

# Institutional Gaps in Mathematics Education Research Procedures Between a Developed and Developing Country

Ernest Kofi Davis

Monash University

Ernest.Davis@education.monash.edu.au

Wee Tiong Seah

Monash University

WeeTiong.Seah @education.monash.edu.au

Alan J. Bishop

Monash University

Alan.Bishop@education.monash.edu.au

This paper reports on a research methodology for an ongoing PhD thesis, focusing on the author's experience as he collected data in Ghana. It looks at what the author did during data collection in Ghana and his experiences in the field. It also highlights some of the institutional gaps that appeared to exist between educational institutions in Ghana and Australia, and discusses some implications for planning and execution of mathematics education research methodologies in a developing country like Ghana.

## Introduction

### *About Ghana*

Ghana is located on the west coast of Africa. It is bounded on the north by Burkina Faso, west by Ivory Coast, east by Togo and south by the Gulf of Guinea, Ghana was a former British colony under the name of Gold Coast, and obtained her independence in 1957 from the British. With an area (of 238 534 km<sup>2</sup>) which is about 3% of the area of Australia, Ghana supports a population (of 22 113 000, a 2005 estimate) which is approximately the same as Australia's. The most predominant religion in Ghana is Christianity (63% of the population are Christians). English language is the official and national language of Ghana, although some 49 languages and dialects are spoken in the country. Ghana's GNP per capita is US\$380 (2004 estimate) with agriculture being the backbone of her economy. The major export commodities of the country include cocoa, gold and timber. Ghana has a long history of formal education dating back from pre-colonial times (1529). Ghana presently operates six years of primary education, three years of junior high school education and four years of senior high school education at the pre-tertiary level. With the exception of grades 1-3, the medium of instruction at all levels of education is English language (see Owu-Ewie, 2006). The next section looks at the context of the data collection exercise, which is the author's (i.e. first author's) ongoing PhD thesis study, investigating cultural influences on primary school students' mathematical conceptions and practices. This will be followed by a review of some previous studies on gaps in educational research phenomenon among countries. The author's experiences collecting data in Ghana is then presented. The author as used in this paper refers to the first author.

### *Context for the Data Collection Exercise*

Children's performance in mathematics both locally and internationally in Ghana have not been good (Duedu, Atakpa, Dzinyela, Sokpe & Davis, 2007; WEAC, 2006;

Ministry of Education, Youth and Sports, 2004). However no study has been done so far in Ghana to look at cultural influences on students' mathematics learning despite the fact the literature has shown that mathematics is a cultural object (Bishop, 1988) and other studies have also shown that the culture of both students and teachers affects mathematics learning in school (Seah, 2004; Presmeg, 2007). The study was therefore designed to explore how children experience mathematics between two contexts of mathematical practices (home and school) and how their knowledge of out-of-school "mathematics" acquired through their culture (as well as language) influence (support/interfere with) their conceptions and practices in mathematics in school; focusing on fractions and measurement. These two topics had been identified for research in this study given the fact that the associated concepts have often been cited as being difficult for Ghanaian students (Duedu, Atakpa, Dzinyela, Sokpe & Davis, 2007; Ministry of Education, Youth and Sports, 2004).

### *Previous Studies on Gaps in Educational Research Phenomenon*

A study on gaps in educational research phenomenon between countries is not new. Buchmann and Hannum (2001) for instance highlighted the effect of institutional variations between developing and industrialised contexts on educational and stratification processes and outcomes, from their study that reviewed theories and research on Education and Stratification in developing countries. p.11. Other researchers have also highlighted some of the problems associated with the importation of research methodologies from the North which do not take account of the social context of the South to the South (Vital & Valero, 2003). Vital and Valero (2003) for instance argue that "the difficulty of research in situation of social and political conflict must inform a broad range of questions, framework and approaches" p. 573. Atweh and Clarkson (2005) also reported on their survey study in Philippines where their participants provided several examples where international trends may not serve the local needs of researchers and their students. It appears whiles some studies have looked at the situation in developing countries in Asia and South America (Atweh, 2004; Atweh & Clarkson, 2005) not many studies have looked at the situation in sub-Saharan African countries such as Ghana. It is against this background that the author discusses his experiences in this paper to inform future research in similar contexts. The next section describes the methodology for the author's ongoing PhD thesis.

### **Methodology for the study**

The section begins with a brief explanation of the methodology for the study. The methodology that the researcher employed to investigate the topic is summarised below under three sub-themes, namely research approach, research participants and data sources

#### *Research Approach*

In this study both quantitative and qualitative methods (mixed methods) were employed to collect data from a cross-section of research participants to address the research questions. Mixed methods approach evolved as a result of the interest by researchers in triangulating different quantitative and qualitative data sources (Jick, 1979). The literature suggests that a combination of qualitative and quantitative methodology is recommended for thorough and comprehensive treatment of various facets of issues related to topic under investigation (Creswell, 1994). It also aids expansion of understanding from one method to another and helps to converge and confirm findings from different data

sources (Creswell, 2003). In this study therefore the author adopted the qualitative approach to pilot test the research instruments after which a sequential mixed method strategy (Creswell, 2003) was used to collect both quantitative and qualitative data for the main study.

Unlike Ghana, Australia expects her researchers working with human participants to obtain ethical approval before they can commence their respective research. The author applied for ethics clearance providing letters from Ghana Education Service (GES) office in Ghana to show that such a study could take place in Ghana. Ethics approval was given once the researcher responded to all queries and provided the Ethics committee with all additional documents the committee requested for to the committee.

The researcher implemented the quantitative methods first followed by the qualitative methods. Thus the researcher went through collection and analysis of quantitative data followed by collection and analysis of qualitative data. The two data sets would be merged as the data are analysed and interpreted.

### *Research Participants*

In order to maintain efficiency of the project execution against culturally- and geographically-based factors, a sample of 150 primary school teachers and their headteachers from 25 out of 74 public primary schools (made up of mix of average, above average and below average performing schools) in Cape Coast Municipality were selected using the stratified random sampling procedure for the questionnaire survey (Stage 1). After giving participants explanatory statements for their keeps and consent forms, which they had to sign and return to the researcher together with the filled questionnaire.

Recruitment of participants for Stage 2 of the study (that is, the interviews) was done at two levels after analysis of data from questionnaire survey (Stage 1). Level one included interviews with headteachers and teachers from ten schools that gave the most “interesting responses” based on the analysis of questionnaire surveys. “Interesting responses” refers to those which provided a range of examples of mathematics practices and those which provided variety of views about mathematics conceptions. Level two included choosing four primary schools based on the interviews to form sampled schools for the qualitative parts of the study. In each of these four cases, factors such as parental involvement in school, implementation of school’s language policy, and school’s views about mathematics conceptions were explored. Eight teachers, four each from Grades Four and Six, and their headteachers were selected for interviews in the selected schools. Thirty-two primary school children, four each from the classes of each of the eight teachers from the four selected schools were also be interviewed. A detailed discussion of the data sources follows.

### *Data Sources*

Data collection for the study was made from three sources. These included questionnaire, interviews and relevant documents. Questionnaires were administered to teachers and headteachers to elicit information about their conception of mathematics. Information on pedagogical issues relating to cultural influences (including language) on children’s conceptions and practices on fractions and measurement were collected from teachers and school children were further explored through the interview questions.

For each of the topics the researcher interviewed Grade Four and Grade Six children. Grade Six was chosen because this level marks the end of primary school, and

thus it is of interest to explore exiting students' knowledge and understanding. Grade Four was chosen because children at this level would have had the experience of grappling with studying mathematics through the use of English language as a medium of instruction for a whole year. They were therefore expected to be in a better position to provide more reliable information about their language preference. Headteachers, teachers and children were also interviewed to elicit information on children's transition between contexts of mathematical practices.

Finally, documentary evidences from children's class exercise books, children's worksheets from the interviews and teachers' marking of children's worksheet from interviews were also collected to help triangulate the findings. The next section presents the author's experiences in the field as he implemented the research methodology.

## Field Experience in Ghana

### *Communication with Local Education Authorities*

When the author lodged his ethics application in Australia for the study to commence, the Ethics committee advised the author to obtain a letter from the Metropolitan Director of Education in Ghana showing that the director will receive reports concerning the conduct of the research on behalf of the committee. When the author approached the Metropolitan Director's secretary, his reaction was "why do they [referring to the Ethics committee] want such a letter from us, tell them we don't do things this way here! You only need introductory letter from us to the schools involved to show that we are aware that such a study is taking place in our schools." The researcher explained to them why they had to write such a letter saying that would protect the subject [which they did not see the need] and also that is what Ethics committee agrees to be a good practice in their context and hence the need to respect the Australian research culture. The letter was finally written for the author to be given to the Ethics committee, which subsequently approved its conduct.

### *During Data Collection*

Following the ethics approval the research instruments were pilot tested in a pilot district (Elmina district) in May/June 2008, after which revisions were made for items that were found to be difficult for respondents to understand and also for those that were ambiguous. Data collection for the main study followed with the author's invitation of schools to participate. Initial invitation of 25 schools was made. In each of the schools the purpose of the study was explained, explanatory statements and consent form were given before the author showed the permission/introductory letter received from the Ghana Education Service (GES) to the respondents. This was to avoid the situation where the GES letter might be perceived as a tool to force research participants to participate. This was then followed by the administration of the instruments. The author's experiences during data collection in the field have been presented under five sub-themes namely non-familiarity with consent forms, child labour, closure of schools due to the use of school premise and teachers by other national agencies, sudden closure of schools due to natural occurrences and trust in researchers by educational authorities, schools and parents

Non-familiarity with consent forms: In Ghana all that a researcher needs to conduct a study in schools is permission from GES (as already noted). As in many societies, people react differently to unfamiliar things. Three schools comprising two above average performing schools and one average performing school declined to participate a week after they had expressed interest in the study. These schools were concerned about their

anonymity. The headteachers of these schools queried why the author claimed to treat their responses as confidential when they had to submit consent forms containing their names and signatures. They queried whether the introductory letter that the author had brought from the GES office was not enough for the purpose. The author explained to them that the letter was enough for the purpose of GES, schools and researchers in Ghana but not for the Australian setting where this study is being carried out. They were suspicious of the intent of the consent forms and therefore asked the author to give them more time to consider whether they would participate, and that if they would they would give a call, but none of them called. The author replaced them by schools in same category. Out of the three schools that replaced those that declined to participate one headteacher refused to submit both the filled in questionnaires and the consent form to the author. Even for schools that agreed to participate, some teachers refused to participate because they had to fill consent forms that had their names and signature on it and submit it to the author. One of them remarked “we have been helping with research projects ever since I started teaching in this school we have never been asked to do this before, why do you want my name and signature”.

Child labour: Teachers advised the researcher to either follow children participants to their houses immediately after school or find a place close to the school to hold interviews because getting them after school was going to be difficult. The researcher kept to his plan of doing the interviews in the homes of the children, since the study is interested in how context affects children’s conceptions and practices in mathematics. With the help of class teachers the researcher always got one of the parents of the children participants’ to allow the researcher to hold the interviews in the house. The researcher observed that in some schools (two out of the four) if he (researcher) goes one hour after close of school he finds that half the children don’t turn up because they had either gone for hawking (selling on the street) or running errands for their parents; two or three hours after school he observed that there is no light at the venue where parents allows the interviews to take place, so the place becomes dark shortly after the interviews had begun (i.e. around 6.00pm) and the researcher has to stop in the middle of the interviews. The researcher had to change the date and come again the second or the third time before the researcher got all the children to interview. In one instance a parent of a child (grade four girl, 10 years old) in one below average performing school had a meeting with the researcher wanting to know whether the research will require the child meeting the researcher often after school because that was going to hurt her business. This girl goes hawking after school everyday to supplement the family income. Thus this girl is not only a student but plays dual role as a students and a bread winner for her family.

Closure of schools due to the use of school premises and teachers by other national agencies: This survey was carried out in an election year in Ghana and at a time when the Ghana government was registering Ghanaians for the purpose of issuing them Ghanaian citizens’ identity cards. The author observed suspected lack of information flow among government agencies which clearly affected research in Ghana. The author for instance had an appointment with a headteacher and teachers of a particular school; he went to the school on the appointed date and time, only to find that almost all teachers were absent. The author met the headteacher who told him that all her teachers had been tasked to carry out the national identification registration exercise somewhere else that day, and requested the author to come back in two weeks time (see GNA, July 2008). The story was not different for the other schools visited; especially schools that were used as registration centres. The researcher met many people who had formed long queues in those schools;

classes had stopped with majority of the children absent. The same situation arose when the voters register was opened later that month (GBC News, July 2008). For almost two weeks the author could not get access to some of the research participants in the affected schools.

Closure of schools due to natural occurrences: There were at least three occasions where the researcher had to cancel data collection either just before or immediately after the interview had started because of monsoon rains, which are often sporadic and heavy with strong winds and thunderstorms. Within a matter of 15-20minutes the clouds can just gather and heavy rains may then follow. Once the clouds begin to form the school closes down before the rains begin because of its nature (i.e. so heavy and noisy that one can hardly hear anything). Also these schools (two of them) located about 30km North of Cape Coast city had no lights so the researcher observed that the classrooms were very dark. It appeared reasonable to the researcher that the school bell went for closing, since it was clear that no academic work could have taken place under such conditions. It should be noted that the majority of primary schools in Ghana have no electricity. The few that have are those that are used for church services on Sundays by some churches. They fix electricity to enable them to play their musical instruments but not necessarily to help the school to get electricity for academic purposes. The situation is therefore a common one.

Trust in researchers by educational authorities, schools and parents: The warm reception and trust accorded by participating schools and parents of participating children were very encouraging. All parents that the researcher chose to hold the activities in their houses agreed without expressed fear or suspicion of a stranger coming into their homes. The author was not seen as a person who could harm the children; it appeared that they had no worries at all about the safety of their children. Schools and educational authorities also did not show any concern about the researcher doing activities with children. In most cases teachers came in to see that all was set for the interview to start. They left once the interview began and came back after the interviews. At no point in the study was the researcher asked by school authority, teachers or parents to provide evidence that it was safe for him to work with the children. The author guesses not many researchers in developed countries could imagine such a high level of interpersonal trust within a society, and thus it has implications for mathematics education research.

## Gaps in Institutional Expectations and Implications for Mathematics Education Research in Developing Countries

It is clear from the discussion of the author's field experiences in Ghana that even though the methodology was implemented, this was not achieved without lessons for future study in similar contexts. It appears that gaps exist between what constitutes ethical research practices in developed countries and that of developing countries. It is clear that although the research procedure which an Australian tertiary institution proposes to protect the researcher, the research participants and the university, the Ghanaian side did not necessarily see it that way. They appear to have seen it as being alien and unpopular. It appears while institutions from developed countries care about legal issues in educational research and therefore plan mathematics education research having that in mind, those from developing countries like Ghana are less concerned about that. This seems to create a bit of misunderstanding between the two cultures.

That child labour would be an issue with participant availability was not even foreshadowed by the author has made it easier to understand the same of researchers from developed countries. The author least expected this, especially after the introduction of

interventions such as capitation grants and school feeding programmes by the government of Ghana to help reduce the financial burden of educating children by parents, particularly those in poor communities (see Agbenyega, 2008). Even though the literature suggests that child labour or housework and schooling are mutually exclusive activities (Buchmann & Hannum, 2001) it appears it has the tendency to affect mathematics education research in some developing countries, especially research that would require a lot of after school hours with children. Researchers in developed countries may not know too that schools can be easily closed due to circumstance which will never call for such closures in their countries (see also Vithal & Valero, 2003).

Gaps also appear to exist between the formalised approaches to research in developed countries as compared to interpersonal trust that prevails in some developing countries. Whilst the formalised system in developed countries may appear to shape research procedures (i.e. need for permissions for working with children, etc for research that requires children as participants) it is evident from the author's experience that the system of interpersonal trust in developing countries has the tendency to re-shape the executed research procedures from developed countries in developing countries.

These gaps affected data gathering for the ongoing doctoral research study in two ways. Firstly, the author ended up gathering less data than planned mainly because of disagreement on ethical issues (i.e. consent forms). Secondly more time was spent than expected in collecting data especially from children due to the difficulty of organising them after school. It is evident from the above discussions so far that these gaps have implication for the planning and execution of mathematics education research in developing countries. In addition to the call by Vital and Valero (2003) for the need to reconceptualise the issue of validity, reliability and generalisability in mathematics education research; the issue of what should constitute an ethical mathematics education research in a developing country like Ghana may also have to be looked at to further help improve the quality of mathematics education research in developing countries. The question therefore is how do mathematics education researchers develop the most appropriate ethical research methodologies for developing countries, taking into consideration their socio-cultural 'baggage'?

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