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Stratifying junior high school integrated science teachers' knowledge with qualification

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Abstract
Junior High School integrated science teachers' knowledge is a variable that determines the effectiveness of the Junior High School integrated science teachers. Junior High School integrated science teachers' effectiveness is not very often determined by output of work, but by Junior High School integrated science teachers' qualification. Ghana Education Service uses West African Senior Secondary Certificate (WASSCE) or Senior Secondary School Certificate Examination (SSSCE) as the minimum qualification needed for employment as non-professional Junior High School integrated science teachers. This arrangement raises an issue relating to quality. Do the WASSCE/SSSCE certificate holders possess Junior High School integrated science knowledge similar to Junior High School teachers whose qualifications are better? To answer this, this survey was designed to find out find out whether differences exist in Junior High School teachers' knowledge of integrated science based on their qualifications. In this survey, 57 Junior High School integrated science teachers were sampled from 83 Junior High School integrated science Teachers in the Assin North municipal. The Junior High School integrated science teachers' knowledge was tested using Junior High School Integrated Science Teachers' Knowledge Assessment Tool. The scores obtained were analyzed using both descriptive and inferential statistics. The study found that beyond SSSCE/WASSCE level, teachers' qualification does not bring about significant gains in Junior High School integrated science teachers' knowledge of integrated science.

Keywords: WASSCE, SSSCE, science teachers, Ghana education service

1. Introduction

The success of students, according to Lenon (2015) [7], depends on the quality and expertise of teachers. The quality and expertise as described by Lenon (2015) [7] has to do with the extent to which teachers understand the subject-matter. It is teachers with good subject matter knowledge who, according to Lenon, make lessons interesting for students. Teacher education programs are tailored to ensure that quality and expert teachers are produced to teach students. During their preparation, a lot of time is spent on equipping the trainees with the requisite subject-matter knowledge as well as pedagogical content knowledge (Liang, Zhang, Huang, Shi, & Qiao, 2015) [8]. It is expected that the teacher with the least qualification has the least expertise and quality, while the one with the highest qualification is of good quality and has the best expertise. It is for this reason that expertise and quality is measured with the qualification of teachers and salaries accordingly.

Teaching qualification, according to Abe and Adu (2013) [2], refers to any one of the many academic and professional certificates that is a required in order to be registered as a teacher. In Ghana, teaching qualification includes Teachers' Certificate 'A', Diploma in Basic Education, Bachelor of Education, Master of Education, Master of Philosophy (with education) and Doctor of Philosophy (with Education). Due to vacancies in some schools, some individual who do not have any of the teaching qualifications mentioned are allowed to practice as non-professional teachers. Such individuals use academic qualification, without professional training, starting from West African Senior Secondary Certificate (WASSCE) or Senior Secondary School Certificate Examination (SSSCE). Even though those using academic qualification to teach do not have professional training, the academic training they received equipped them with subject-matter content knowledge, which may be better than that of the professional teachers (Lennon, 2015) [7].

Even though teaching qualification is used as a measure of teacher quality and expertise, research into the effect of teacher quality and expertise is inconclusive (Hanushek, & Rivkin, 2006; Zuzovsky, 2011; Abe, 2014) [3, 12, 1]. While some researchers have found advanced qualification positively correlating with teacher quality (Harris & Sass 2011; Unanma, Abugu, Dike, & Umeobika, 2013; Abe, 2014) [4, 11, 1] others like (Palardy, & Rumberger, 2008; Harris & Sass, 2011; Musau & Abere, 2015) [4, 9] have found that gaining advanced qualification makes no difference in teacher quality. It is evident, that measures of teacher expertise and quality like educational level has been well researched, however, there is not much definitive evidence, empirically, that higher qualifications would necessarily make a quality teacher.

For researchers like Unanma, Abugu, Dike, & Umeobika (2013) [11] and Abe (2014) [1], it is good to possess higher teaching qualification, not just for the money, but to bring about better learning in students. To them higher qualification means getting extra knowledge those with lower qualifications do not have. By implication, the teachers with higher teaching qualification possess better subject-matter content knowledge. For example, Unanma, Abugu, Dike, & Umeobika (2013) [11] found that teachers who have higher qualifications are in good position to lead students to achieve more, because they have been equipped with knowledge to teach their subjects. They also mentioned that, teachers who continually upgrade their knowledge by going for further education will be able to easily manipulate the teaching and learning process to make learning easier for students. Abe's (2014) [1], conclusion on the effect of teaching qualification on teacher expertise was much straight forward; professional

qualification is the key variable that influences students' performance.

Others disagree. Musau & Abere's (2015) [9] findings suggest that attaining higher qualification does not significantly influence teacher expertise. To them students' performance in science and mathematics can be enhanced by factors, such as career growth of teachers, which tend to lead teacher job satisfaction. Musau & Abere's (2015) [9] were by this suggesting, it is teachers' commitment to work that makes the difference and not necessarily the teaching qualification they hold. According to Harris & Sass (2011) [4], productivity of elementary school teachers does not correlate with advanced degrees. Harris & Sass (2011) [4] were of the view that using degrees to determine the salaries of teachers is not a good way of compensating basic school teachers, instead, salary schedules should be based on the productivity levels of the teachers.

Knowing that the certificate holder has not taken as much content courses like the masters' degree holder makes it a bit odd for disagreement to exist on whether or not teaching qualification makes, a difference in teacher expertise. In the mist of the disagreement, Kimani, Kara, & Njagi (2013) [6], found a place to perch. They found that teaching qualification does not a difference and makes a difference at the same time. They found that teaching qualification makes a difference only up to the first degree, beyond that, no gain in teacher expertise and quality comes as a result of higher teaching qualification. So, one can conclude that, attaining higher teaching qualification makes a difference, but it does so only up to a point.

It appears Ghana Education Service has taken SSSCE/WASSCE as the point qualification stops making a difference in basic school teachers' knowledge. Due to shortage of professional teachers, Ghana Education Service (GES), employs people who do not have professional teaching qualifications to fill the vacancies. The minimum qualification for the non-professional teachers is SSSSCE/WASSCE. Though GES employs holder of Higher National Diploma (HND), first degree and second degree holders who do not have certificates in education, the majority of non-professional teachers teaching in Junior High Schools are those having the minimum qualification. The first and second degree holders prefer teaching in Senior High Schools to Junior High Schools.

There are more SSSCE/WASSCE graduates teaching in private schools than in public high schools. According to GES (2015), as of 2015, 87.8% of the 77,289 teachers in the public Junior High Schools were professional teachers. In the private Junior High School, the situation was worse. A whopping 83.5% of the 26,119 teachers were non-professional teachers. Many private schools in Ghana have a challenge recruiting professional teachers because of issues relating to remuneration. For many, they hire just one to two professional teachers to professionally manage the affairs of the school. This study did not examine private Junior High School integrated science teachers' knowledge of integrated science nor knowledge of Junior High School integrated science teachers in general. It only sort to examine the Junior High School integrated science teachers' knowledge, in order to find out whether or not Junior High School integrated science teachers' knowledge relate their qualification.

Method

The research design used in the study was survey. The design was used to find out whether differences exist in Junior High School teachers' knowledge of integrated science based on their qualification. To do this, 57 public Junior High School integrated science teachers in the Assin North Municipal, Ghana, were randomly sampled from a total of 87 public Junior High School integrated science teachers in the municipality. The sampled teachers were asked to take respond to items in the Science Teachers' Subject-matter Content Knowledge Assessment Tool.

Instrument

Science Teachers' Subject-matter Content Knowledge Assessment Tool was the instrument used to in collecting data from the Junior High School integrated science teachers. The instrument was designed by the researcher, purposely for this study. The Junior High School integrated science syllabus is organized according to years and sections. For each year, unites are organized according to the same sections. Basic Education Certificate Examination (BECE) questions are set to cover the three years as well as the sections in the Junior High School integrated science syllabus. In developing the tool, the researcher selected 30 multiple choice items across the sections and years to ensure content validity. The 30 items constituted Part II of the instruments. In Part I, some demographic data were collected from the teachers. After pre-testing the instruments, the sampled Junior High School integrated science teachers were asked to answer the items in the presence of the researcher and at their respective schools within 40 minutes. The items were scored dichotomously and the scores were analyzed using both descriptive and inferential statistics.

Results

Teachers were asked to indicate their highest qualification by selecting from a number of researcher defined qualifications. Those whose qualification was not part of those defined were given the option to specify their qualification. However, none of the respondents indicated they have qualifications other than what had been specified. The distribution of teachers with respect to their qualification has been presented as part of data in Table 1. The mean scores of teachers in these categories were computed and analyzed using means and analysis of co-variance.

Table 1: Mean Scores of Teachers Based on Qualification

Academic Qualification	Mean	N	Std. Deviation	Minimum	Maximum	Variance
SSSCE/WASSCE	18.5714	7	4.64963	13.00	27.00	21.619
Teachers' certificate 'A'	22.7500	4	5.37742	17.00	30.00	28.917
Diploma	25.4750	40	3.18641	16.00	30.00	10.153
Bachelor	25.5000	6	3.01662	22.00	29.00	9.100
Total	24.4386	57	4.14047	13.00	30.00	17.143

The mean scores appeared proportional to the qualifications. The least qualification, SSSCE/WASSCE had the least mean (18.5714), while the highest qualification, Bachelor, had the highest mean score (25.5000). Though the score for those holding diploma and Bachelor only differed by 0.025, it did not alter the trend of the mean score increasing with increasing levels of qualification.

The minimum and maximum scores deviated from the trend observed with the mean scores. Respondents with the least qualification, SSSCE/WASSCE, had the poorest minimum and maximum score of 13 and 27 respectively. However, respondents with the highest qualification had the best minimum score, but not the best maximum score. Teachers holding Teachers' Certificate 'A' and Diploma had the highest score of 30, but those holding Teachers' Certificate 'A' had a better minimum score than those holding diploma. The expected trend of the maximum and minimum scores increasing with the increasing level of qualification was shattered by these values.

Analysis of variance was conducted to find out whether the mean scores for the various categories of qualifications were statistically different. A test for homogeneity using Levene's test was conducted.

Table 2: Test of Homogeneity of Variances of Groups Based on Qualification

Levene Statistic	df1	df2	Sig.
.699	3	53	.557

The Levene statistic shown in Table 2 indicates that at p=0.05, the test for homogeneity was passed, p > 0.05. This implies that equal variances cannot be assumed and so the post-hoc test was done using Scheffe.

Table 3: Analysis of Variance for Teachers Based on Qualification

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	302.096	3	100.699	8.112	.000
Within Groups	657.939	53	12.414		
Total	960.035	56			

As shown in Table 3, there is a statistical significant difference in the mean scores of holders of SSSCE/WASSCE, Teachers' certificate 'A', Diploma and Bachelor: F (57) = (8.112), p = 0.000. This is an indication that teachers' qualification has an impact on teacher knowledge, because the different groups showed differences in their level of knowledge of Junior High School integrated science. The differences in mean across the groups was large. The effect size calculated using eta squared was 0.31467 (31.467%). However, it is not clear where the difference(s) lie. A post-hoc test was conducted to identify the categories that differed.

Table 4: Analysis of Variance Post-hoc Comparison of Mean Scores of Various Certificate Holders

	Academic Qualification	Academic Qualification	Mean Difference	Std. Error	Sig.
Games-Howell	SSSCE/WASSCE	Teachers' certificate 'A'	-4.17857	3.21210	.596
		Diploma	-6.90357*	1.82819	.028
		Bachelor	-6.92857*	2.14595	.037
	Teachers' certificate 'A'	SSSCE/WASSCE	4.17857	3.21210	.596
		Diploma	-2.72500	2.73551	.763
		Bachelor	-2.75000	2.95734	.792
	Diploma	SSSCE/WASSCE	6.90357*	1.82819	.028
		Teachers' certificate 'A'	2.72500	2.73551	.763
		Bachelor	-.02500	1.33060	1.000
	Bachelor	SSSCE/WASSCE	6.92857*	2.14595	.037
		Teachers' certificate 'A'	2.75000	2.95734	.792
		Diploma	.02500	1.33060	1.000

The post-hoc comparison conducted using Games-Howell test shows that the mean score of respondents holding SSSCE/WASSCE (M=18.5714, SD=4.64963) was not significantly different from the mean score of holders of Teachers' Certificate 'A' (M=18.5714, SD=4.64963). However, the mean score of respondents holding SSSCE/WASSCE (M=18.5714, SD=4.64963) differed significantly from the mean scores of holders of Diploma (M=25.4750, SD=3.18641) and Bachelor (M=25.5000, SD=3.01662). The mean scores of holders of Teachers' Certificate 'A' (M=18.5714, SD=4.64963) was not significantly different from the mean scores of holders of SSSCE/WASSCE (M=18.5714, SD=4.64963), holders of Diploma (M=25.4750, SD=3.18641) and holders of Bachelor (M=25.5000, SD=3.01662). Finally, the mean scores of holders of Diploma (M=25.4750, SD=3.18641) was not significantly different from the mean score of holders of Bachelor (M=25.5000, SD=3.01662). The only difference in teacher knowledge of junior integrated science exists between the holders of SSSCE/WASSCE on one hand and the holders of Diploma and bachelor on the other hand. To determine the degree to which the mean scores of SSSCE/WASSCE and the other certificate holders varied, the two mean scores were computed and compared.

Table 5: Mean Scores of Other Certificate Holders and SSSCE/WASSCE holders

Teacher Type	N	Mean	Std. Deviation	Std. Error Mean
SSCE/WASCE	7	18.5714	4.64963	1.75739
Other Certificates	50	25.2600	3.36737	.47622

There was a difference between the mean scores of the professional teachers and non-professional teachers. This difference was found to be statistically different. The independent samples t-test conducted, revealed that there is a statistically significant difference between teacher knowledge of professional integrated science teachers (M=25.2800, SD=3.36737) and teacher knowledge of non-professional integrated science teachers (M=18.5714, SD=4.64963). So, the SSSCE/WASSCE do not have weak knowledge in integrated science only because they hold the least certificate, but also because they are non-professional.

Discussion

Teachers' qualification makes a difference. Musau & Abere (2015) [9], suggested that there is no need attaining higher qualification as a teacher, because it does not bring about any difference in teacher expertise. However, like Abe (2014) [1] found, higher qualification leads to increased teacher knowledge which eventually leads to becoming a better teacher. The teacher must have a good understanding of the subject-matter in order to bring about meaningful learning in students. Obtaining a higher qualification enhances one's understanding of subject matter, only because the teachers with the highest qualification, in integrated science, for example, have taken more courses in integrated science and so would make a difference, regarding knowledge of integrated science in the classroom.

The difference qualification brings was evident in the result presented. The mean scores of 18.5714 for SSSCE/WASSCE holders and 25.5000 for the six first degree holders attest to this. While the SSSCE/WASSCE holders had the minimum qualification, Bachelor degree was the maximum for the sample. From this, it can be seen that the performance of the various groups of teachers reflected their qualification. The SSSCE/WASSCE had not studied more courses in integrated science compared to the other groups. At the individual level, there were respondents with lower certificates who had superior subject-matter content knowledge. For example, the minimum score of the bachelor degree holders was 22, while the maximum score for the SSSCE/WASSCE holders was 27. Another example can be seen by comparing, by comparing the maximum score of the Teachers' Certificate 'A' holders and the bachelor degree holders. One of the four Teachers' Certificate 'A' had all questions correct while none of the bachelor degree holders had all questions correct.

Statistically, differences in the mean scores were mixed. The findings of the study were close to what Kimani, Kara Njagi (2013) [6] found. The mean scores revealed that, of the four groups, it was only the SSSCE/WASSCE holders whose mean scores differed. This suggests that, like Kimani, Kara Njagi (2013) [6] found, teacher qualification does not make a difference in Junior High School integrated science teachers' knowledge of integrated science after attaining a certain qualification. For the sample used in the study, Junior High School integrated science teachers make insignificant gains in their knowledge of Junior High School integrated science after the SSSCE/WASSCE level. Had it not been that the Teachers' Certificate 'A' program has been phased out since 2004, it would have represented the level at which qualification ceases to lead to significant difference in Junior High School integrated science teachers' knowledge of integrated science.

Conclusion

The effect of qualification on Junior High School integrated science teachers' knowledge cannot be said to be strictly directly proportional. Even though it is good to have higher qualification, it would not automatically translate to enhanced knowledge of integrated science. This is because, beyond SSSCE/WASSCE, teacher qualification ceases to cause gains in Junior High School integrated science teachers' knowledge. It would therefore be appropriate for GES to stop using SSSCE/WASSCE as the minimum qualification for non-professional teachers and use Diploma instead, since the holders of diploma and Bachelor have just about the same knowledge of Junior High School integrated science.

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