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The Impact of In-service Teacher Training Through an Outreach Program on the Content Knowledge of Basic School Mathematics Teachers in Ghana

University of Cape Coast, Ghana
Ernest Kofi DAVIS[1]
Hiroshima University
Takuya BABA
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1. Background and Objectives of the Study

In 1987, the government of Ghana instituted a nation-wide reform in the educational system beginning from the basic school[2] level. The main aims of this reform were (1) to improve the access and participation of all school age children, (2) to improve the quality of education, and (3) to change the duration of pre-university education from 17 years to 12 years[3]. The reform changed the curricula of all pre-university institutions as well as their subjects of study, including mathematics. The curriculum reform in mathematics, in particular, consisted not only of the reorganization of the existing curriculum and introduction of new content, but also of the introduction of new ways of teaching and assessing student learning (MOE, 2000). This reform was mainly influenced by the idea of pragmatism in education from the United States of America.

After a decade of this extensive reform, Ghana still faces problems in her educational system in general, and in the teaching and learning of mathematics in particular. The problems include a lack of teachers, poor teaching methods, and poor learning achievement of students, especially in mathematics (Bennet, 2003; Annamuah-Mensah, 1998; Africa Recovery, 1998). It is therefore believed that many of these teachers should take an upgrading course in a long term as opposed to traditional short in-service training, and at the same time steps need to be taken to control the annual shortage of teachers.

This has led the Institute of Education at the University of Cape Coast, Ghana to establish Outreach Programs (otherwise known as evening classes) as a way of helping to improve teachers' knowledge and practice as well as students' learning, and also to control the annual shortage of teachers. In this program teachers stay on their jobs and attend training sessions at the training center at the close of work every day. There are two courses within this program. Teachers are awarded a Diploma in Basic Education at the end of two years and a Post Diploma Bachelor of Education degree in Basic Education at the end of four years. From 1998, the year when the program started until 2002, 430 teachers had obtained Diplomas and 162 had obtained Post Diplomas through this program.

Campus-based training, where teachers take study leave, thereby exacerbates the problem of teacher shortage. On the other hand, in a distance

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[1] This author was a graduate student of Graduate School of International Development and Cooperation, Hiroshima University when he made this presentation. In October, 2004, he has gone back to Ghana, and he is currently a lecturer in University of Cape Coast.

[2] Basic school level means both primary school and junior secondary schools. Main focus of this paper is on primary school level.

[3] The structure of pre-university education was changed from 6 years of primary education, 4 years of middle school education and 7 years of secondary education, to 6 years of primary education, 3 years of junior secondary and 3 years of senior secondary education.

education, where teachers meet their lecturers once a month, teachers teach and up-grade themselves simultaneously. The main benefit of the Outreach Program is that it offers teachers the opportunity to put their new learning into practice immediately and observe its effectiveness. Few studies, however, have been done to ascertain how effective this initiative has been.

Moreover a study conducted by Akyeampong et al (2000), revealed that teachers in Ghana enter the training with a weak mathematics background, and several other studies have shown that elementary school teachers also seem to have a weak mathematics background. As for in-service training, training in some cases does not offer them the opportunity to deepen their understanding of mathematics (Wheeler and Feghali, 1983; Comiti, C. and Ball L.D., 1996), but Weiss, Boyd and Hessling (1990) observed that in-service programs intending to teach teachers mathematics do indeed increase teachers' knowledge in mathematics.

It is therefore against this background that the researchers have chosen to investigate whether the training program offered by the University of Cape Coast is improving participants' content knowledge of mathematics or not. In other words, the purpose of the study is to ascertain the impact of the aforementioned in-service training by the Outreach Program on teachers' content knowledge and the source of motivation to attend training, while the whole study has also covered pedagogical skills and attitudes.

2. Research Methodology

In order to pursue this purpose, the case study method was considered, and the following questions have been posed to guide the study;

i. What is the motivation of the teachers to attend in-service training through the Outreach program?

ii. What impact, if any, do teachers see of the Outreach Program on their content knowledge level in mathematics?

iii. What is the difference, if any, in the content knowledge of in-service trained and non in-service trained teachers?

In conceptualising the impact of the above mentioned in-service training, the researchers sought to compare in-service trained teachers with non in-service trained teachers at one level, and, at another level, outsiders' perceptions about the impact of the training were solicited to increase the internal validity of the findings of this study (Figure 1).

Two research instruments, questionnaire and observation checklist, were prepared. The data collected were analysed using both quantitative and qualitative approaches.

The training draws teachers from all 12 districts in the central region of Ghana. Participants and non-participants, as well as the head teachers and the circuit supervisors[4], were mainly drawn from four districts in the central region of Ghana, namely, Cape Coast district, Komenda-Edina-Eguafo-Abrem (K.E.E.A) district,

[4] Circuits supervisors play the role of school inspectors in Ghana.

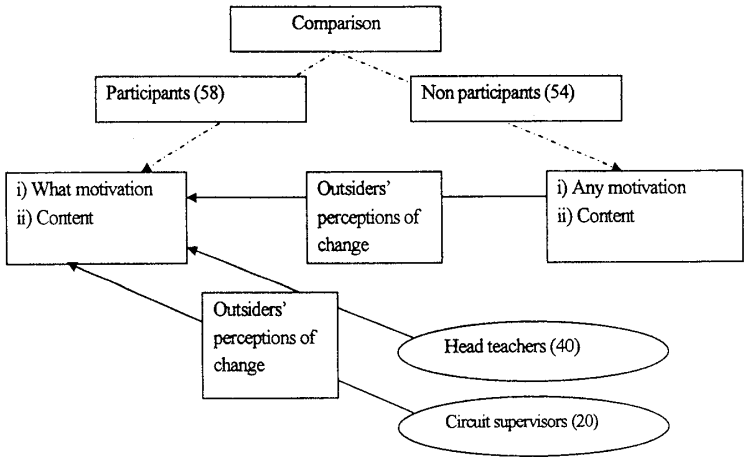

Figure 1 Conceptual Framework of Research (Produced by Researchers)

Table1 Research Instruments and Number of Subjects

	Questionnaire		Lesson Observation
	Number administered	Number returned and valid	
Participants	90	58	6
Non-participants	90	54	6
Head Teachers	70	40	Not applicable
Circuit Supervisors	20	20	Not applicable

Jukwa-Twifo-Praso-Upper Denkyira district and Abura Dunkwa district. The relationship between the research instruments and the number of subjects is presented in Table1.

The target population consisted of all 592 in-serviced trained teachers who had graduated from the Outreach Program, those who had not had this training, head teachers and circuit supervisors in the central region. The valid sample consisted of 58 participants, 54 non-participants, 40 head teachers and 20 circuit supervisors from 4 districts (Table 1).

Only schools where teachers participated in the Outreach Program were used as a sample, implying not all basic teachers (participants and non-participants) had an equal chance of being involved in the study.

As for the observation, three schools were selected from the Cape Coast district. Participants and non-participants for this study were selected from the same schools, and there is no difference between them in terms of teaching experience and teaching practice score, which was given in the Teacher Training College (TTC).

Further description of each of the research instrument is provided as follows:

The questionnaires (See ANNEX 1) were administered at the training centers, schools and district education offices by the researcher and four experienced mathematics educators, who also assisted with the observation activity. They scored the teaching of the teachers, using a standard observation checklist (See ANNEX 2) developed by the Faculty of Education of the University of Cape Coast. In all, 12 teachers, 6 participants and 6 non-participants, from 3 Basic schools in the Cape Coast district were observed. 10 of them were selected from the primary schools (Grade1 to 6) and 2 from the junior secondary schools (Grade7 to 9). For each observation, two experienced mathematics educators and the researcher observed the teachers' teaching.

3. Results and Discussion

The personal characteristics, the motivation of teachers to participate in the program, and the content knowledge of the teachers are presented and discussed using descriptive statistics such as the mean and deviation. Concerning their content knowledge, the teachers' strengths and

Table 2 Biographical Data of Respondents.

Number of Respondents in brackets	Gender	*Age (years)	Class	**Teaching/work Experience (years)	Qualification
Participants(58)	M (46.6%) F (53.4%)	1 (46.6%) 2 (32.8%) 3 (17.2%) 4 (3.4%)	Primary (75.9%) JSS (24.1%)	1 (50.0%) 2 (22.4%) 3 (15.5%) 4 (12.1%)	Diploma in Basic Education(100%)
Non-participants(54)	M (40.7%) F (59.3%)	1 (68.5%) 2 (22.2%) 3 (7.4%) 4 (1.9%)	Primary (72.2%) JSS (27.8%)	1 (74.1%) 2 (14.8%) 3 (3.7%) 4 (7.4%)	Certificate A*** (90.7%) Other (9.3%)
Head Teachers(40)	M (52.5%) F (47.5%)	1 (22.5%) 2 (30.0%) 3 (27.5%) 4 (20.0%)	N/A	1 (65.0%) 2 (7.5%) 3 (7.5%) 4 (20.0%)	Certificate A (27.5%) Diploma (30.0%) B.Ed (27.5%) Master (10.0%) Other (5.0%)
Circuit Supervisors(20)	M (80.0%) F (20.0%)	1 (30.0%) 2 (30.0%) 3 (40.0%)	N/A	1 (90.0%) 2 (5.0%) 4 (5.0%)	Certificate A (15.0%) B.Ed (70.0%) Master (15.0%)

Notes

*Age (years); 1-(less than 35), 2-(35-44), 3-(45-54), 4-(more than 54)

**Teaching/work experience (years); 1-(less than 11), 2-(11-15), 3-(16-20), 4-(more than 20)

***Certificate A is the certificate awarded to teachers who complete a three-year post secondary teacher training course

weaknesses are analysed from various perspectives.

3. 1 Personal Characteristics of Teachers, Head Teachers and Circuit Supervisors

Table 2 shows the result of the Section A of the questionnaire. It can be observed that more than half of the participants and non-participants were female, whereas more than half of the head teachers and circuit supervisors were male. 79.4% of the participants and 90.7% of the non-participants were less than 45 years of age. Correspondingly, the majority of the participants (72.4%) and non-participants (88.9%) had less than 15 years working experience. Only 12.1% of the participants and 7.4% of the non-participants had more than 20 years of teaching experience. This is an indication that compared to Japan (Adu-Yeboah, 2002), basic school teachers in Ghana change their jobs very often.

Teaching is attractive to people, not just as a career, but because of many incentives it provides in the first few years of training and teaching, such as allowances, food, and an alternative route to higher education (study leave). In general, study leave is not seen as an opportunity to develop one's skills as a basic school teacher but as a way to leave the sector altogether (Hedges, 2000). This situation is deplorable and some steps should be taken to change it.

3. 2 Motivation

Against the item 1 in the attached questionnaire, the motivation of teachers to attend training as perceived by teachers, head teachers and circuit supervisors are presented in Table 3 below.

From Table 3, it can be observed that all the non-participants had heard about the program, with the majority (96.3%) of them believing that it was necessary for them to improve their competence in teaching. The rest did not see the need because they were nearing retirement age. It should be noted that this training does not provide the opportunity for teachers to leave basic school teaching, since they have to teach and upgrade themselves simultaneously.

67.2% of the participants were encouraged either by their spouse, friends or superiors to take advantage of the program. 46.6% of participants and 42.6% of non-participants had heard about the program through friends. The majority of the teachers, both participants (82.8%) and non-participants (79.6%), obtained or wanted to obtain further training because of the need to improve their teaching skills. 51.6% of the head teachers and the circuit supervisors believed that the main reason for teachers was to improve their teaching skills.

There seemed to be some differences in opinion between head teachers, circuit supervisors

Table 3 Motivation to Attend Training

Respondents	Have you heard about the program?	Do you have plans for further studies?	Were you encouraged to attend?	**Where did you hear about the program?	*Main reason to attend the course
Participants	N/A	N/A	Yes (67.2%) No (32.8%)	F (46.6%) A (20.7%) UB (19.0%) P (13.8%)	T (82.8%) S (12.1%) L (1.7%) O (3.4%)
Non-participants	Yes (100%)	Yes (96.3%) No (3.7%)	N/A	F (42.6%) A (7.4%) UB (16.7%) P (33.3%)	T (79.6%) S (14.8%) L (1.9%) O (3.7%)
Heads/ Circuit Supervisors (Perception)	N/A	N/A	N/A	N/A	T (51.6%) S (36.7%) L (6.7%) E (5.0%)

Notes

*T-(to improve teaching), S-(get a better salary), L-(afraid of losing job), E-(everybody is obtaining degree/Diploma), O-(other reasons).

**F-(through friends), A-(through advertisement), UB-(through the University's Brochure), P- (through participants)

and teachers but it is clear that the vast majority answered that the main motivating factor was to improve the teachers' teaching skills.

Here again there is no difference between participants and non-participants in terms of information sources and reasons. For those non-participants, they were not able to attend the course because of family problem, financial problem etc.

3. 3 Content Knowledge

The content knowledge of teachers is analysed in three aspects, including problem area, improvement of content knowledge and observation of classroom teaching. The problem area aims at identifying topics that are problematic for teachers. The second aspect of the analysis targets the improvement of content knowledge. Responses by teachers may be biased, and this study therefore has counter-checked this possibility by soliciting a third party's perception and observation of lessons, which is the third aspect.

3. 3. 1 Problem Area

Against the item 25 (b) in the attached questionnaire, the majority of the participants and the non-participants stated they had or used to have a problem in teaching at least one of the following topics in mathematics. These include; fractions (addition of fractions with different denominators, decimal fractions, division of fractions), long division, ratio and proportion, measurement (conversion from one unit to another; time, length, weight), statistics and probability (collecting and handling of data), word problems and others (i.e. algebra, construction, quadratic equations, factorisation and transformation).

81% of the participants claimed to have had a problem in teaching at least one of the topics mentioned above. The details of such problems are shown in the Table 4. Out of those who declared a problem in teaching certain topics, 28.2% named fractions, followed by statistics and probability (25.2%), and measurement (17.1%).

63% of the non-participants declared they had a problem in teaching at least one of the topics mentioned above in mathematics. Compared with the participants, more of the non-participants believe that they had no problem. This may be due to the fact that the participants were exposed to new approach of teaching, which enabled them to accept that they had a problem. Out of the 63% of non-participants who declared that they had a problem in teaching certain topics, 30% of them named fractions, followed by statistics and probability (24%), and long division (16%) (See Table 4).

67.5% of the head teachers indicated that in their view, teachers had a problem in teaching at least one of the above-mentioned topics in mathematics. The remaining 32.5% thought otherwise. This is probably due to the fact that few schools have started experimenting with subject teaching at all levels instead of only at grades 7, 8, and 9. Unlike the head teachers and the teachers, all the circuit supervisors indicated that teachers had a problem in teaching at least one of the topics mentioned above in

Table 4 Problematic Topics for Teachers

	Fractions (F)	Long Division (LD)	Ratio and Proportion (R&P)	Measurement(M)	Statistics(S)	Word Problem(W)	Other (O)
Participants	28.2%	9.9%	6.3%	17.1%	25.2%	9.9%	2.7%
Non-Participants	30%	16%	10%	14%	24%	8%	0%
Head Teacher	26.5%	19.1%	1.5%	20.6%	16.2%	13.2%	2.9%
Circuits Supervisors	35.2%	11.8%	7.8%	17.6%	19.6%	7.8%	0%

mathematics. This may be due to the nature of their work.

It must be noted that all the respondents indicated that fractions (addition of fractions with different denominators, decimal fractions and division of fractions) was the most "troublesome" topic.

Fractions remain as a problem probably because of the level at which fractions are introduced at the primary school. Even though officially fractions are supposed to be introduced at the grade two, in reality they are introduced right from grade one. In grade one, pupils are introduced to the concept of subsets (Ministry of Education 1997, p.7) and in grade two they are required to identify fractions up to 1/8, compare fractions, find multiples of fractions and order fractions (Ministry of Education 1997, p.25, p.31).

3.3.2 Improvement of Content Knowledge of the Participants as Perceived by Themselves

Table 5 shows the extent to which participants' problems had been solved against 25(c) in the attached questionnaire. From Table 5 it can be seen that the majority (98.7 %) of participants who had stated they had a problem, had their problems solved to some extent, with only 1.7% not yet having their problems solved.

Thirty-four participants (58.6%) currently say that they do not have any problem in teaching mathematics. The remaining twenty-four (41.4%) admit that they still have problems in teaching certain topics. Out of this group, six (10.3%) of them have a problem in teaching fractions; it should therefore be noted that fractions continue to be the major problem for participants.

3.3.3 Improvement in Content Knowledge of Participants as Perceived by Outsiders

Table 7 shows the impact of training perceived by participants and outsiders against item 10 in the attached questionnarie. It can be seen that 94.8 % of the participants and 77.8 % of non-participants either strongly agreed or agreed that the program had helped the participants to improve their content knowledge in mathematics. And 85 % of the head teachers and 90% of the circuit supervisors also either strongly agreed or agreed that the outreach program had helped participants to improve their content knowledge level in mathematics.

Table 5 Participants' Problem(s) Solved.

Extent	Totally Solved	Quite Solved	A little Solved	Not Solved
Participants (%)	8.6%	65.5%	24.1%	1.7%

Table 6 Distribution of Difficult Topics Before and After the Program

	Fractions	Long Division	Ratio and Proportion	Measurement	Statistics	Word problem	Others
Before	32	11	7	19	28	11	3
After	6	3	0	0	1	0	5

Table 7 Impact as Perceived by Participants and Outsiders

Statement	Role	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Outreach Program has helped participants to improve their content knowledge in mathematics	P	39.6%	55.2%	5.2%	—	—
	N-P	33.3%	44.5%	18.5%	3.7%	—
	HD	32.5%	52.5%	10%	5%	—
	S	35%	55%	10%	—	—

Notes

P-(Participants), N-P-(non-participants), HD-(head teacher), S-(circuit supervisors)

Table8 Distribution of Scores on Content Level

Content	Role	1	2	3	4	5	Mean	Standard deviation
In lesson preparation	P	–	–	–	83.3%	16.7%	4.17	0.39
	N-P	–	–	41.7%	50%	8.3%	3.67	0.65
In teaching	P	–	–	–	91.7%	8.3%	4.08	0.29
	N-P	–	–	25%	66.7%	8.3%	3.83	0.58

Notes
P - (Participants), N-P - (Non-participants), 1-weak, 2- below minimum, 3-minimum, 4-good and 5-outstanding

3. 4 Observation of Lesson

The researcher conducted lesson observation, using the lesson observation checklist, with the help of four mathematics educators, one each from a basic school and a secondary school and two lecturers from the Department of Science Education, University of Cape Coast. This tool has been developed by University of Cape Coast as a standard tool for lesson observation and is commonly used by circuit supervisors. The observers confirmed the assertions of teachers, head teachers and circuit supervisors used in this survey, that the training had improved the content knowledge of participants. During the observation, apart from one participant who fumbled with the concept of zero while teaching subtraction facts, the rest did not have any problem with content in their teaching. In contrast, three of the non-participants had a problem in teaching the various topics.

The scores of the participants and non-participants on their content as demonstrated in their lesson notes and in their actual teaching are presented in Table 8. It shows that the score of the participants in their lesson preparation ranged between 4 (good) and 5 (outstanding), with a mean of 4.17 and a standard deviation of 0.39, and that of the non-participants ranged between 3 (minimum) and 5 (outstanding), with a mean of 3.67 and a standard deviation of 0.65.

With regard to the actual teaching, the scores of the participants ranged from 4 (good) to 5 (outstanding), with a mean of 4.08 and a standard deviation of 0.29, while the score of the non-participants ranged from 3 (minimum) to 5 (outstanding) with a mean of 3.83 and a standard deviation of 0.58. It must be noted that, as compared with the non-participants, the participants exhibited a good level of content knowledge both in their lesson preparation and in their teaching.

3. 5 Comments

These were the comments by the author and four mathematics educators about the observed teachers (both participants and non-participants) regarding their content knowledge in mathematics:

Mr. X, a participant and a grade three teacher, in teaching subtraction facts, kept telling pupils that it was wrong to start a number with zero. He attracted the comment that "this fact about zero is a misconception because for decimals, zero can precede a number (example 0.000278). It is only true for whole numbers".

Mr. J, a non-participant and a grade five teacher, in teaching prime factorisation defined a prime number as a number which has only two factors; one and the number itself. He forgot emphasizing the fact that the two factors must be distinct. He either did not know that fact or refused to teach it. When he asked students to give examples of prime numbers, a child mentioned one. The teacher got confused and accepted one as a prime number. From his definition of the prime number as number having only two factors, that are one and the number itself, these children first write one, and add the number in question, say two, if they can not find other factors (i.e. 1, 2 as factors of 2) and conclude that two is a prime number. When it got to the case of the number one, the child wrote one first as usual, and went ahead to write one which is the number in question (i.e. 1, 1 as a prime

number). He attracted some doubt from the assessor regarding the question "What is the definition of a prime number?"

Ms Z, a non-participant and grade two teacher, in teaching subtraction fact, attracted the comment that the "teacher should know that 28 from 13 means 13-28 not 28-13, this misconception must be corrected."

Ms K, a non-participant and Junior Secondary School teacher had a problem in explaining the concept of finite and infinite sets. She attracted comments like "Choice of real life examples should be made carefully, notation for listing elements in curly brackets {2,4,6 etc} is not the convention. Use three dots to show that a set is infinite {2, 4, 6 ...}"

From the above comments it is evident that, compared to the participants, more of the non-participants seemed to have a problem with certain basic concepts in mathematics.

4. Conclusion

Both participants and non-participants are not essentially different in terms of personal characteristics and motivation. Based on the findings of the study, the following conclusions have been drawn, within the limitations of the study, against the questions set at the beginning:

i. The main motivating factor for attending the program is the desire to improve teachers' teaching skills in mathematics, and to meet the current trends in teaching and learning of mathematics, and this accounted for many teachers who join the program in the four districts where the survey was carried out.

ii. Participants in the Outreach Program were found to have better content knowledge in mathematics compared with their non-participant counterparts. The outsiders also confirmed that the Outreach Program has improved participants' content knowledge level in mathematics

iii. There is a little difference between participants and non-participants in terms of their content knowledge. It should however be noted that non-participants perceived the problems less frequently than participants.

Hence, in-service teacher training through the Outreach Program seems to be improving teachers' content knowledge level in mathematics, but this research could only reveal some facts related to its impact of the program through case study method. Therefore, further research is needed to establish its impact in a larger scale.

The following recommendations have been put forward for future studies in this area:

i. Fractions seem to be the major problem for teachers in the Central Region. In order to improve the quality of teaching, further research is needed, especially content-based research on why certain topics, such as fractions, are problems.

ii. The findings of this study should be confirmed in other districts, in terms of increasing the number of teachers in the research sample, and making lesson observations across different topics.

References

Adu-Yeboah, C. (2002). *A case study of school based in-service training in Japan.* Unpublished master thesis, Hiroshima University.

Akyeampong, K. & Furlong, D. (2000). *A baseline study of the teacher education system in Ghana*, MUSTER discussion Paper No7, CIE, University of Sussex.

Annamuah-Mensah, J. (1998). *Science education as a tool for national development: The missing framework.* Paper prepared for presentation at Eastern Washington University. Online at: http://cehd.ewu.edu/faculty/ntodd/GhanaUPLP/Science_Education_Ghana.html.

Bennett, A. (2003). 320 *Keta classrooms without teachers.* The Ghanaian chronicle on the web, vol.11. Online at: http//www.ghanaian-chronicle.com/page2d.htm.

Comiti, C. & Ball, D. L. (1996). Preparing teachers to teach mathematics: A comparative perspective. In Bishop A. J., Clements K., Keitel C., Kilpatrick J. & Laborde C. (eds). *International handbook of mathematics education*, Vol.2, pp.1123-153, Dordrecht, Holland: Kluwer Academic.

Copeland, R. W. (1984). *How children learn mathematics: teaching implications of Piaget's research*, 4th edition. New York: Macmillan Publishing Company.

Hedges, J. (2000). *The importance of posting in becoming a teacher in Ghana*, MUSTER discussion Paper No13, CIE, University of Sussex.

Curriculum Research and Development Division (CRDD) (1997). *Mathematics syllabus for primary schools*, Ghana Education Service, Accra, Ghana.

Ministry of education of Ghana (MOE), (2000). *Reforms of the* 1980*s*. Online at: http//www.Ghana.edu.gh/past/eightiesReforms.html.

United Nations (1998). Tight spending undermines health and education. *Africa Recovery*, vol. 11, no.3, p. 6. Online at: http://www.un.org/ecosocdev/geninfo/afrec/vol11no3/ghanabx.htm.

Weiss, I., Boyd S., and Hessling, P. (1990). *A look at exemplary NSF teacher enhancement projects.* Chapel Hill, NC: Horizon Research, Inc.

Wheeler, M.and Feghali, I. (1983). Much ado about nothing: pre-service Elementary school teachers' conception of zero. *Journal for Research in Mathematics Education*, vol.14, pp.147-155.

ガーナ国基礎教育における夜間現職教員研修が数学教員の数学科知識に与える影響の研究

ケープコースト大学
アーネスト・コフィ・デイビス
広島大学
馬 場 卓 也

要 約

本研究は，ガーナにおける現職教員夜間研修プログラムが基礎学校教員の教科知識に与えた影響について，事例研究を行うことを目的としている。また同時に，教師がこの研修への参加動機を，自らを高めることとしていることについても確認しようというものである。

この研修プログラムは，教員の質やその不足の問題を解決することが目的で，1998 年に始められた。本プログラムの良い点は，研修を受講する教師が教壇に立ちながら，同時に研修も受けることができるということである。したがって教師は研修の中で新しく学習したことを，授業の中ですぐさま活用する事ができるのである。ところがこの研修プログラムの効果について，未だ研究がなされておらず，より良い研修を求めていく上で，まだ為すべきことは多数存在する。

そこで本研究では，ガーナ国中央州における現地調査を実施した。質問紙調査において，研修受講者 58 名，研修未受講者 54 名，校長 40 名，指導主事 20 名の有効回答を得た。さらに研修受講者の内 6 名が選出され，さらに 6 名の未受講者と合わせて計 12 名の教師の授業が観察され，さらにその内の受講者 1 名と未受講者 3 名より授業についてコメントを得た。このようにして収集されたデータに対して，平均や標準偏差などの記述統計による量的分析と，コメントの内容分析を行った。これらを通じて本事例では，この研修プログラムにおいて基礎学校教師の数学教科知識が高まったが，他方で未だに分数を指導する上での問題が存在していることが分かった。

ANNEX 1

RESEARCH INSTRUMENT

1. QUESTIONS FOR IN-SERVICE TRAINED TEACHERS

INTRODUCTION: This questionnaire is about a research into In-service training in Ghana. Your candid response to this questionnaire is very valuable and will be appreciated. Your response will be treated as confidential and would be used for research purposes only.

SECTION A

Biographical Data

1. Gender; Male ☐ Female ☐ 2. Class/Form taught.....

3. Subject; Special Area (**You may choose more than one; Circle please**).

(a) Mathematics (b) Science (c) Technical Skills (d) Vocational Skills

(e) Agricultural Science (f) Social Studies (h) Other State.....

4. Age (**Circle**);

(a) <25 (b) 25-34 (c) 35-44 (d) 45-54 (e) >54

5. Teaching experience after training college in years (**Circle**);

(a) 1-5 (b) 6-10 (c) 11-15 (d) 16-20 (e) >20

6. Highest Qualification (**Circle**);

(a) 3-Year Post Secondary Cert A (b) 4- Year Post Middle Cert A

(c) Diploma (Basic Education) (d) Post Diploma (Basic Education) (f) Master Degree

(g) Other State.....

SECTION B

1. Why did you go in for the Diploma or Post Diploma evening classes program?

Tick only one option (main reason).

Statement	Tick
I wanted to improve my teaching	
I wanted to get a better salary	
I was afraid of loosing my job	
Every body was obtaining a Diploma	

Other reason(s) state. .....

RESEARCH INSTRUMENT 1 (Continued)

2. (a) Did anybody encourage you to pursue this program? YES ☐ NO ☐

(b) If YES who encouraged you to pursue this program?.....

3. Where did you hear/read about this program? **Tick only one option.**

Statement	Tick
Through a friend	
Through advertisement	
From the university's brochure	
Through a participant	

Other state. .....

4. (a) In what way(s) did the combining of teaching and attending evening classes affect your course at the university? **You may tick more than one option.**

Statement	Tick
I attended classes at the university late	
I did not get time to read my notes/other reading materials	
I did not get time to do assignment	
I did not get enough time to prepare for examinations	

Others state. .....

(b) How often did the combining of teaching and attending evening classes affect your teaching and other activities in your school? **Respond to each of the items (Tick).**

Statement	Very Often	Often	Sometimes	Hardly Ever	Never
I went to school late					
I did not have enough time for my students/pupils					
I hardly gave class work or assignments					
I hardly participated in extra curricula activities					
I did not get time to read my teaching notes /other reading materials					

5. On the average how many times in a week did you leave your school/class before the close of school? **Circle please**

(a) Once a week (b) Twice a week (c) Thrice a week (d) None

RESEARCH INSTRUMENT 1 (Continued)

6. On the average how often did you take permission to absent yourself from school because of examinations/assignments in each term? **Circle please.**
   (a) 1-5days (b) 6-10days (c) 11-15days (d) >15days
7. (a) Was the time for start of lectures convenient for you? YES ☐ NO ☐
   (b) If NO what time will you suggest.....(c) Why.....
8. How did you find combining teaching in your school with studies in the university? **Tick Please.**

Option	Tick
Very easy	
Manageable	
Difficult	
Very difficult	

9. (a) Did you have any problem combining your role as a student in the university with that of a teacher in your school? YES ☐ NO ☐
   (b) If YES, state the problem.....

Respond to each of the items (Tick)

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
10	Outreach program has helped me to improve the level of my content knowledge in mathematics					
11	Outreach program has helped me to improve my skill of involving students during my lesson					
12	Outreach program has helped me to learn how to take students' prior knowledge into account when planning curriculum/instruction					
13	The curriculum of the Outreach program is very relevant to what I teach now					
14	The Outreach program has helped me to improve my skill to develop and use teaching/learning materials in mathematics					

RESEARCH INSTRUMENT 1 (Continued)

15	The Outreach program helped me to Learn how to use inquiry/investigation-oriented teaching strategies					
16	The Outreach program has helped me to learn how to assess student learning in mathematics					
17	The Outreach program has helped me to improve my questioning skills					
18	The Outreach program has helped me to improve my skill to have students work in cooperative learning groups					
19	The Outreach program has helped me to improve ways of encouraging students' interest in mathematics					
20	The Outreach program has helped me to improve my skill of using chalkboard efficiently					
21	The Outreach program has helped me to improve my class management strategies					
22	My ability to develop students activities has improved after I attended the Outreach program					
23	My skill in preparing scheme of work and lesson notes have improved after I attended the Outreach program					
24	The Outreach program has improved my techniques of introducing my lessons.					

RESEARCH INSTRUMENT 1 (Continued)

25. (a) Did you have any problem teaching certain topics in mathematics before you enrolled for the evening classes program? YES ☐ NO ☐

(b) If YES which topics posed a problem? **You may tick more than one.**

Topic	Tick
Addition of fractions with different denominator	
Decimal factions	
Division of fractions	
Long division	
Ratio and proportion	
Measurement; time, length, weight	
Statistics and probability (collecting and handling of data)	
Word problems	

Other state. .....

(c) To what extent has/have the problem(s) been solved (**Tick**)

Statement	Tick
Totally Solved	
Quite Solved	
A Little Solved	
Not Solved	

26. (a) Do you presently have any problem teaching certain topics in mathematics?

YES ☐ NO ☐

(b) If YES, state.....

(c) How do you normally handle topics that are difficult for you to teach? Tick please

Statement	Tick
Assign to students	
Visit library to research	
Consult my colleagues	
I skip it	

27. (a) Is there any difference in your teaching skills after your Diploma/Post Diploma course?

YES ☐ NO ☐

(c) If YES, why .....

(d) If NO, why not..... .....

RESEARCH INSTRUMENT 1(Continued)

28. (a) Has your ability to teach mathematics improved after your Diploma/Post Diploma course?

YES ☐ NO ☐

(b) What is the extent of the difference? **Tick please**

Statement	Tick
A very big difference	
A big difference	
A small difference	
A very small difference	

Respond to each of the items (Tick)

	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
29	I enjoy teaching mathematics					
30	Mathematics is a difficult subject					
31	I like mathematics					
32	I don't like preparing teaching aids in mathematics					
33	I wish mathematics is taught by teachers who specialize in it					
34	I wish I do not teach mathematics everyday					
35	I find mathematics very easy to teach					
36	Learning mathematics is mostly memorizing facts					
37	There is only one correct way to solve a mathematics problem					

38. (a) Has your attitude towards the teaching of mathematics changed for the better after attending the Outreach program? **Tick please**. YES ☐ NO ☐

(b) If YES, Briefly explain.....

(c) If NO, why not.....

.....

ANNEX 2

RESEARCH INSTRUMENT

UNIVERSITY OF CAPE COAST
FACULTY OF EDUCATION
TEACHING PRACTICE UNIT
TEACHING PRACTICE ASSESSMENT FORM A

NAME OF STUDENT: .....LEVEL :.....

REGISTRATION NO: ..... PROGRAMME: .....

SCHOOL OF PRACTICE: .....FORM/CLASS: .....

SUBJECT: ..... DATE: ..... TIME: .....

LESSON TOPIC: .....

DIRECTION: Indicate by means of a circle the degree to which the student-teacher measures up to the area described below.

AREAS OF DEVELOPMENT	0 ABSENT 1 WEAK 2 BELOW MINIMUM 3 MINIMUM 4 GOOD 5 OUTSTANDING	COMMENTS
A LESSON PLAN Objectives (clear, measurable, appropriate) Logical presentation of lesson. Subject Knowledge (demonstrated in lesson plan)	0 1 2 3 4 5 0 1 2 3 4 5 0 1 2 3 4 5	
B. INTRODUCTION Interesting and captivating. Linked to appropriate previous knowledge.	0 1 2 3 4 5 0 1 2 3 4 5	
C. MASTERY OF SUBJECT MATTER (demonstrated through teaching). Relevant subject matter Accurate information	0 1 2 3 4 5 0 1 2 3 4 5	
D. SUBJECT DELIVERY (in relation to teaching and learning) Appropriate teaching methods and strategies Clear logical steps in lesson delivery. Good pacing/timing	0 1 2 3 4 5 0 1 2 3 4 5 0 1 2 3 4 5	
E. TEACHING/LEARNING RESOURCES (TLR) Use of adequate and appropriate TLR, (competent use of TLR, including chalkboard).	0 1 2 3 4 5	
F. CLASSROOM MANAGEMENT & ORGANISATION Individual, group and whole class management. Class control.	0 1 2 3 4 5 0 1 2 3 4 5	
G. STUDENT PARTICIPATION Involving students in lesson verbally and non-verbally. Competent handling of students' questions/ Contributions.	0 1 2 3 4 5 0 1 2 3 4 5	
H. COMMUNICATION Correct use of language. Clear and audible voice.	0 1 2 3 4 5 0 1 2 3 4 5	
I. CLOSURE Tidy, interesting, linked to objective(s)	0 1 2 3 4 5	
J. LESSON EVALUATION Lesson objective(s) achieved.	0 1 2 3 4 5	
K. APPEARANCE No distractive mannerism.	0 1 2 3 4 5	

TOTAL SCORE: ..... RECOMMENDED SCORE AND GRADE .....

GENERAL REMARKS:.....

.....

.....

NAME OF SUPERVISOR ..... SIGNATURE: .....