective supervision. Educational administrators' ability to adequately supervise Mathematics teachers' actions in and out of the classroom is necessary for effective teaching practices. Teaching involves more than just classroom delivery. Evaluation, teacher feedback, and one-on-one tutoring contribute to effective teaching. Supervision is needed to ensure these activities are undertaken effectively for the learner's benefit. Alber (2015) mentions the five high teaching practices: teacher clarity, classroom discussion, feedback, formative assessments, and metacognitive strategies.

Another challenge summarising all the challenges is the poor Mathematics learning outcomes at the school level. Mathematics teaching aims to make students understand concepts to pass internal and external examinations to progress in their education. In Ghana, students must pass Mathematics to move from one stage of the education ladder to another. This has not been the case, as many students tend to fail their final Mathematics exams. According to Fokuo, Lassong and Kwasi (2022), the poor performance of students in Mathematics in Ghana can be attributed to

factors such as lack of coverage of Mathematics curriculum content, lack of interest in Mathematics, and students' belief that they cannot understand Mathematics.

Purpose of the Study

Mathematics is essential in the school education curriculum at all levels in Ghana. Without a good pass in Core Mathematics at the SHS level, students cannot have access to tertiary education. The learning outcomes in Core Mathematics at the SHS level in Ghana have not been as expected. Most students fail to achieve the required grades to continue their education. Prospective Mathematics teachers must be trained to deal with this challenge, and practising teachers also need in-service training to turn the tide. This study aims to analyse core mathematics learning outcomes at the senior high school (SHS) level of Ghana's school education and also to investigate if there are external factors capable of influencing students' grades during the WASSCE examination.

Research Objectives

The following objectives will guide the study;

1. To investigate the performance trend of final-year SHS students in Core Mathematics in Ghana.
2. To investigate factors that influence students' Mathematics grades in WASSCE.
3. To suggest recommendations for improving the results of final-year SHS students in Core Mathematics in Ghana.

Delimitation of the Study

The data used for the analysis is based on provisional results published by WAEC (2017 – 2022) at the end of every examination year. This is done after marking scripts of candidates of that particular year. The results are provisional because some results would have been withheld at the point of release due to examination malpractice. After investigations, some withheld results are released but do not significantly impact these Statistics since the number is small.

2. IMPLEMENTATION METHOD

Population

The study population is all final-year SHS May/June WASSCE candidates who sat for Core Mathematics from 2017 to 2022 and SHS Core Mathematics teachers of Ghana.

Sample and Sampling

The whole population of SHS May/June WASSCE candidates was used for the study. Purposive sampling was used to select four (4) teachers who had been teaching for at least two (2) years and had experience invigilating during WASSCE examinations for semi-structured interviews.

Data Collection Tools

The researchers utilised secondary data (provisional WAEC core mathematics results of all candidates from 2017 to 2022) and a semi-structured interview schedule for data collection. The Mathematics teachers were made aware of the study and its purpose. They were first asked for their consent before they agreed to participate in the study. The provisional WAEC core mathematics results data is in the public domain.

Data

The May/June Core Mathematics WASSCE provisional results of all candidates from 2017 to 2022. The provisional results were downloaded online as WAEC publishes them at the end of every examination year. The audio recordings of the semi-structured interviews that the researchers conducted were transcribed for analysis.

Data Analysis

The data on provisional WAEC core mathematics results collected was analysed using descriptive statistics (frequencies and percentages) concerning the first objective of observing learners' performance from 2017 to 2022. The recorded audio from the semi-structured interview was transcribed and thematically analysed to identify the themes emerging from the interviews.

3. RESULTS AND DISCUSSION

The table below shows the May/June WASSCE Core Mathematics results of final-year SHS students of Ghana.

Table 2.0: WASSCE May/June Core Mathematics Results of final SHS candidates from 2017 to 2018

Serial No.	Year	Results Obtained by Candidates		
		A1 – C6 (mark ≥ 50%)	D7 – E8 (40 ≥ marks ≤ 49)	F9 (marks < 40)
1	2017	122450 (42.73%)	73409 (25.59%)	58351 (20.35%)
2	2018	120519 (38.33%)	94607 (30.09%)	99275 (31.58%)
3	2019	223737 (65.31%)	72408 (21%)	46384 (13.54%)
4	2020	243904 (65.71%)	76535 (20.61%)	49721 (13.40%)
5	2021	238819 (54.08%)	85073 (19.30%)	61778 (13.99%)
6	2022	256264 (61.39%)	55812 (13.36%)	43767 (10.48%)
TOTAL		**1205693 (59.60)**	**457844 (22.63%)**	**359276 (17.76%)**

(source: www.waec.gh.org)

Table 1.0 shows that, in 2018, the lowest percentage (38.33%) of candidates achieved grades between A1 and C6 compared to the rest of the years considered in the analysis, which was a decrease in performance compared to the previous years' performance. A combined percentage of 61.67% achieved grades between D7 and F9.

In 2017, a year before the lowest achievement in 2018, 42.73% of the candidates achieved grades from A1 to C6. Also, 25.59% had grades between D7 and E8, and 20.35% had F9.

There was a massive improvement in the performance of candidates in 2019 and 2020. The percentage of candidates achieving A1 to C6 was 65.31% and 65.71%, respectively. Subsequently, candidates with grades from D7 to E8 were 21% and 20.61%, respectively. The combined candidates who had F9 also stood at 26.94%.

Compared to 2020, there was a decline in the achievement of candidates in 2021. In 2021, as shown in Table 1.0, 54.08% had grades from A1 to C6, which is a decline compared to the 65.71% in 2020. Also, 19.30% had grades from D7 to E8, and 13.99% had F9.

There has also been an improvement in the 2022 performance. From the published results, 61.39% had grades from A1 to C6, 13.36% from D7 to E8 and 10.48% had F9. Altogether, from 2017 to 2022, 1205693 (59.60%) had achieved grades A1 to C6, 457844 (22.63%), D7 to E8 and 359276 (17.76%) F9.

Fig 1.0 Percentages of Grades (A1-C6) attained from 2017 to 2022

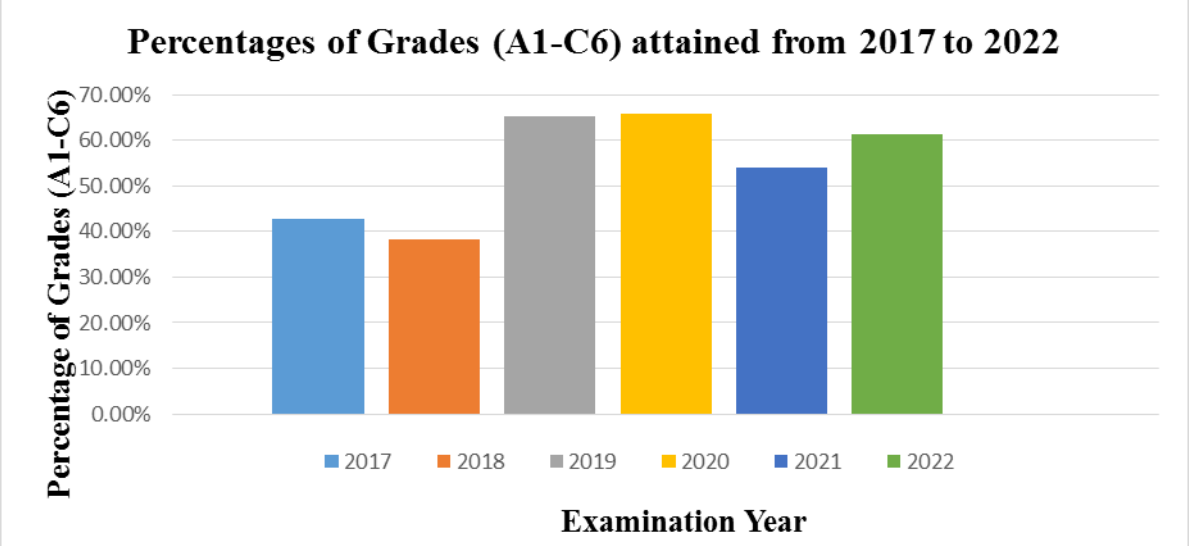


Figure 1.0 shows that the best performance of candidates concerning (A1-C6) was in 2019 and 2020, where candidates who achieved A1-C6 were more than 60% of the population. It can

also be seen that there has been an improvement in the performance of candidates since 2019, although there was a little dip in 2021where the number of candidates who had A1-C6 was below 60%.

Fig 2.0 Percentages of Grades (D7-E8) attained from 2017 to 2022

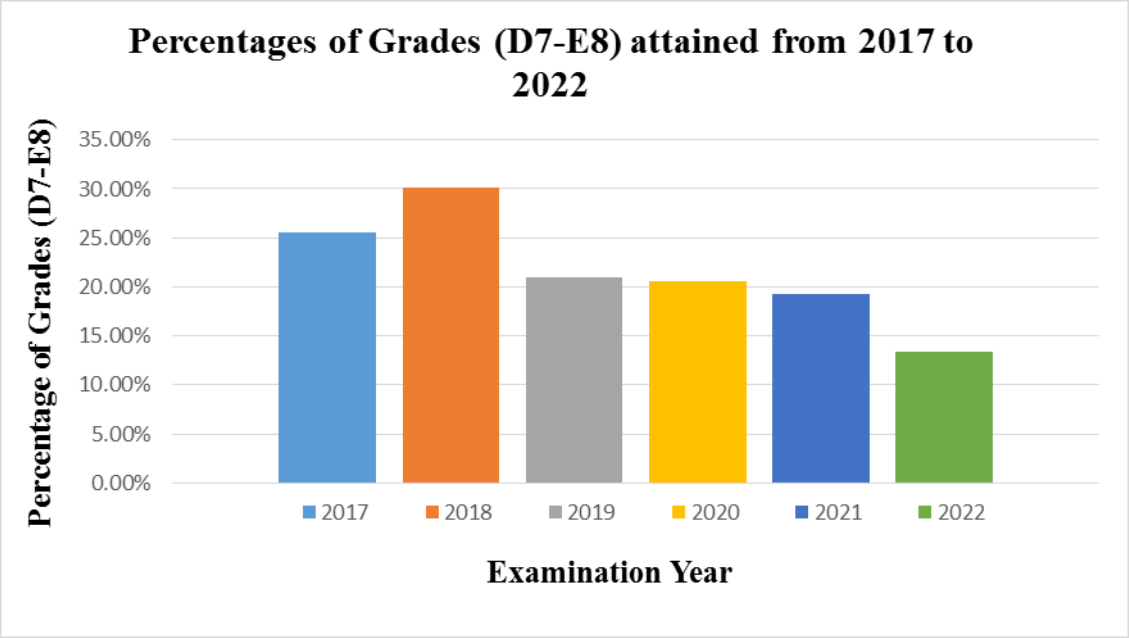


Figure 2.0 reveals that D7-D8 had the highest attainment in 2018. This dropped in 2019 and has been declining ever since. This is positive as it indicates that more students are attaining higher grades for the past four years than in previous years.

Fig 3.0 Percentages of Grades (F9) attained from 2017 to 2022

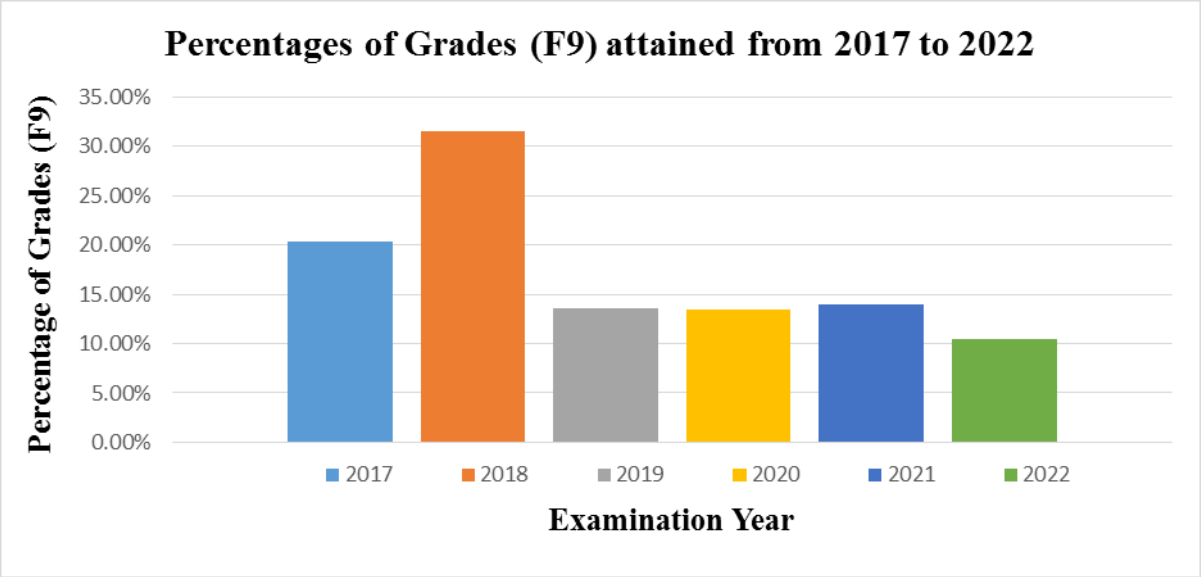
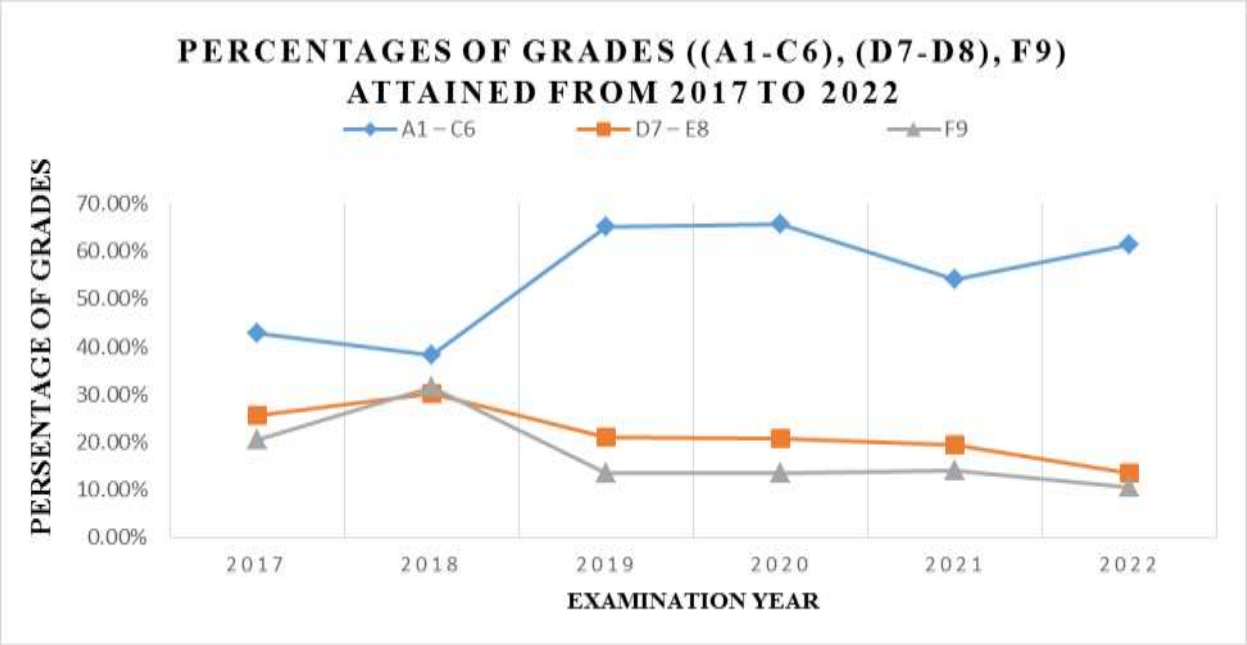


Figure 3.0 represents the percentage of candidates who failed Core Mathematics from 2017 to 2018. It shows that the highest percentage of failure was in 2018 when more than 30% of the candidates failed the exams. Since 2019, the rate has consistently stayed between 10% and 15%. Although these numbers are generally low, measures must be implemented to reduce these numbers further.

Fig 4.0 Percentages of Grades ((A1-C6), (D7-D8), F9) attained from 2017 to 2022



It can be seen from Figure 4.0 that, from 2019, the performance of candidates has been better compared to previous years. Candidates' attainment of A1- C6 has seen an improvement. The graph shows that except for 2021, where candidates achieving A1-C6 dropped to below 60% from 2019 to 2020, the percentage has stayed above 60%, which shows consistency. Also, since 2018, the number of candidates achieving D7- E8 and F9 has consistently declined. This shows an improvement in the performance of candidates.

It must be noted that candidates who achieve A1-C6 are eligible to apply for admission to tertiary education. Therefore, candidates who achieve grades between D7- and E8, although they have not failed, must rewrite Core Mathematics for better grades before they can gain admission into any tertiary institution in Ghana.

From the thematic analyses of the transcribed interviews, the following themes emerged:

1. There are no criteria for registration of candidates for Core Mathematics for the WASSCE examination. Once candidates are registered as first-year students, their performance or level of punctuality throughout the three years doesn't matter. It is obligatory to register them for the WASSCE examination. There is a lengthy process to be followed if management decides not to register or to repeat a student, which makes them end up registering all students regardless of their academic standings.
2. The registration of candidates experiences no bias since students' names are automatically sunk into the WAEC from the Ghana Education Service from their first-year records.
3. The examinations are conducted in a conducive environment. The schools' environments are usually conducive for the examination because schools are mostly on vacation during the examination.
4. There are activities before and during the examinations that can impact students' performance. Some of these factors include:
    a. The influx of several supposed examination questions on social media distracts the attention of candidates from preparing adequately for the examinations.
    b. There is a leakage of examination questions allegedly sold to candidates from various sources.
    c. Malpratices, including entering examination halls with foreign materials and copying from other candidates.
    d. The solving of questions for candidates by external individuals during the examination.
5. Teachers and top management officials sometimes are involved in examination malpractices.

6. The management of Senior High schools is indirectly forced to ensure students pass by whatever means possible. For example, headteachers are made to sign performance contracts during appointments but may not have the necessary tools available to ensure it happens.
7. Invigilators are not adequately trained.
8. Invigilators are not adequately motivated and can easily be influenced to engage in illegal activities. The amounts of money paid to them are meagre and sometimes take a year to be paid.
9. WAEC must implement more measures, such as using body cameras on invigilators, to reduce malpractices drastically.
10. Culprits of malpractices are sometimes prosecuted, results cancelled, and banned from all WAEC activities depending on the severity of the malpractice.

These themes from the analyses of the interviews clearly indicate that various external and internal factors influence the performance of candidates during the WASSCE examinations. It can, therefore, be possible that the recent improvement of the performance in core mathematics of SHS levers might not be a result of the candidates' effort but other external factors during the WASSCE examinations.

Discussion

In Ghana, WASSCE holders must attain a minimum grade of C6 in English, Mathematics and Science or Social studies for non-science-related tertiary education programs to qualify for admission into tertiary education. The following are the general admission requirements for the Bachelor of Education (B.Ed) Program: Holders of the WASSCE: CREDIT PASSES (A1-C6) in Six (6) Subjects, including Three (3) Core Subjects (English Language and Core Mathematics) and Three (3) Elective Subjects (Related to the Course of Study) (Colleges of Education- Ghana, 2022). While admissions criteria for universities vary by institution in Ghana, the National Accreditation Board (NAB) establishes the baseline admissions requirements for all providers. Candidates must obtain a C6 in at least three WASSCE core subjects and three WASSCE elective subjects. (International Trade Administration, 2022).

This indicates that candidates with grades lower than C6 (D7 to F9) in Core Mathematics do not qualify for tertiary education. So, although many candidates who obtain D7 – E8 in core Mathematics have not failed, it still looks like a failure because they cannot gain admission to any tertiary institution with their grades. From this, it implies that in 2018, out of 314,401 candidates whose results were released, 193,882 (61.67%) candidates could not gain admission to tertiary education. Of the 2022813 results from 2017 to 2022 by WAEC, 817120 (40.39%) did not qualify for tertiary education.

There is an improvement in the performance of candidates from 2019, with candidates obtaining A1 to C6 from 2019, 2020 and 2022 eclipsing 60%, and 2021 being above 50% compared to 2017 and 2018, which were below 50%. Although there is an improvement, 40% (D7 – E8: 22.63% and F9: 17.76%) of candidates who sat for WASSCE could not access tertiary education due to their poor grades in Core Mathematics. This situation is worrying as it deprives candidates of access to tertiary education. It must also be noted that the improvement might not be legitimate due to malpractices during the examination. The performance from 2011 to 2017 (A1 – C6) stood at 43.8%, 49.4%, 36.6%, 36.6%, 24.0%, 32.83% and 42.73%, respectively, which makes an average of 37.9% (Fletcher, 2018).

The themes that emerged from the thematic analyses of the interviews indicate the existence of anomalies before, during and possibly after the examinations, which can influence students' performance. WAEC reports malpractices yearly, which sometimes leads to the cancellation of results. Others are either released or cancelled later upon the outcome of investigations into the malpractices. Upon release of the 2022 results, WAEC outlined various malpractices and the resulting punishments, as shown in Table 3.0 below.

Table 3.0: 2022 WASSCE released results malpractices

Table 3.0: 2022 WASSCE released results malpractices

Serial No.	Number of Candidates	Punishment	Reason
1	3,845	Subject results cancelled	Sending foreign material into the examination hall.
2	518	Entire results cancelled	Sending mobile phones into the examination hall.
3	117	Entire results withheld	Alleged cases of impersonation were detected during the examination.
4	179	Script being scrutinised	reported cases of collusion

Source: (WAEC, 2022)

WAEC stipulated that "The withheld results of candidates may be cancelled or released based on the outcome of the investigations" (WAEC, 2022). The rules governing WAEC examinations are stipulated on their official website. Among the punishable practices include bringing foreign material to the examination hall, irregular activities inside or outside the examination hall, collusion, impersonation, leakage of examination questions, mass cheating, insult/assault on supervisors/invigilators/inspectors, contravention of instructions to candidates and multiple registrations (WAEC, 2022).

Suggestions for Improving the Results of Final-Year SHS Students in Core Mathematics

The following suggestions could help in improving the performance of candidates in core Mathematics:

1. The Ghana Education Service (GES) must ensure that qualified Mathematics teachers are recruited to teach Mathematics in the Senior High School
2. Mathematics teachers should be given in-service training to improve upon their Pedagogical Content Knowledge (PCK)
3. Mathematics teachers should research to employ the best methodologies during Mathematics lessons.
4. Ethical standards of teaching and learning Mathematics should be enforced to enhance students' understanding of concepts.
5. Mathematics teachers should be given orientation on the expectations of WAEC examiners.
6. Teachers should be motivated by school administrators to work as expected
7. Curriculum developers must ensure Mathematics teachers have enough time on the school timetable to teach concepts to understand
8. School administrators must ensure that the necessary teaching-learning materials are provided for use by Mathematics teachers
9. Teachers should also be encouraged to involve ICT in Mathematics lessons as they can improve the understanding of concepts
10. WAEC must ensure that students and schools involved in malpractices are dealt with to discourage students. This will encourage students to concentrate on preparing for the exams instead of relying on possible malpractices for better grades.
11. WAEC should give examination invigilators enough incentives to prevent them from being coaxed into condoning malpractices.
12. WAEC must ensure invigilators are given enough training before the start of the examination.
13. WAEC, as time goes on, should employ technological measures to curtail the recurrent examination malpractices.
14. There should be an enforced criterion and flexibility on the part of school management towards registering candidates for the WASSCE examinations.
15. WAEC should enforce rules and regulations governing examinations.

4. CONCLUSION

The study aimed to examine final-year SHS students' performance in WASSCE Core Mathematics. A good pass in Core Mathematics (C6 or better) is a requirement for entry into tertiary education in Ghana; this necessitates knowing students' performance. From the study, it can be seen that, although there is an improvement in the performance of candidates in recent times compared to previous years, the performance of candidates is not encouraging as many candidates end up with grades below the requirement. From 2018 to 2022, there seems to be an improvement in student performance, but the legitimacy of this improvement is questionable since WAEC reports malpractices among candidates and sometimes schools. It was also realised that many factors during the WASSCE examination could impact students' performance.

It is suggested that WAEC motivate examination invigilators and employ technological measures to deal with the issue of malpractices. Also, hiring qualified mathematics teachers and motivating mathematics teachers and curriculum developers to ensure enough time for teaching mathematics are some of the measures that can be taken to ensure improvement in the performance of candidates in WASSCE Core Mathematics.

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