



Ministry of Education
REPUBLIC OF GHANA



Trends in Performance of WASSCE Candidates in the Science and Mathematics in Ghana: Perceived Contributing Factors and the Way forward

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Context of Science and Mathematics Education at Secondary Schools

- Science and Mathematics offer such a foundation for students to be critical and analytical in their thinking.
- It is, therefore, gratifying that Ghana's constitution mandates that all efforts should be made to ensure education up to pre-tertiary levels become free (Republic of Ghana, 1992).
- Development of economies is closely linked to the advancement in the fields of mathematics and science education to occasion accelerated expansion.
- Secondary Education Improvement Project (SEIP) is but one of the interventions to drive the agenda forward.
- Therefore, the study sought to provide trends in performance and offer insight into perceived reasons causing the trends.



Research Questions

- The following research questions guided the cause of the study:
 1. What has been the trend of the performance of WASSCE candidates in mathematics in Ghana from 2007 to 2016?
 2. What has been the trend of the performance of WASSCE candidates in science in Ghana from 2007 to 2016?
 3. What are the perceived contributing factors to students' performance?



Methodology

- The exploratory survey research design was applied in the conduct of this study.
- One hundred and seventy (170) schools were **carefully** sampled from 875 senior high schools countrywide using the **proportional stratified random sampling** from each of the ten administrative regions in Ghana.
- Within each school:
 - The head of the school
 - Heads of Department of Science and Mathematics
 - One teacher each of science and mathematics,
 - Ten (10) students from two from elective science and maths as well as other programme areas;
 - ✓ were randomly selected.



Data Sources

Research Questions 1 & 2:

- WASSCE results from 2007 to 2016 for the 170 schools for Science and Mathematics
- Data characterized by ordinal scores where the unit of analysis in this consideration is letter grade.

Research Question 3:

- Questionnaire was used to generate data from Heads of schools, Heads of Department of Science and Mathematics; a teacher each for the Mathematics and Science fields, and 10 students each from each of the 170.



Results for Research Question 1

Highlights

- The performance of students in Core Mathematics is characterized by a high percentage of candidates with Grade F9.
- **Figure 1** shows the performance of students across the years in Core Mathematics. The proportion of F9 obtained across the years remains about the largest regarding ratio of the grades earned.

More highlights

It can be observed from the stack performances that grade C6 to F9 across the year groups was approximately 50% per year group or worse. Performance, however, improved steadily from 2007 to 2012 and decreased from 2012 steadily to 2015 and rose again in 2016 (see **Table 1**).



Results for Research Question 1 *Cont'd*

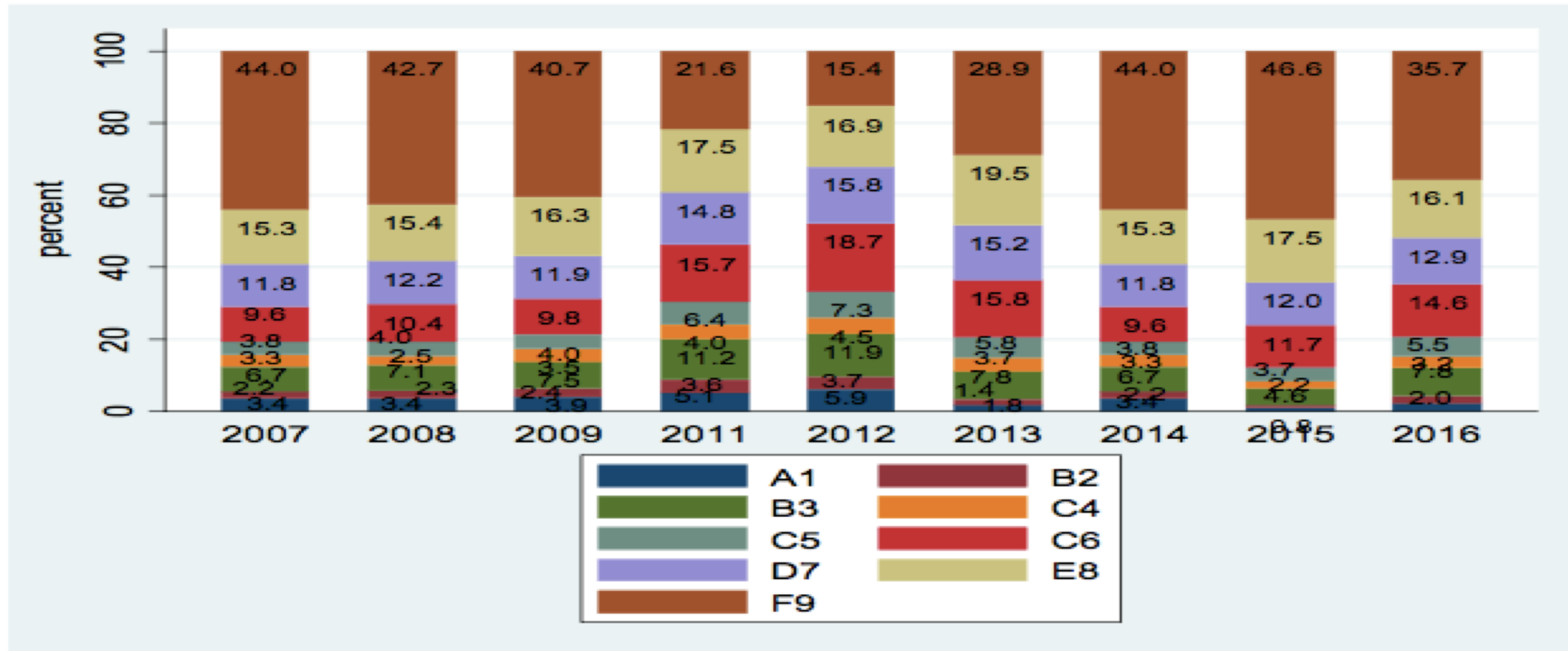


Figure 1: Bar chart showing the Proportion of WASSCE Grades Obtained in Mathematics for 2007 - 2016

Results for Research Question 1 *Cont'd*

Table 1: Distribution of Mathematics Grades of Sampled Schools for 2007 – 2016 in WASSCE

GRADES	2007	2008	2009	2011	2012	2013	2014	2015	2016	Total
A1	1,203	1,217	1,596	1,927	2,586	1,727	1,203	523	1,481	13,463
B2	775	806	994	1,379	1,615	1,375	775	562	1,283	9,564
B3	2,408	2,512	3,044	4,275	5,202	7,473	2,408	2,894	5,064	35,280
C4	1,173	898	1,425	1,518	1,951	3,499	1,173	1,387	2,085	15,109
C5	1,357	1,433	1,641	2,451	3,206	5,553	1,357	2,351	3,583	22,932
C6	3,440	3,670	4,019	5,966	8,165	15,033	3,440	7,424	9,491	60,648
D7	4,210	4,306	4,846	5,638	6,896	14,524	4,210	7,607	8,404	60,641
E8	5,482	5,471	6,661	6,632	7,375	18,568	5,482	11,101	10,518	77,290
F9	15,721	15,121	16,605	8,217	6,716	27,605	15,721	29,591	23,318	158,615
Total	35,769	35,434	40,831	38,003	43,712	95,357	35,769	63,440	65,227	453,542

Source: WAEC Data



Results for Research Question 2

- the grades improved progressively from 2007 to 2012 and decreased from 2012 gradually to 2015 and went up in 2016.
- The failure rate in Integrated Science was in the neighbourhood of 30% for each of the years of 2007 to 2009, 2014, and 2015.
- Apart from 2008 and 2015 where there were a few candidates who obtained grades A1 and B2, it was observed that in the rest of the years, more candidates obtained grades A1 and B2, comparatively.
- Also, apart from 2011, 2012, 2013 and 2016 that candidates obtained about 50% in grades A1 to C6 cumulatively, the rest of the years had more students who achieved more cumulative grade of D7 to F9.
- This proportion across the years remains the most substantial grade that candidates got in the Integrated Science except in 2011 and 2012.
- **Figure 2** provides the trends in performance in Integrated Science for the sampled schools (**See also Table 2**).



Results for Research Question 2 *Cont'd*

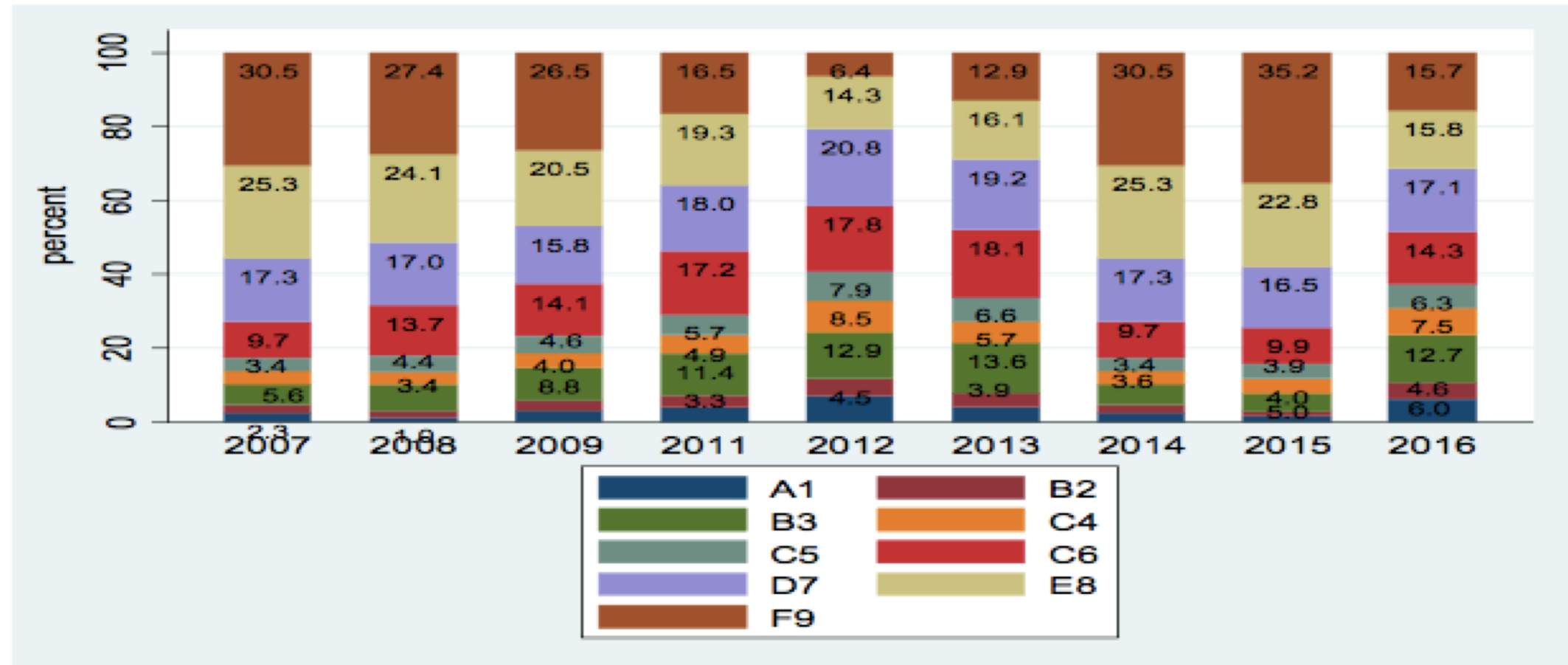


Figure 2: Bar chart showing the Proportion of WASSCE Grades Obtained in Science for 2007 - 2016

Results for Research Question 2 *Cont'd*

Table 2: Distribution of Science Grades of Sampled Schools for 2007 – 2016 in WASSCE

GRADES	2007	2008	2009	2011	2012	2013	2014	2015	2016	Total
A1	838	370	1,215	1,405	3,023	3,677	838	851	3,924	16,141
B2	758	625	1,130	1,265	1,990	3,748	758	831	2,967	14,072
B3	2,017	2,549	3,579	4,363	5,623	12,975	2,017	3,164	8,282	44,569
C4	1,301	1,214	1,639	1,875	3,713	5,420	1,301	2,513	4,910	23,886
C5	1,230	1,549	1,885	2,162	3,453	6,269	1,230	2,489	4,099	24,366
C6	3,480	4,834	5,748	6,576	7,778	17,250	3,480	6,313	9,321	64,780
D7	6,166	6,029	6,425	6,866	9,096	18,272	6,166	10,506	11,121	80,647
E8	9,046	8,512	8,345	7,384	6,250	15,282	9,046	14,480	10,297	88,642
F9	10,883	9,705	10,825	6,315	2,819	12,241	10,883	22,334	10,193	96,198
Total	35,719	35,387	40,791	38,211	43,745	95,134	35,719	63,481	65,114	453,301

Source: WAEC Data



Some Specific Highlights of Trends

For both Mathematics and Science students' performance in 2011 and 2012 was relatively outstanding compared to other years.

- These two cohorts of students experienced a four-year duration
- students were made to study only the core subjects of Mathematics, English language, Integrated Science, and Social Studies.
- An exceptional performance of candidates also emerged in 2016 compared side by side the preceding years of 2013, 2014 and 2015.



Highest Academic Qualification of Teachers

Highest Academic Qualification	No. of Science Teachers [N*(%)]	Highest Academic Qualification	No. of Mathematics Teachers [N**(%)]
B.Ed. (Science)	120(36.9)	B.Ed.(Mathematics)	129(41.6)
HND/B.Sc./B.A	126(38.8)	B.Sc.(Mathematics)/B.A./HND	121(39.0)
B.Ed. (Basic Education)	9 (2.8)	B.Ed. (Basic Education)	19(6.1)
M.Ed. (Science)	27(8.3)	M.Ed. (Mathematics)	27(8.7)
M.Phil. (Science Education)	11(3.4)	M.Phil. (Mathematics Education)	5(1.6)
M.Phil. (In Science related fields)	32(9.8)	M.Phil. (In Mathematics related fields)	9(2.9)
Total	325(100.0)	Total	310(100.0)



Distribution of Science and Mathematics Teachers' Teaching Specialization

Subject Area	No. of Teachers in their Area of Specialization [N(%)]	No. of Teachers in Out-of-Subject Area of Specialization [N(%)]	Total [N(%)]
Science	115 (72.8)	43 (27.2)	158(100.0)
Mathematics	84 (54.5)	70 (44.5)	154 (100.0)



Results for Research Question 3

- The qualifications that science and mathematics teachers of the selected senior high schools hold are presented in Table 3.
- The highest qualification of senior high school teachers was in two categories. First degree and second (masters') degree
- For the science teachers, the majority (78.5%) possess Bachelor's Degree in Science Education or related fields [the rest 21.5% possessed higher degrees.
- Similarly, among the Mathematics teachers, 86.7% possessed first degrees while the remaining 13.3% had higher degrees.
- Highlight of science and mathematics teachers teaching specialization (**See Table 4**)

Results for Research Question 3

- It was noted that Science and Mathematics syllabi were often not completed before students wrote the WASSCE.
- The majority of the respondents estimated that teachers could complete between 50-75% of the syllabus for both science and mathematics. Reasons:
 - insufficient duration to enact the curricula.
 - delay of first-year students' admission and 3rd taking examinations within the third year.

E.g., some schools admitting students in the second term of the first-year.

- Excessive extra curricula activities
- Contact hours per week for the teaching of science and mathematics short.

Results for Research Question 3

- low comprehension level of students in mathematics and science
- weak foundation of students in mathematics
- teachers and students felt that there was a *general* privation of teaching and learning materials
- truancy on the part of both some teachers and students.
- Schools not having the full complement of Science and Mathematics teachers, low interest in learning mathematics and science, poor teaching approach and laziness.
- Teachers teaching more than the stipulated number of classes and hours.
- There is little to no recognition for higher degrees making it not motivating enough for teachers to obtain higher degrees

Conclusions and Policy Lessons

- The trends established regarding the performance of WASSCE candidates in Ghana from 2007 to 2016 do not provide a definitive pattern of performance.
- However the performance of students in 2011, 2012 and **2016** that the seemed to be outstanding due to earlier reasons provided, the performance in the rest of the years could be described only as reasonably satisfactory.
- Perceived reasons related to the kinds of performance profiled the decade long study has to do with the
 - academic
 - professional qualification of teachers,
 - uncompleted curriculum for secondary schools among others.



Conclusions and Policy Lessons *Cont'd*

- The Ministry of Education and the Ghana Education Service should ensure that teachers are recruited to teach only in their areas of specialization to ensure maximum output in their fields.
- In view of the finding that there is little to no recognition for higher degrees, it is recommended that the Ministry of Education should take steps to recognize higher degrees and qualification with for instance marking the salary differentials based on teacher level of qualification and work output.
- The three years duration of secondary education on paper is less in comparison with actual period of schooling as indicated in the findings hence we recommend that there should be a systemic change in school practices so that three years of schooling actually equate to three years of academic work.



Thank you



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Citations

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