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**An Evaluation of Computer Aided Learning
(BRAC-CAL) in Secondary Schools
in Bangladesh**

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CONTENTS

Acronyms	
Acknowledgement	
Executive Summary	i
Chapter 1. Introduction	1
Chapter 2. Methodology	5
Chapter 3. Research Findings	9
Chapter 4. Conclusions and Recommendations	27
References	33
Annextures	35

ACRONYMS

A2I	Access to Information
BEP	BRAC Education Programme
BLC	BRAC Learning Centre
CAL	Computer Aided Learning
CoI	Co-Investigator
DSHE	Directorate of Secondary and Higher Education
FGD	Focus Group Discussion
GI	Group Interview
GoB	Government of Bangladesh
HREC	Human Research Ethics Committee
HT	Head Teacher
ICT	Information & Communications Technologies
NCTB	National Curriculum and Textbook Board
OER	Open Educational Resources
PACE	Post Primary Basic and Continuing Education
PI	Principle Investigator
PIS	Project Information Sheet
RoI	Return on Investment
RQ	Research Question
SSI	Semi-Structured Interview
SMC	School Management Committee
Ss	Students
T	Teacher

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EXECUTIVE SUMMARY

BACKGROUND AND PURPOSE

Over recent decades, Bangladesh has made substantial improvements in terms of children's access to and equity of education, as well as making significant efforts to improve the quality of education. Yet challenges remain: classroom over-crowding is common (secondary school class sizes may typically be around 60-70 students, but can be double this); there are often few classroom resources beyond national textbooks; teachers may be underskilled, with limited curriculum or pedagogic knowledge. Taken together, these factors may contribute to an over-dependence upon didactic classroom practices such as lecturing or 'chalk-and-talk' by teachers; they can negatively affect students' motivation, attendance, learning and school-completion. Such problems may be most severe where multiple forms of disadvantage (rurality, socioeconomic status, minority status, gender) intersect.

In this situation, the BRAC Education Programme (BEP) team have been working to support professional development and school improvement in a number of non-government secondary schools, targeting schools serving disadvantaged communities. In 2004, BEP began a pilot programme of Computer Aided Learning (CAL), to explore whether high quality multimedia resources could be developed and used to improve the teaching of English, Mathematics and Science. Teachers were intended to be able to use these materials for whole class teaching. Fifty non-government secondary schools were selected for the BRAC-CAL pilot, with 300 teachers participating (six teachers were selected from each school - 2 teachers per subject- to provide peer-support). Pilot schools were encouraged to retrofit one existing classroom for CAL, with the BRAC-CAL programme providing one computer and either a data-projector or series of 'daisy-chained' monitors, so all students could see and hear the multimedia curriculum materials being presented by teachers. Teachers were provided with an initial training (covering: basic ICT skills; ICT troubleshooting; how to access and use the CAL materials) and several refresher trainings (with updates to the materials and further support to classroom use) over several years. Teachers were also visited in schools over a sustained period of time, for classroom observation and technical or pedagogic support.

The purpose of this formative evaluation was to enable BRAC to assess the extent to which BRAC-CAL was achieving the intended purpose. The objectives of the study were to evaluate:

- ▶ The context in which the CAL programme operated and its appropriateness to that context
- ▶ Changes in teaching and learning practices
- ▶ The strengths and limitations of the ‘teacher development’ approach
- ▶ Strengths and limitations of the ‘educational technology’ model

METHODOLOGY

The evaluation was carried out within a Realist Evaluation framework (Pawson 2013). Accordingly, it addressed three overarching research questions:

- RQ1. By what processes did BRAC-CAL seek to bring about change?
- RQ2. How did those processes interact with the classroom and school contexts?
- RQ3. What outcomes did the programme have for teaching and learning?

Qualitative research methods were chosen to provide an in-depth understanding of participants’ experiences and the ways in which those experiences were shaped by context. The sample comprised six schools (three from Bogra and three from Comilla districts). Seventy-eight participants contributed to sources of evidence including: classroom observations; semi-structured interviews with teachers and with head-teachers; focus group discussions with teachers and group interviews with students. Thematic analysis was conducted using NVIVO software, drawing upon analytical processes outlined by Braun and Clarke (2006). The analysis set out to provide a rich description across the data set.

FINDINGS

RQ1: By what processes did BRAC-CAL seek to bring about change?

Five key processes emerged from participants’ responses, as being central to their understanding of how BRAC-CAL sought to bring about change, including:

a. Enduring relationships for school and professional development

Most Head Teachers began their discussion of the introduction and effectiveness of the BRAC-CAL programme with reference to long-term and highly-valued prior relationships between BRAC and the implementation schools, before and throughout the CAL programme.

b. High quality (content and pedagogy) curriculum materials

The provision of high quality digital learning materials in English, Mathematics and Science, is central to the BRAC-CAL programme. These take the format of presentations rich with animations, audio, photo and video resources.

c. Teacher Training in ICT and use of curriculum materials

Several teachers' accounts suggested that the primary focus of the initial training was on becoming familiar with the ICT and learning how to open and use the CAL materials. Yet other teachers referred to learning rudimentary strategies for organising groups or encouraging student participation.

d. Extended Follow-on support

Most of the teachers referred to receiving numerous face-to-face training sessions for several years after their initial training. (Whilst most of the teachers reported positively on this, one teacher suggested that after several years, the follow-on support needed to move on from 'how to use the materials').

e. Classroom observation and feedback in schools

Head teachers and teachers from four of the six study schools referred to having received numerous school visits and classroom observations from BRAC-CAL, especially in the initial years of implementation.

RQ2: How did those processes interact with the realities of classroom and school contexts?

a. How did Teachers and Head Teachers react to the BRAC-CAL training and approach?

Head Teachers and teachers were unanimously positive in response to the programme. Teachers appreciated their trainers for being sensitive and encouraging, helping teachers overcome their anxiety in using the computer for the first time. Teachers, Head-Teachers and Students liked the materials and preferred CAL lessons to non-CAL lessons. One head teacher mentioned '...these (materials) are excellent and are prepared based on child psychology. The need, taste and capability have been considered while developing the content. That's why the children like these very much.' (C-Dist-School 3, Head Teacher). In five of the six schools, teachers or head teachers said they would like such materials for other subjects, or they would like the content for current subjects to be extended.

In four of the six schools, teachers reported that they wanted to be able to adapt or co-develop the materials, for example using the animations in Power Point. Several comments emphasised the benefit of CAL's 'ready-made' content, noting how long it took teachers to develop their own material in the government programme. In two schools (B-Dist School 2, C-Dist-School 3), teachers suggested breaking the content into smaller units. Teachers from all schools felt that the programme had a positive

effect on their workload, making their professional lives easier in terms of both lesson preparation and lesson delivery. A few teachers mentioned that the integration with the textbooks or examinations could be tighter.

b. What were Teachers and Head Teachers doing to put BRAC-CAL into practice?

Head teachers were reported to organise and monitor routines to ensure high level of use of CAL lessons in the ICT-equipped classrooms, in all schools. In two schools (C-Dist-Schools 2 & 3) head teachers were explicitly reported as monitoring usage and in one of these (C-Dist-School 3), teachers reported sitting each week with the Head Teacher, to review lesson plans for the week.

Teachers were typically delivering several CAL lessons per week, usually at least one for each group of students they taught. It appears that CAL classrooms are time-tabled for near-continuous use for teaching and learning of target subjects, in most schools. In some schools, there is evidence that access to the ICT-equipped classrooms and CAL resources may be limited (for teachers or students) other than for the scheduled CAL lessons. In two of the six schools, teachers had access to other computers (provided in a room in school, or through teachers own laptops) to practice and prepare.

c. How did the contexts of the schools affect programme implementation?

Implementing the materials in contexts where many teachers had limited pedagogic knowledge or practice meant the materials were most commonly used to support passive learning activities.

Five out of six schools reported tensions between the number of students, the number or size of classrooms available and the number of classrooms equipped for CAL. Some schools faced a general shortage of classrooms, which meant that Head Teachers could not see how to break large groups (the class) into smaller classes (divisions). There was often chronic over-crowding in the CAL lessons: “Every class has more than 100 students. We face difficulty accommodating everyone in CAL class. The CAL class becomes cozy and hot and damp. Only four fans are much less for the whole class. So, we face difficulties...” (B-Dist-School 2, Teacher FGD). In one school, attendance at the CAL science lesson was (31%) whilst the non-CAL science lesson was 74%, with fieldworkers identifying overcrowding of the CAL classroom as the reason. Having only one CAL classroom limited access for any particular subject or group of students.

Irregularity of electricity supply was identified as a problem by half of the schools. Only two schools had a UPS power supply working and available in the CAL room. Two schools reported disruption to CAL lessons due to unpredictable electricity supply and broken UPS. One school had no UPS and experienced severe disruption: “Irregularity of electricity in this area is the biggest problem... If there is electricity we conduct the CAL lesson every day... Without electricity we cannot carry on the classes.” (C-Dist-School 2, Head Teacher). No schools reported any maintenance

problems with the computers, desktop monitors or sound systems. There were problems with UPS and data projectors reported broken in one-out-of-three schools.

RQ3: What outcomes did the BRAC-CAL programme have for teaching and learning?

a. Teachers' learning: confidence, subject knowledge and teaching strategies

Teachers report having improved their confidence and skill in ICT, at least in relation to the intended purpose of being able to use the CAL resources in their teaching. Most teachers were observed using CAL confidently in lessons, though in over a quarter of lessons (27%) the teachers had to call for technical help from other colleagues, which caused some disruption.

In terms of teachers' own learning, teachers talked primarily about learning ICT skills: how to open and use the CAL materials. Several teachers also said they learned 'methods of teaching, pair and group work' or they learned to give 'interactive', 'participatory' or 'student-centred' classes, but very few teachers were able to elaborate upon this or give any practical illustrations of how they did this. Lesson observations raised doubts about claims of improved pedagogic knowledge or practice, indicating that most teachers provided few if any opportunities for extended, unpredictable student utterances or writing. A third of all teachers (6, 33%) made no attempt to organise students into pairs or groups in either CAL or non-CAL lessons, whilst a quarter of teachers (5, 27%) organised students into pairs or groups in which students did not talk together, at least in one lesson. Only four teachers (22%) consistently created opportunities for student-student talk in both observed lessons – these were all English teachers. Only one mathematics teacher made any opportunity for student student talk and then only in one lesson.

Two teachers (of eighteen) said that they felt they had improved their own curriculum/content knowledge, through using the CAL materials, but did not give any specific illustration, e.g. "I could identify some mistakes in my content knowledge and teaching method after watching those CAL materials. It is not only educational for students but also for me a great way to correct my incorrect knowledge" (B-Dist-School 1, Maths Teacher).

b. Students' learning and classroom interactions

In terms of observed classroom practices, there was little discernible difference between CAL and non-CAL lessons, beyond the use of the CAL materials themselves. In all lessons observed, the dominant student activity was 'watching and listening'. This was typically interspersed with occasional short responses to teachers' closed questions by individual students or by the whole class in chorus, with short pieces of written work at the end of the lesson. There were very few occasions observed where students were invited to make extended utterances. In almost three-quarters (72%) of observed lessons, there was no opportunity for student-student talk: in more than half of the lessons (60%) teachers made no attempt to organise students in pairs or groups and in more than one-in-ten lessons (12%). These patterns were very similar

for both CAL and non-CAL lessons, with variations attributed to differences between teachers or subjects, rather than the use of CAL in lessons.

Despite this, there was unanimous self-reporting (e.g. from every school and from all groups- Head Teachers, Teachers and Students) that the BRAC-CAL programme had improved the teaching and learning. Some of the most commonly used terms¹ to describe this were: See, Understand, Time and Question. These were usually closely associated in participant responses, to put forward a general argument that students understood ideas better when they saw these visually in the CAL materials; this meant they learned things more quickly, in less time, and asked less questions for clarification. Teachers and students alike said they preferred CAL to non-CAL lessons. Several teachers' expressed the view that CAL lessons were more 'participatory', but observation data did not indicate any notable differences in student participation, between CAL and non-CAL lessons. When gender was discussed, most respondents thought boys and girls had equal opportunity to participate in lessons and interact with teachers, but when it came to opportunities to come to the front of class and 'operate' the CAL resources, some participants thought boys are more eager than the girls.

c. Students' opportunity for self-study outside of lessons

In general, students' opportunity was limited to occasionally coming to the front of class to control the CAL presentations. Students from two schools expressed a strong desire for more independent access to the ICT and/or CAL resources, but stated that they lacked the courage to ask their teachers or principals. No students reported having regular access to CAL resources outside lessons.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

BRAC-CAL's appropriateness to context

The classroom materials appeared quite appropriate: Head Teachers, Teachers and students all reported that they made lessons more engaging, students more motivated and students' learning quicker, deeper and more enduring. Teachers generally thought BRAC-CAL 'made their lives easier', reducing the burden of lesson preparation and making classes easier to manage. However, there are several contextual challenges: the programme only partially addressed improving teachers' subject knowledge and pedagogic practice, as a secondary aim. In five-out-of-six schools, participants reported difficulties with over-crowded CAL classrooms. Half of the schools reported some disruption from intermittent electricity supply: although most schools had UPS, this was only working and available in a third of CAL classrooms. Whilst computers and speakers appear to be well-maintained, a third of the schools reported problems with UPS or data projector maintenance.

¹ Each term given here was used to describe changes in classroom practice or student learning, in data from each and every participant group (HT, T & Ss) at each and every school.

Changes in Teaching and Learning Practices

The use of CAL materials and the support provided over several years, seem to have had little effect on most teachers' pedagogic knowledge and practice, or on teachers' subject knowledge. In almost three quarters of lessons observed (72%), teachers provided no opportunity for student-student talk or joint work. However, despite this, students and teachers alike reported improved student attendance and behaviour (e.g. better concentration, less side-talk, less disruption) during CAL lessons (although during the fieldwork attendance was similar for both). Changes in teaching and learning were ascribed mostly to the CAL materials themselves – students liked the materials; they found it helpful to be able to see animations, videos or pictures of people, places and things that were otherwise beyond their experience or imagination. Yet if pedagogy had also been improved, much greater changes in teaching and learning may have been possible.

The Strengths and Limitations of the Teacher Development Approach

The programme had limited impact on teachers' pedagogic practice or subject knowledge; although it did help their confidence in using ICT in class, improvements in teaching and learning seem modest. In relation to pedagogy, only four of eighteen teachers observed consistently created opportunities for student-student talk in their lessons: these were all English teachers, so this is likely a function of these being language lessons. In relation to subject knowledge, two of eighteen teachers felt the CAL materials had helped in this regard, though they gave no specific examples of what they had learned. Despite the weak emphasis on the development of teachers' pedagogy and content knowledge, other aspects were well aligned with the characteristics of teacher development associated with improved teaching and learning in the international literature (see for example, Popova *et al.* 2016; Westbrook *et al.* 2013; Avasolos, 2011; Cordingley, 2013). There was a strong focus on the curriculum and provision of curriculum related materials for classroom use. Teachers were supported over an extended period of time, including through school visits and classroom observation. Two Teachers participated in groups, including two teachers per subject, which enabled peer support between teachers. In school, teachers had strong encouragement and support from head teachers, to put the training into practice. Whilst follow-on support was ongoing over several years, it took the form of initial training and occasional 'refresher' training. Several studies identify more regular support (e.g. meeting together every 4-8 weeks) as beneficial (see Westbrook *et al.* 2013). If the teacher development programme had prioritised the development of teachers' subject knowledge and pedagogic practice, the positive aspects of programme design suggest successful outcomes would have been likely.

The Strengths and Limitations of the Educational Technology Model

Prior review of international literature on the use of Educational Technology in low-to-middle income countries (Power *et al.* 2014) show that programmes producing positive improvements in teaching and learning are typically associated with: a clear and specific curriculum focus; the use of relevant curriculum materials; a focus on teacher development and pedagogy and evaluation mechanisms that go beyond

outputs. The BRAC-CAL programme clearly meets the first two criteria. BRAC-CAL had a weak focus on teacher development, emphasising ICT skills over pedagogic practices, although the teacher support model was generally well aligned with international evidence. Prior evaluation mechanisms did not examine the extent to which teaching and learning practices or outcomes had changed.

There is evidence that the educational technologies provided through BRAC-CAL are being used extensively, at or near full time, for teaching and learning in the target subjects. This is rare (see Power *et al.* 2014). Students and teachers alike preferred CAL lessons to non-CAL lessons. However, student learning with CAL most often remained a largely passive process of watching and listening, usually interspersed with short answers to closed questions. Most students had little opportunity for extended talk and no opportunity for independent access to the technology or use of the materials.

RECOMMENDATIONS

1. **Focus on developing teachers' subject knowledge, pedagogic understanding and classroom practice:** BEP should shift the focus and content of teacher training from 'how to use ICT and CAL materials' towards how to teach your subject effectively, including the use of ICT and digital materials. In particular, teachers should be helped to think about the nature of student learning activity – i.e. what is it that students are doing in the classroom, beyond watching and listening, in order to learn? What could students be doing, that might help them learn English, Mathematics or Science more effectively?

BEP should explore whether or how the materials could be used to challenge and develop teachers own subject knowledge more effectively.

2. **Work with schools to explore ways of tackling issues of context:** intermittent electricity, maintenance and classroom over-crowding; BEP should prioritise the provision of UPS to schools with the most unreliable electricity supply or explore alternative sources of power. BEP should work with schools to address difficulties in UPS and projector maintenance.

BEP should work with schools to explore options for reducing class sizes to manageable levels (some participants suggested 60 students), perhaps including provision of a second CAL classroom.

3. **Take steps to ensure programme sustainability:** BEP should consider institutionalisation of the programme in partnership with GoB institutions (e.g. A2I, DESHE, NCTB). BEP should engage with the relevant GoB institutions, to explore inclusion of the CAL resources in the next Sector Wide Approach (SWAP), which is currently in early design, with support from Asian Development Bank.

BEP should also consider whether the programme could be adapted for use in primary, providing higher quality curriculum materials in relation to the governments' MultiMedia Classroom programme.

4. **Explore opportunities to enable more independent use by students:** BEP should work with schools to explore ways in which students might be able to use the materials more independently in or out-of-school, perhaps through provision of student copies of the CAL discs, or through enabling student access online. One Head Teacher suggested that students could be trained to deliver CAL lessons for their peers.

5. **Explore options for enabling more flexible use of the CAL materials:** BEP should explore whether it is possible to organise materials into smaller units, with more flexible navigation, so that teachers feel empowered to use the materials within their teaching, rather than that their teaching is being driven by the materials.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Over recent decades, Bangladesh has made substantial improvements in terms of children's access to and equity of education, as well as making significant efforts to improve the quality of education. Yet challenges remain: classroom over-crowding is common (secondary school class sizes may typically be around 60-70 students, but can be double this); there are often few classroom resources beyond national textbooks; teachers may be under-skilled, with limited curriculum or pedagogic knowledge.

Whilst a small number of students (known colloquially as 'front-benchers') may grasp some messages delivered by the teachers, many students remain inactive and untouched; collaborative learning activities like group work, pair work, chain drill are rarely seen in rural classrooms (Maleque, Begum & Hossain, 2004; Nath, 2009; Nath & Chowdhury, 2009; Ashrafuzzaman, Babu & Begum, 2010; Babu, 2015). Taken together, these factors contribute to an over dependence upon didactic classroom practices such as lecturing or 'chalk-and-talk' by teachers; they can negatively affect students' motivation, attendance, learning and school completion. Such problems may be most-severe where multiple forms of disadvantage (rurality, socioeconomic status, minority status, gender) intersect.

In response to these challenges, BRAC (the worlds' largest non-governmental development organisation) initiated a number of interventions to improve teaching-learning in secondary schools. Drawing upon evidence in the literature that suggested educational technology in classrooms may be beneficial (Fonkoua 2006; Newhouse 2002). BRAC began a pilot project in Computer Aided Learning (CAL), to explore the use of multi-media digital resources to improve the teaching and learning of English, Mathematics and Science, in formal, non-government secondary schools. Since its launch in 2004, 300 teachers from 50 schools (6 teachers per school; 2 teachers per subject) have taken part in the pilot programme. The BEP team set about to develop digital content iteratively (especially interactive animations) that would be enjoyable for students to learn from and easy for teachers to teach with. These materials were based on the national curriculum and were intended to be appropriate to the national context. Initially the contents were developed for Science, Mathematics and English for grade VI to X, as it was thought that many teachers struggled with weak content

knowledge and pedagogic practices in these subjects. The animated materials were intended to support the development of basic language skills and vocabulary in English; to provide practice activities in mathematics; and to demonstrate practical processes in science. Whilst the BEP team recognised that changes in classroom interaction would be dependent upon the ways in which teachers used the materials (not just the materials themselves) they anticipated that the materials would help make classroom practice more 'learner-centred', by providing opportunities for groupwork and pairwork, as well as prompting teachers to ask more open questions. The main objectives of the programme (see <http://e-education.brac.net/#>) were to:

- ▶ Ensure conceptual clarity and better application based on the national curriculum and local context
- ▶ Move the classroom from teacher centred to more interactive and engaging one, creating a 'joyful learning environment'
- ▶ Enable teachers to use technology as an effective tool for educating students
- ▶ Create self-learning provision for both teachers and students
- ▶ Prepare the students to enter and successfully cope with the ever-expanding high tech global environment.

BEP considered that the development of CAL material was the most crucial part of the project. This was carried out in collaboration with a number of secondary school teachers, teacher trainers, sector specialists, and resource persons from several institutions. After writing the scripts, animations were developed by a group of technical experts including artists, graphics designers and animators. Materials were developed with reference to students' perceived age, ability, interest, taste and contexts. BRAC initially piloted this programme in seven schools of Mirzapur in Tangail, equipping the schools with computers and either a data projector or 5-8 daisy-chained monitors. Teachers received five days of face-to-face training, with two days providing basic understanding on ICT and three days on using the multi-media contents in the classroom. The trainers and some of the content developers jointly demonstrated an ideal class using these materials. Later on the participant teachers practiced conducting lessons using the materials. In this initial training, teachers had freedom and flexibility in using CAL materials. For example, if some teachers thought that CAL material was not necessary to teach particular part of content they could omit the material for that section. The trainers and content developers provided feedback on teachers' practice lessons. After this initial training, the CAL materials were finalised following a series of review and feedback sessions involving various representatives from the government and private sectors. This was an innovative approach as both students and teachers were actively engaged beside other specialists in the iterative content development process.

After the initial five-day workshops and finalisation of the materials, teachers attended a refresher workshop for two-to-three further days, either in their schools or at a BRAC Learning Centre (BLC). Here they again observed model lessons from the experts and

practiced lessons themselves, discussing any problems collectively. Teachers then returned to their schools, to try and incorporate CAL. BEP's programme organisers regularly observed the CAL classes and provided feedback to the teachers after the refreshers training. Some selected rural school teachers were also developed as master trainer to train the other rural teachers. More recently, all teachers of the CAL programme received further three-day refresher training as the need arose, for example, if the curriculum was changed or there was any change in the materials. There was no fixed schedule for this.

The initial results from the piloting indicated that the CAL programme had helped students become more motivated, with associated improvements in attendance. Teachers found the materials helpful. They reported that the CAL materials saved their time and energy and felt they stimulated them to be creative and to use real-life examples in classroom. Similar results were obtained from Sharmin and Roy study in 2011. Over a decade has passed since the inception of BRAC CAL in 2004. At the time of this study, CAL was being implemented in 50 secondary schools of rural Bangladesh. BRAC had recently moved towards co-funding of the programme, providing DVDs, for English, Mathematics and Science at modest cost. Materials were available for each subject and each year (classes VI, VII, VIII and IX-X) on separate DVDs. Most of the teachers typically need 3 DVDs, each costing around 100 BDT (around \$1.25). BEP has also provided open-access to the materials online (at <http://e-education.brac.net/#>), where individual flash animations can be downloaded and played offline. No further evaluation had taken place since 2011. The current formative evaluation has been initiated to assess the ongoing impact of CAL and to inform future decision-making regarding the programme.

1.2 PURPOSE OF EVALUATION

The purpose of this formative evaluation was to enable BRAC to assess the extent to which the BRAC-CAL was achieving the intended goals of improving the teaching and learning of Mathematics, Science and English. The objectives of the study were to evaluate:

- ▶ The context in which the CAL programme operated and its appropriateness to that context
- ▶ Changes in (nature or extent) teaching and learning practices
- ▶ The strengths and limitations of the 'teacher development' approach, in relation to developing teachers' confidence, subject knowledge and classroom practices
- ▶ Strengths and limitations of the 'educational technology' model, in relation to practical issues affecting development of teacher and student access, ownership and capabilities.

The evaluation did not seek to quantify changes in learning outcomes at this stage, but rather to enable the CAL team understand any impacts on teaching and learning practices, to better inform future programme design and implementation.

CHAPTER TWO

METHODOLOGY

2.1 DESIGN

The evaluation was carried out within a Realist Evaluation Framework (Pawson, 2013). Accordingly, it addressed three over-arching research questions:

- RQ1 By what processes did BRAC-CAL seek to bring about change?
- RQ2 How did those processes interact with the classroom and school contexts?
- RQ3 What outcomes did the programme have for teaching and learning?

Qualitative and open-ended research methods were chosen to explore these questions, aiming to provide in-depth understanding of participants' experiences and insights. RQ1 was addressed in terms of programme design, by review of project documentation and direct engagement with the programme team. It was also explored in terms of how teachers experienced these processes, from teacher interviews and teacher focus group discussions in schools. RQ2 and RQ3 were explored through field visits to schools. Field visits gathered general information about the school and the community it served, through questionnaire and semi-structured interviews with head teachers. Individual BRAC-CAL teachers were observed during CAL and non-CAL lessons, then took part in semi-structured interviews about the effects of participating in CAL on them and their teaching, as well as on their students' learning. Group interviews were held with three students from observed lessons, to explore students' experiences and views of the CAL programme. Finally, focus-group discussions were held with all of the BRAC-CAL teachers² to consolidate views about how the programme had worked in the school.

² Even though the number of teacher participants was of necessity smaller than is typical for FGDs (e.g. around 6-10) they are described as FGDs because they relied upon interaction between participants on topics raised by the researcher, as distinct from GIs where emphasis is placed on questions and responses. See Gibbs 1997, <http://sru.soc.surrey.ac.uk/SRU19.html>. In one school, the head teacher also participated in the teachers' FGD.

2.2 SAMPLE

At the time of the study, BRAC-CAL was operating in fifty schools across six districts of Bangladesh: Bogra, Comilla, Gazipur, Rajshahi, Sylhet and Tangail. The scope of the study allowed for two field teams to collect data over a one-week period. Two districts- Bogra and Comilla were purposively selected, as the schools here had participated in BRAC-CAL for some time and adequate communications infrastructures meant the field teams could travel to three schools in each district, within the time constraints. Within each school, the head teacher and three selected CAL teachers (one from each subject: English, Mathematics and Science) participated in the study. From each teacher's CAL class, three students were also selected to participate. All the respondents for interview and FGD were selected purposively by the field teams. In total, the sample consists of six schools, 18 teachers and 54 students and provided ninety sources of qualitative data within the data set, including:

- ▶ 36 classroom observations (CAL and non-CAL lessons);
- ▶ 18 semi-structured interviews with teachers, post-observation;
- ▶ 18 Student group interviews;
- ▶ 6 focus group discussions with BRAC-CAL teachers;
- ▶ 6 semi-structured interviews with Head Teachers
- ▶ 6 School Information Sheets.

2.3 FILEDWORK AND DATA COLLECTION

The study was accomplished with six post-graduate research assistants from Dhaka University, working in two teams, each team led by a senior researcher from BRAC Research and Evaluation Division (RED). Each research assistant had expertise in one of the target subjects, English, Mathematics or Science. Research Assistants were given one-day training on the field protocols by the Co-investigator (COL) and Principle Investigator (PI). Each team was assigned to collect data from one district: Comilla or Bogra.

Each research team reached at the selected school before the start of the school day. The research team met first with the head teacher. The team leader greeted the head teacher, introduced the team and clarified the research purpose. Head teachers called the subject teachers of Science, Mathematics and English and introduced them with the research team. The research objectives and tasks were explained to everyone. Then the head teacher and lead researchers checked the school routine and agreed on how the research tasks could be carried out with minimum disruption to regular activities. Team leaders conducted the semi-structured interviews with head teachers whilst research assistants worked with the teachers for their target subject. They tried to observe the CAL and non-CAL lessons of the respective teachers first, and then conducted semi-structured interviews with the teachers and group interviews with students. If any of the research assistants was free while another was conducting interviews, group interviews or FGD they helped the interviewer by taking

notes. Photographs of classrooms and other aspects of the schools were taken with permission. When all the observations, individual teacher interviews and students' group interviews were completed the Mathematics, Science and English teachers were invited to take part in a focus group discussion, facilitated by the team leader.

At the end of each day, the research team wrote up their field notes formally, prioritising any interview or discussion which did not have an audio recording to refer back to. The team leaders checked the collected data and provided feedback each day, to improve reliability and reduce bias between research assistants.

2.4 DATA MANAGEMENT AND ANALYSIS

After the field work was completed the research assistants were given a week to complete all the transcriptions and formal field notes in Microsoft Word. The team leaders renamed all files in a standard format, anonymising the data and organising all items systematically in folders. Thematic analysis of the data was conducted with Nvivo software, drawing upon approaches described by Braun and Clarke (2006). The analysis set out to provide a rich description across the data set (rather than a detailed account of one particular aspect). The analysis combined deductive approaches (coding data against the pre-existing research questions and critical issues identified within international literature) and inductive approaches (coding outside the pre-existing frameworks and attempting to identify significant themes). The analysis allowed for extensive triangulation and comparison across the various data sources, both within and between schools. Initial coding and analysis was shared mutually between the PI and the Co-I and team leaders, before the report was finalised.

Data will be stored on secure servers at The Open University and will be maintained for three years.

2.5 ETHICS

The study was compliant with ethical requirements for both the Open University UK and BRAC-RED. Research carried out from the Open University UK is undertaken within a structured framework, which includes assessment by the OU Human Research Ethics Committee (HREC). The research is governed by and adheres to, Open University policy available on the OU Research Ethics Website (<http://www.open.ac.uk/research/ethics/>). A full ethics proposal was prepared for this study and received preliminary approval from the HREC co-chair, but this was not progressed further after it became clear OU staff would not be able to participate in fieldwork due to enhanced security restrictions in 2016. Research carried out by the Research and Evaluation Division (RED) of BRAC is also subject to internal ethical approvals procedures, whereby, proposals are reviewed by relevant programmes and senior researchers before the proposal is finalised and approved.

All participating teachers and Head Teachers were provided with a project information sheet (PIS) in Bangla; this information was conveyed to students orally, in Bangla, by local field workers, who invited discussion and clarification. For teachers and head teachers, the participant information was given in writing and written consent was obtained; written consent for students' participation was provided by the teachers and head teachers, who were legally responsible for the students while in school.

2.6 BIAS AND LIMITATIONS

This section deals with issues that are more usually thought of as validity and reliability, but in the context of a qualitative approach are more appropriately seen as 'bias' in the various stages of the research process. In addition, some of the practical limitations in data collection are noted. At the first stage, there was a possibility of bias in school selection. Field work, particularly with schools in rural areas, was inevitably disruptive and its brevity meant that it was much less likely that the ordinary business of a typical half day in the school would be observed.

The protocol for the lesson observation attempted to record objective behaviours, but the sampling choice of which behaviours to record was subject to the bias of the observer. In each field team, there were field workers with graduate level specialisation in the subjects covered by the study: English, Mathematicss and Science, but whilst fieldworkers had specialist subject knowledge, they did not have experience of teaching or teacher education, nor international experience of researching teacher development or teaching practice. This was mitigated by initial orientation, close supervision from the field team leaders and comprehensive debriefing each day. Each fieldworker observed and interviewed the BRAC-CAL teachers with whom they shared a subject specialism, as well as conducting the group interviews with students from the observed lessons.

Inevitably, the presence of an external observer would affect the type of lesson given by the teacher (something that is 'better' than usual, though also producing a more nervous performance particularly with a first language English speaker as an observer). Although it had been stressed to the schools that the observers were not evaluating individual teachers or teaching, the visits created pressure and it was possible that the school would try to present what they perceived to be their best teaching. Therefore, observed practices should not be taken as illustrative of 'business as usual', but rather as teachers and schools presenting what they view as their 'best' practices. The individual interviews, group interviews and FDGs followed a standard protocol with open and structured phases (see Appendix 5e), so that participants were given a chance to express their own views (without the interviewers' preconceptions), but also to discuss a standard set of issues, to provide a consistent set of data.

CHAPTER THREE

RESEARCH FINDINGS

RQ1: BY WHAT PROCESSES DID BRAC-CAL SEEK TO BRING ABOUT CHANGE?

From participants responses, a number of mechanisms were seen to be central to the process of bringing about changes through the BRAC-CAL programme:

a. Enduring relationships for school and professional development, with support from head teachers and School Management Committees (SMCs).

Most of the Head Teachers began their discussion of the introduction and effectiveness of the BRAC-CAL programme with reference to long-term and highly valued prior relationships between BRAC and the implementation schools, preceding the CAL programme. These were seen to have laid foundations of trust, not just with the academic staff, but also with the School Management Committee (SMC) and by extension, the community. For example:

“We have a long relationship with BRAC which started through a teacher training programme in 2001... they found the training very effective. They enjoyed and felt they benefitted professionally... Later on returning to the school I talked to the teachers and SMC. All agreed happily and we started our journey with BRAC CAL from 2011.” (C-Dist-School2-HT)

“BRAC started to work many years ago in our school...After that, BRAC came to us with the proposal of CAL programme... the SMC members... happily agreed... with mutual consent from everybody, CAL was started in our school ” (C-Dist-School1-HT)

All head teachers also reported very positive attitudes to CAL programme implementation and outcomes, which may in part explain why all schools continued to implement the CAL programme on an on-going basis, even five years or so after initial participation.

“SMC thought it was a blessing that BRAC choose their school for the intervention... the quality of the school was increasing and the community people was treating this school differently... SMC felt proud of that... local

people feel proud that their children are studying in such a school where CAL is available. Other schools have such kind of technology... but practically [teaching and learning with] that doesn't exist. But in BRAC school, students really learn through technology... Parents respect me for that"(C-Dist-School 3-HT).

b. High quality (content and pedagogy) curriculum materials

The provision of high quality digital learning materials in English, Mathematics and Science, is central to the BRAC-CAL programme. These take the format of presentations rich with animations, audio, photo and video resources. A little like Interactive Radio Instruction (IRI), the materials present curriculum content but also include instructions for student activity during the lesson. These are particularly useful for showing things that are difficult using textbooks or locally available resources alone, e.g.

"For a science class, if I want to teach chemical reaction, then taking acids, bases to class, it is a tough job. But now my students can see the reaction in CAL materials too'. (C-Dist-School 3, T-FGD).

c. Teacher Training in ICT and use of curriculum materials

Several teachers' accounts suggested the primary focus of the initial training was on becoming familiar with the ICT and learning how to open and use the CAL materials. E.g.

'Those training programmes provided the primary knowledge about operating and handling of CAL materials, how to use computers...'. (B-Dist-School 2, Science T)

'T3:...we were trained for technical operation of CAL tools. T2: We were trained to plug-in and plug-out projectors and such. T1: They taught us to operate CAL class with the equipment' (C-Dist-School 1, T FGD).

Yet, other teachers referred to learning rudimentary strategies for organising groups or encouraging student participation:

"T3: Before training I just solved the math problems on the blackboard. After training I started engaging my students, calling them to the board, giving them group work...T2: now we just give direction. Then, we monitor their work, if slow learners are really working or not... I learned from the training that we should mix good and bad students in group then let them sit. It helps their learning'. (C-Dist-School 3, T FGD)

d. Extended Follow-on support

Most teachers referred to receiving numerous face-to-face training sessions for several years after their initial training. For example:

“Every year we have done one CAL training, where we get new contents and learned to teach on those. We have done training in Dhaka, Comilla and Chittagong. And after using CAL for 4-5 years and having trainings, has helped us tackle the problems.” (C-Dist-School 1-Science T).

“We have refreshers at the beginning of every year. We get new content every year at this time... This refresher helped us share our knowledge. Some uses computer less, some uses more. And those who are good... come to the board and share his/her routine”

Whilst most teachers reported positively on this, one teacher suggested that after several years, the follow-on support needed to move on from how to use the materials.

“Actually, I liked the training at the beginning. But later in the training programme they taught us how to play a CD and carry on such simple (things) which we already know. In that stage it got boring.” (C-Dist-School 3, Teacher).

e. Classroom observation and feedback in schools

Head teachers and teachers from four of the six study schools referred to having received numerous school visits and classroom observations from BRAC-CAL, especially in the initial years of implementation. Most noted these had reduced over time. Given that schools began BRAC-CAL on average five years before the study, it is perhaps more remarkable that such in-school engagement has continued so long, rather than that it has reduced over later years.

“BRAC colleagues also visited many classes of our teachers. They provided feedback. Sometimes we got bored because of their too much coming (said with a smile). However, now-a-days they come less. May be our teachers have become expert that's why they come little.” (C-Dist-School 1, HT)

RQ2: HOW DID THOSE PROCESSES INTERACT WITH THE REALITIES OF CLASSROOM AND SCHOOL CONTEXTS?

a. How did Teachers and Head Teachers react to the BRAC-CAL training and approach?

Head teachers and teachers were unanimously positive in response to the programme; a key aspect in this seemed to be that almost all participants thought

CAL had improved student motivation, attendance and learning (effects on teaching and learning covered in RQ3 below).

Where teachers talked about their initial training, they praised the trainers for being sensitive and encouraging, helping teachers overcome their anxiety in using the computer for the first time. The following is typical of teachers' responses.

"T3: My first day training was three days long. It was the first training of CAL. They were introducing CAL materials for class six. We saw the materials and we also had to take demo classes on those materials. I liked that very much. I haven't touched computer before. They taught me. The trainers were very friendly. They first taught us well. The trainings were enjoyable as well....' T1: 'All of us had the same feeling of excitement. We were excited that we could then present those interesting materials to students.'"(who said this?)

The CAL materials are central to programme design and implementation and were commented upon by all participants. Amongst the comments, a number of recurrent themes were identified. Teachers, Head-Teachers and Students found the materials to be high-quality and highly-effective in supporting teaching and learning (more in RQ3 to follow). One head teachers observed '...these are excellent and are prepared based on child psychology. The need, taste and capability have been considered while developing the content. That's why the children like these very much.' (C-Dist-School 3, Head Teacher). In five of the six schools, teachers or head teachers said they would like such materials for more subjects, or they would like the content for current subjects to be extended. To extend the materials, some teachers suggested more student exercises, such as individual or group work, within the materials. In three of the six schools, mathematics teachers said they would like more examples to be included.

There were extensive references (40) from all schools, that the BRAC-CAL programme had positive effects on teachers' workload, making their professional lives easier. This may be one of the most extensively referenced areas. Teachers say it makes their lives easier actually during lessons (more in RQ3 below), but also in lesson preparation. The following illustrate the general nature of teachers' comments:

"In traditional methods teacher needs to talk a lot, take notes and preparation before class. However, CAL lessons require less preparation time for teachers. The contents appearing on the screen do not help the students only it helps the teachers as well. Thus, it helps to lessen teacher's workload. He said, 'CAL is about less time more learning and regular class is like more talk, more time but less learning.'" (B-Dist-School 3, Head Teacher)

"Well, as we have to take quite a load of classes we can't manage that much time for preparation. It's like instant preparation before the class... In case if the preparation is quite poor someday, then there is multimedia class for rescue! There are enough materials here in a multimedia class. So, we

can take a class on any chapter without second thought.” (C-Dist-School 1, Teacher)

“We have already said this. CAL class is easier for us to handle than regular class.” (B-Dist-School 2, Teacher FGD)

In all schools, teachers and head teachers commented upon the relationship between the BRAC-CAL programme and national curriculum, textbooks and examinations, or the government training on ICT. In general, teachers and head teachers express the view that BRAC-CAL ‘pioneered’ the use of digital content in classrooms and prepared them well for subsequent government training. A few teachers mentioned that the integration with the textbooks or examinations could be tighter, for example: “CAL lessons help the students know the basic knowledge about lessons, but is not sufficient for the exam preparation. In CAL lessons, need to add more exercise and examples in covering the curriculum which help the students in the exam”. (B-Dist-School 3, Teacher FGD).

In four of the six schools, teachers reported wanting to be able to adapt or co-develop the materials, perhaps in light of the government training programme (which centred upon teachers developing their own digital content in the form of PowerPoint slides, using media they could find on the internet). Some teachers suggested that if the CAL materials were made available as PowerPoint slides, that would enable them to modify these. ‘BRAC’s animations are very well made. We cannot make things like that. But we want to show our fair share of creativity too...’ (C-Dist-School 3, Teacher FGD). Yet there were also several comments emphasising the benefit of CALs ‘ready-made’ content, noting how long it took teachers to develop their own material in the government programme.

“(In CAL) Our work is limited to open or use, we can’t do more than that. We get a government training about making digital content. But we are not so confident... It took so much time... full night... Using CD is easier. There are so much information in it.... Because (content) which we made, that’s source was the only textbook - if we don’t download any picture or writing from the internet. But CD is readymade. It’s easy.” (C-Dist-School 2, Teacher FGD)

In the quote above, where the teacher says ‘Our work is limited to open or use...’ this could be interpreted as meaning ‘this makes life easy for us’ as they say later, but another interpretation could be ‘this is quite constraining’. Several teachers made comments that suggest the latter, for example:

“Well, as you see when we play on the CD it continues on as itself and makes me like an inactive spectator in the class. I just keep standing. Everything has to be said is done by the tool. Maybe I would want add a slide or show a picture to the students but I can’t. Or students might have something to say that I need to provide some clue - I can’t.” (C-Dist-School 3, Teacher)

“When we take CAL class, then we become fully dependent on CAL material, there are some limitations about what I say, how I say that or how far I will go to that rules, there are bindings. What they tell me to teach, I only teach that thing. But in Non-Cal class, I am free to teach in my own way.” (C-Dist-School 1, Teacher).

In two schools (B-Dist School 2, C-Dist-School 3), teachers mentioned that the CAL materials were in large units which were sometimes difficult to cover in a lesson. They suggested breaking the content into smaller units, which could be covered in a lesson. Smaller units with less linear navigation and greater teacher control, might go some way to addressing teachers’ desire to modify or use the materials more flexibly.

b. What were Teachers and Head Teachers doing to put BRAC-CAL into practice, in their schools?

Head Teachers were reported to organise and monitor routines to ensure high levels of use of CAL lessons in the ICT-equipped classrooms, in all schools. In half of the schools, teachers and head teachers explicitly said that routines were planned for the year, but this is probably true of all schools as it appears to be integral with the time-tabling of lessons. In two schools (C-Dist-Schools 2 & 3) head teachers were explicitly reported as monitoring usage and in one of these (C-Dist-School 3), teachers report sitting each week with the head teacher, to review lesson plans for the week.

In some schools, there is evidence that access to the ICT-equipped classrooms and resources may be limited (for teachers or students), other than for the scheduled CAL lessons.

“The HT controls access to CAL classroom. Every day from morning to evening classes go on continuously in CAL classroom. As a result, both students and teachers cannot get any chance to use it for this time constraints. However, they have other computers in school to practice.” (B-Dist-School 1, HT Interview)

“Overall HT controls access to that room. However, teachers can use CAL equipment outside of class routine as per need. But the frequency of that is very low. But students are not allowed to use the equipment on their own. If anyone want to use a teacher goes with them.” (B-Dist-School 2, HT Interview)

“The teachers use it as per their routine. No additional permission is required for using the CAL class. If there is no activities in any day then the CAL classroom remained locked.... well, when the classroom was situated in the first floor then the girls could use the CAL classroom.... to observe any drama or movie in the projector. We also permitted. But... (now) I am not responding to such request from them.... Though I don’t show interest but they are still interested to use these classrooms.” (C-Dist-School 1, HT Interview)

In one school (B-Dist-School 1), the head teacher had provided an additional computer for teachers to use anytime, outside the CAL classroom. (The interview excerpt above might suggest that students in this school also have access to computers outside CAL, but students say this is not the case). In one other school (C-Dist-School 1), all teachers had purchased their own laptops, after encouragement by the head teacher; this school was also in the preparing to construct more multimedia classrooms.

Teachers were typically delivering several CAL lessons per week, usually at least one for each group of students they taught. It appears that CAL classrooms are time-tabled for near continuous use for teaching and learning of target subjects, in most schools.

c. How did the contexts of the schools affect programme implementation?

The main contextual challenges schools reported relates to a tension between the number of students, the number or size of classrooms available and the number of CAL equipped classrooms. These tensions were commented upon extensively by Head Teachers, Teachers and Students from five of the six schools (but not mentioned by participants from B-Dist-School 3). These tensions manifest in three related but distinct ways.

Firstly, some schools faced a general shortage of classrooms, which meant that Head Teachers could not see how to break the year group (class) into smaller classes (divisions). For example:

“At present I have been struggling with room crisis. I need to make several sections but can’t do that because of room constraint” (C-Dist-School 1, Head Teacher)

“THE biggest problem of the school is its infrastructural poor condition. I feel really sad when I say 100+ students are sitting in a room and trying to study. if their parents were rich enough they would withdraw them from this school because of its poor infrastructure. I have room crisis. I should have two sections in each class but I can’t accommodate it.” (C-Dist-School 3, Head Teacher).

Secondly, most schools had only one classroom available for CAL lessons, meaning all CAL lessons for all subjects needed to be scheduled in that class. Several respondents indicated that they could manage better if there were more than one CAL classrooms available.

“The problem is that we have only one CAL classroom but number of CAL lesson is not one per day. We have to conduct 4-5 CAL lesson per day ideally. per subject 3-5 lessons are expected to be conducted using CAL materials in a week but very often we cannot do that because of the room crisis. What we do is that, we prioritise the lesson and then decide which lesson would be held today....” (C-Dist-School 3, HT).

Thirdly and for BRAC-CAL perhaps most importantly, there was often chronic overcrowding in the CAL lessons. Observed attendance ranged from forty three to one-hundred-and-four students, with registered numbers as high as one hundred and forty students in a class. Many teachers reported problems related to overcrowding, e.g.

“We have large class sizes. Every class has more than 100 students. We face difficulty accommodating everyone in CAL class. The CAL class becomes cozy and hot and damp. Only four fans are very less for the class. So, we face difficulties in grabbing their attention.” (B-Dist-School 2, Teacher FGD).

“No, all students don’t have an equal chance (to participate) because of a large number of students. If we have 30/40 students, then we can sit them properly for this kind of class. In group work, we should rearrange the students.... If there that kind of table which we used in BRAC during our training, then it can be easy (we can’t do seating arrangement as we were shown in training). How BRAC tell us? We can’t do that kind because of our student number.” (C-Dist-School 2, Teacher).

Problems of overcrowding were also regularly raised in student focus groups:

“Yes, there’s a problem. We are 74 students but the CAL class is too small. We all can’t sit in the class. Many of us have to class there standing the whole time.” (C-Dist-School 1, Student GI)

“Most of the time I try to come to this class as soon as possible. Some days, I tell my friends to keep a seat for me. Then when we have finished writing, we tell our standing friends to seat and write. Sometimes standing students use their friend’s back to keep their note-copies and write.... Our regular class is larger. We all could easily sit there. But the CAL class is small. We sit five students in a bench, still some of the students have to do the class standing.” (C-Dist-School 2, Student GI).

“S2: We all can’t sit in this class. Many have to keep up standing through the whole class. S3: We have many students in our class. It is 140.” (C-Dist-School 3, Student GI).

In C-Dist-School 3 mentioned by the student above, the observed science class had 140 students on register, but only 43 students (31%) attended the science CAL lesson, with the fieldworker noting this was because the classroom was full. In the same school, attendance at the non-CAL science lesson was more than double this, at 104 students (74%).

One school was sufficiently motivated by these challenges, to have been developing plans to build and equip further CAL classrooms the following year, with the support of the SMC (C-Dist-School 1, Head Teacher).

The second most significant issues related to electricity supply, which was identified as a problem by half of the schools. Only two schools had a UPS power supply working and available in the CAL room, but these did not seem to be schools facing electricity challenges: the head teacher of one said ‘...the area is blessed in terms of available electricity’ (C-Dist-School 3) whereas, no participants raised any issues with electricity in the other school (B-Dist-School 3).

In two schools, the UPS was reported not working (B-Dist-School 1 & 2), with this disrupting use:

“They do not have alternative power supply in that room, The IPS battery was also wasted which was not replaced. This hampered classes.” (B-Dist-School 1, Head Teacher).

“We get 1-2 mathematics CAL class every week. But when the electricity is not available we do not get the opportunity to enjoy CAL class” (B-Dist-School 2, Teacher Interview)

Another school (C-Dist-School 1) had a working UPS but this was not available in the CAL classroom. Whilst the head teacher said

‘In my school I have no problem with electricity. Electric connection is there. So, no problem with electricity.’ the teachers disagreed: “T3: Electricity is great problem here. Sometime it happens that I have preparation for CAL class but can’t conduct it just because of load-shedding. T1: But we have an IPS... Though it’s not currently equipped as the CAL classroom has been shifted.” (C-Dist-School 1, Teacher FGD)

The final school reported they did not have a UPS. Ironically, this is the school which seemed most in need of one, with all respondents reporting substantial disruption to implementation of CAL classes, for example:

“Irregularity of electricity in this area is the biggest problem in our area. See, there is no electricity now. It rained at last night which destroyed the connection. I called to the electricity office just before you came to the school. They could not fix the problem till now. Such kinds of problems are happening regularly now. Also when rain is not a problem we cannot enjoy proper supply of electricity. If there is electricity we conduct the CAL lesson every day but we cannot do that if electricity crisis is there. We don’t have alternative power source, at this moment we cannot effort that as well... Without electricity we cannot carry on the classes.” (C-Dist-School 2, Head Teacher).

“Well, electricity problem is quite regular here.” (C-Dist-School 2, Teacher)

“We have one Math Class every Monday. But many weeks we could not have it because of load-shedding.” (C-Dist-School 2, Student GI).

The third issue, maintenance, appeared to have worked well in all schools, especially considering that the project had been running for several years. Maintenance issues were discussed in all head teacher interviews and teacher focus groups. Four of the six schools reported all equipment fully functional. No schools reported any maintenance problems with the computers, desktop monitors or sound systems. Teachers seemed to manage between the troubleshooting training they had from BRAC, now years of accumulated experience and the support of the ICT teacher and Head Teacher. The following account was typical:

“I haven’t face any difficulties today. I am using it for many years. With practice, we have become more expert operating computers. In our training we were also taught how to maintain these machines and take care of those. Sometimes we ask our ICT sir for help. If he fails too, we call for BRAC’s Technical support. He comes the next day or within a day to fix these” (C-Dist-School 3, Teacher Interview).

There seemed to be maintenance issues related to Uninterrupted Power Supplies (UPS) and data projectors. Two schools (B-Dist-School 1 and 2) reported the UPS being broken, whilst one school (C-Dist-School 1) had a working UPS, but for some reason this was not available for use in the CAL classroom. Two schools (B-Dist-School 1 and C-Dist-School 1) had recently sent their projectors for repair, one of these schools was using an alternative projector from another project (Connecting Classrooms, the British Council) for CAL lessons. Projectors were critical for the intended use:

“We faced problem twice with BRAC projector and they solved the problem. Later on it disturbed and now it is in Dhaka for repairmen. We are working with another one from British council. If projector is not working, we really have nothing to do.” (C-Dist-School 1, Head Teacher Interview).

RQ3: WHAT OUTCOMES DID THE BRAC-CAL PROGRAMME HAVE ON TEACHING AND LEARNING?

a. On teachers’ learning: confidence, subject knowledge and teaching practices

Many teachers reported improvements in their confidence and skill in ICT, at least in relation to the intended purpose of being able to use the CAL resources in their teaching. In terms of teachers’ own learning, teachers talked primarily about learning ICT skills and learning how to open and use the CAL materials:

“The training programmes provided the primary knowledge about operating and handling the CAL materials, how to use computers.” (B-Dist-School 2, Teacher)

“We were trained to plug-in and plug-out projectors with computer and screen and such... they taught us to operate CAL class with the equipment.” (B-Dist-School 1 Teacher FDG).

Question 9:

Have they learned anything about teaching methods in CAL training?

Answer

Teacher said 'they have not learned anything about that in the training, they just learned about operating the computer and using CAL resources'.

T: "I learned about computer operating first-time from that training. She introduced us to that new technology and we almost forgot about our fears."
(Field notes, C-Dist-School 1, Maths Teacher Interview)

Although most teachers expressed confidence in the using the ICTs in class, there were technical problems requiring teachers to call for support, in over a quarter of CAL lessons observed (5 lessons: 27%. Five out of six schools). On three occasions, the difficulty was with the connection to speakers, once with making the monitor work and once accessing the CAL presentation. On all occasions, the schools ICT teacher or a technician was able to fix the problem and the lesson continued after a few minutes disruption.

Several teachers also said they learned 'methods of teaching, pair and group work' or they learned to give 'interactive', 'participatory' or 'student-centred' classes, but very few teachers elaborated upon this or give any practical illustrations. For most teachers, these responses seemed to be largely rhetorical (perhaps indicating development of declarative knowledge i.e. knowing about something, which may have only partially translated into procedural knowledge i.e. practically knowing how to do something), e.g.:

'Before training she used to just lecture.. but after that she learned about various and effective student centred teaching activities through CAL which includes group activity, encouraging students to participate, though sometimes she cannot implement these in her class because of time constraints or other problems, yet she learned a lot... about teaching methods'. (Field notes, B-Dist-School 3 Teacher Interview)

There were very few examples where teachers explicitly said how they were implementing more active teaching strategies, beyond using key terms (e.g. group-work, pair work) mentioned above. The only explicitly mentioned strategies were: asking students to show things on the board; giving students independent activity that teachers could monitor; asking students to discuss questions in pairs or groups before answering; sitting students in mixed ability groups and using greater eye-contact.

HT: "Before training I just solved the math problems on the blackboard. After training I started engaging students, calling them to board..."

T2: "Before training we did all the work in the class... Now we make students attentive too and we just give direction. Then we monitor their work, if slow

students are really working or not... I learned from the training that, we should mix good and bad students in group and then let them sit. It helps their learning.” (C-Dist-School 3, Teacher FGD)

T1: “In training, we learned that keeping an eye contact is the best way to keep students engaged in the lesson. If she’s not with you, she loses her concentration any time and start side-talking. In CAL training... we learned to use group work and pair work. They will discuss in pair and groups and then they will answer in questions... But I have never given a group work in Maths. I use it in science class though...”(C-Dist-School 3, Maths Teacher).

Looking across all observed lessons (CAL and non-CAL), there was little evidence to support teachers’ views that they had learned methods of ‘pair and group work’, or that many knew in practice how to create environments or activities which might be considered ‘interactive’, ‘participatory’ or ‘student centred’. Four teachers (of eighteen; 22%) allowed opportunity for student-student talk in only one observed lesson and half of these teachers also had one observed lesson in which they organised pairs or groups where there was no opportunity for student-student talk. Just four teachers (of eighteen) organised student-student talk consistently in both observed lessons; these were all English teachers (from B-Dist-School 1,2 & 3, C-Dist-School 3).

A third of all teachers (6 of 18, 33%) made no attempt to organise students into pairs or groups, in CAL or non-CAL lessons. Over a quarter of CAL teachers (5 of 18, 27%) were observed at least in one lesson, to organise students into pairs or groups in which there was then no subsequent student-student talk or joint activity. This occurred in CAL and non-CAL lessons alike. For example,

‘After lecturing for a moment he asked students to form groups with every two benches, students started forming groups. Teacher wrote instructions regarding group work, questions were written there and students were given five minutes for their work. Although teacher named it group work students started working individually, no sign of group discussion was seen there. On the board there were four questions that the students needed to answer. Students wrote and teacher walked around the classroom observing their work in progress. The students wrote individually, no peer discussion.’ (B-Dist-School 2-Non-CAL Science observation).

‘The teacher asked the students, “Do you know about him?” The voice in the CAL materials said “Jainul Abedin ,The great artist.” On screen, the CAL material provided three questions about Abedin – ‘Do you know who is in the picture, what do you know about them, why are they famous?’ The materials also provided instructions on screen, that students should ‘Ask and answer the questions with your friends.’ The teacher first said students should read the instruction aloud and then discuss the questions with their friend. But (instead of all the class working talking in pairs) one girl and the girl sitting beside her also stand up, and they two both start to say to the teacher ‘who

was Jainul Abedin, why he was famous'. [This was not a pair work actually].'
(C-Dist-School 2-CAL English observation)

In total, almost two-thirds of the teachers (11 of 18; 61%) were observed over two lessons in which they either made no attempt to illicit student-student talk, or in which they organised students into pairs or groups without any student-student talk or joint activity. Classroom observation data indicated that most students had few if any opportunities for extended, unpredictable utterances, writing or activity, either individually or in collaboration with others. Such findings raise serious doubts about teachers' claims of improvements in their pedagogic knowledge or practice.

In terms of the development of teachers' own subject knowledge, just two teachers (out of eighteen) said that they thought using the CAL materials had benefitted them in this way. Neither gave specific examples of what they had learned:

HT: "After my 20 years of teaching what I have not learned about English, I have learnt from BRAC's CAL content". (C-Dist-School 3, Teacher FGD).

"I could identify some mistakes in my content knowledge and teaching method after watching those CAL materials. It is not only educational for students but also for me a great way to correct my incorrect knowledge"
(B-Dist-School 1, Maths Teacher)

b. Students' learning and classroom interactions

In terms of observed classroom practices, across the thirty two observed lessons, there was little discernable difference between CAL and non-CAL lessons, beyond the use of the CAL materials themselves.

In relation to attendance, on the day of the study attendance overall was marginally higher (71%) for CAL lessons than for non-CAL lessons (69%), but this difference is unlikely to be meaningful. Yet the attendance figures do raise questions – attendance at CAL mathematics lessons was 80%, whereas, non-CAL mathematics lessons were much less well attended (66%). Conversely, as noted earlier, in one school with a small CAL classroom (C-Dist-School 3), less than a third of 140 students attended the CAL science lesson, whereas, three-quarters attended the regular lesson. This difference was attributed to over-crowding in the CAL classroom.

In all lessons, the dominant student activity was 'watching and listening', either to the teacher or to the CAL materials. This was typically interspersed with occasional short responses to teachers' closed questions by individual students or by the whole class in chorus, with short pieces of written work at the end of the lesson. There were very few occasions observed where students were invited to make extended utterances, either in asking questions or giving answers to teachers, or in discussion with other students.

Pair work

In four out of five lessons observed (26 of 32, 81%), there was no attempt at pair work. Of the six lessons (19%) where pair work was attempted, in three of these fieldworkers explicitly noted that there was no student talk within the pairs. There were only three lessons observed (9%) where there may have been student talk in pairs: two of these were CAL lessons, one a non-CAL lesson. All three lessons where students may have spoke in pairs were English lessons:

'Teacher gave a passage to read overall class. Then made a pair with backbencher student. Teacher wrote 5 questions about India. After 5-minute teacher asked question individually, such as – When India got freedom? Who built Taj? Why is India famous? Students replied perfectly.' (B-Dist-School 1, CAL English observation).

'Teacher said the students make pair with the beside student. Then teacher said them 'Make three sentence for three minutes. Make three sentence with three tense'. Teacher monitored the class what they do. After three minutes, teacher said to the students 'Have you finished?' Most students said yes. 2 student hands up, teacher asked the right answer from one. He replied well. Teacher said thank you.' (B-Dist-School 3, CAL English observation).

'Teacher told the students to make pair with beside one. 'Discuss about the lesson from exercise book for five minutes'. In that time teacher monitored the class. After five minutes, teacher selected three paired students. Teacher called 1st pair to come forward to make a dialogue with one another. They did it and teacher said the students 'Do you agree?' Maximum student replied Yes. Teacher thanked him. All the student clapped'. (B-Dist-School 3, Non-CAL English observation).

Group work

In three out of five lessons observed (19 of 32, 60%), there was no attempt at group work. There were thirteen observed attempts at organising students in groups (5 in CAL, 8 in non-CAL lessons), of which two (2 of 13, 15%) involved no student-student talk or shared task. The number of observations of students talking in groups was lower for CAL (4) than non-CAL lessons (7). Group talk was observed mainly in English (5) and science (5) lessons and only once in a mathematics lesson (apart from this one instance of group talk, there was no other student-student talk in any of the twelve maths lessons observed).

In summary, in almost three-quarters (72%) of observed lessons, there was no opportunity for student-student talk: more than half of the lessons observed (60%) teachers made no attempt to organise students in pairs or groups and in more than one-in-ten lessons (12%), students were organised into pairs or groups without any student-student talk taking place. These patterns were very similar for both CAL and non-CAL lessons, with variations attributed to differences between teachers or subjects, rather than the use of CAL in lessons.

Despite this, there was unanimous reporting from study participants (e.g. from every school and from all groups- Head Teachers, Teachers and Students) that the BRAC-CAL programme had improved the processes and outcomes of student learning. Some of the most commonly used terms³ to describe this were:

- ▶ Understand (92 references)
- ▶ Question (77 references)
- ▶ See (73 references)
- ▶ Time (68 references)
- ▶ Like (56 references)
- ▶ Participate (41 references)

See, Understand, Time and Question were usually closely associated in participant responses, to put forward a general argument that students understood ideas better when they saw these visually in the CAL materials; this meant they learned things more quickly, in less time, and asked less questions for clarification. For example:

“I took a class on Magic Box today. If I had to teach that in normal class, I had to tell a lot in the lecture. But here in CAL they can understand very easily, using a lot less explanation... in CAL most of them can learn in short time... In normal class students ask more questions, they have more queries. But here, queries are answered in the CAL resource. They watch it for a lot of time and understand it very clearly. When they see something in animation, they understand what was being described to them very well, they might not have questions.... Students understand better in CAL class.” (C-Dist-School 3, Maths Teacher).

“I also like multimedia classes very much. Because, in a normal class which topics we find difficult are easily presented in a CAL resource. We can see pictures, videos and animations which are easier to understand.... Normal class is monotonous... When we do not understand something in normal class, teacher tells us that he will take that class in multimedia with CAL resource again. This way, our confused understandings are sometimes get cleared... In January we had a normal class on magic square. We did not understand at first. So, we asked him and he explained it again. And the next day he took us to the CAL class... “ (C-Dist-School 3, Maths students’ GI)

“That (non-CAL) class was not so effective because they can’t see... I said about Jainul Abedin or Mother Theresa, but they did not see that. If they see then they can remember easily.” (C-Dist-School 2, English Teacher).

“In our normal classes we have to read though we understand or not. But if see practically (in CAL class) we can remember clearly. And then we can complete that lesson at home in short time.” (C-Dist-School 1, English students GI).

³ Each term given here was used to describe changes in classroom practice or student learning, in data from each and every participant group (HT, T & Ss) at each and every school.

S4: 'We usually ask questions more or talk more in regular Non-CAL classes'
S2 (smiling): 'We actually listen and watch with deep concentration in CAL class, so we forget to ask question.' S1: 'We enjoy it very much'. (C-Dist-School 1, Science students' GI).

However, there were occasional views to the contrary, for example, where a teacher referred to difficulty in managing CAL lessons, or where students say they find their teachers' explanations easier:

"I do not face much problem in using computer. But sometimes it is really difficult for me to manage the class because I have to maintain the computer and the class at the same time. As a result, students sitting behind make chaos" (B-Dist-School 1, Science Teacher)

"Sir understands by which example we will be able to learn. But multimedia cannot know that, it is a computer. So that gives us examples, we do not understand most of the time. For example... the theorem of Pythagoras can be explained in many ways. But CAL's explanation is hard for us to understand. I could not understand it by that method. Then sir taught me an easier one. Also I wanted to learn about the easier method. So, finally I succeeded." (C-Dist-School 2, Maths student GI).

Like(d) was commonly used by teachers and students, to express the view that they preferred the CAL classes to the non-CAL classes. (But the term is perhaps over-highly ranked, as it was also frequently used in making comparisons, e.g. 'it was like this, but not like that').

Participate was commonly used to support the view that students participate more in CAL lessons:

"When they just had to do the math and copy my math from the board, they did not think. But now they have scope to think, to talk to others. This is helping them to participate more. They can share their ideas" (C-Dist-School 3, Teacher FGD).

Yet, it was sometimes used to express the view that students participated less in CAL classes:

"They said that they participate more in normal class. In a normal class, they have more time. And multimedia they have less time to ask because at first sir explains the content, then the CAL material. Then students have to participate in some individual work. Then they have to answer some questions back. These back to back activities provide them of less scope to ask questions to teacher." (C-Dist-School 2, Maths Student GI).

Observation data did not indicate any notable differences in student participation between CAL and non-CAL lessons.

Where gender was discussed, most respondents thought boys and girls had equal opportunity to participate in lessons and interact with teachers, but when it came to opportunities to come to the front of class and use the CAL resources, participants from two schools (B-Dist-School 3, C-Dist-School 3) said they thought boys volunteered for this more eagerly than girls (who were seen to be reluctant). In one school, the students said the teachers did not appear to try and select students to use CAL equally (favouring boys); whilst in the other school, the teacher said they explicitly tried to ask boys or girls equally and scolded those who were reluctant.

c. Students' opportunity for self-study outside of lessons

Teachers and students from all schools were asked whether or not the students had opportunity to use the CAL resources (computers or curriculum materials) independently, outside of lessons. In general, students' opportunity was limited to occasionally coming to the front of class to open or move the software on, during CAL lessons. In two schools, Head Teachers said students had access; one head teacher was very open and warm to this:

Yes, they can do that... Some of our students are more capable than the teachers in using ICT. In CAL lesson mainly teacher operates the ICT materials. However, if students want to know and work on CAL material after class they request their teacher. The teachers then in their free time take the students to the CAL... Sometimes students demanded to watch videos or other content that directly do not match with their syllabus. For example, once a group of students wanted to watch the video of *Haj* in projector... Sometimes they want to enjoy different videos from you-tube. To fulfil this wish they use the CAL classroom and projector. (C-Dist-School 1, Head Teacher)

But students from both schools said they only had access to computers in ICT lessons; they had no access to ICT or CAL resources outside lessons. It is possible that this was a communication issue.

Students from two schools expressed a strong desire for more independent access of the ICT and/or CAL resources, but said they lacked the courage to ask their teachers or principles.

'They thought of taking the CAL resources home, but could not ask the teacher for it.

S1: "I have never been so close to teachers that I can ask. I was shy too. I did not know how to ask for this material..." S2: "I think teachers will give us these. They want us to get good marks, good understanding. As these has always helps us to understand, I think sir will permit us to take these home" (C-Dist-School 1, Student FDG).

S1: "Once we touched PC in our ICT class. We felt so good! We typed our names in a spreadsheet. We learned how to write in a computer for the first time" S2: "We have seen key boards in pictures of text books. But using that by ourselves was fun! We learned how to write without paper-pen" S3: "We want to touch computer in our Math and Science class too. But we are not allowed, we can come to the multimedia classes sometimes and sometimes the doors are locked"(C-Dist-School 3, Student FDG).

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

BRAC-CAL's appropriateness to context

The CAL programme was designed in at least in part to address challenges of poor teachers' subject and pedagogic knowledge, by attempting to provide high quality subject/pedagogic materials for use in the classroom. The classroom materials themselves appeared very appropriate: Head Teachers, Teachers and students all responded very positively to the programme and most thought it made lessons more engaging, students more motivated and students' learning quicker, deeper and more enduring. Teachers generally thought BRAC-CAL 'made their lives easier', reducing the burden of lesson preparation and making classes easier to manage. However, the programme only partially addressed improving teachers' subject knowledge and pedagogic practice, as a secondary aim. In the context for which the programme was designed, a primary emphasis on teachers' content knowledge and pedagogy would have been more appropriate.

The second biggest contextual challenge, identified by participants in five-out-of-six schools, was dealing with overcrowded CAL classrooms. There are numerous reports of many students having to stand throughout lessons and of students at the back having trouble seeing the CAL materials or carrying out activities or written work. Some teachers also said that classroom overcrowding limited their ability to implement more active learning strategies.

Half of the schools reported some disruption from intermittent electricity supply. Although most schools had UPS, this was only working and available in a third of CAL classrooms. One school without UPS reported severe disruption to CAL delivery. Whilst computers and speakers appear to be well-maintained, a third of schools reported problems with UPS or data projector maintenance.

CAL classrooms were time tabled for near full capacity usage for CAL lessons (subject to electricity availability and equipment maintenance), which is a remarkably high Return on Investment (RoI), in terms of use of educational technology for teaching and learning. But as there is only one classroom for the whole school, individual

subject classes have limited timetabled CAL lessons and students have little or no access outside these.

Changes in Teaching and Learning Practices

Classroom observation data suggest little difference in teaching and learning between CAL and non-CAL lessons, other than the use of the CAL materials themselves. In all lessons, the dominant student activity was 'watching and listening', either to the teacher or to the CAL materials. This was typically interspersed with occasional short-responses to teachers' closed questions, by individual students or by the whole class in chorus, with short pieces of written work at the end of the lesson. There were very few occasions observed where students were invited to make extended utterances, either in asking questions or giving answers to teachers, or in discussion with other students. Students rarely volunteered questions and teachers rarely invited students to expand on their ideas. Less than four-out-of-ten lessons (38%) provided any opportunity for student-student talk, either in pairs or groups. In more than half of the lessons observed (60%) teachers made no attempt to organise students in pairs or groups and in more than one-in-ten lessons (12%), students were organised into pairs or groups without any student-student talk taking place. These patterns were very similar for both CAL and non-CAL lessons, with variations attributed to differences between teachers or subjects, rather than the use of CAL in lesson. Such practices are likely to severely constrain student learning.

Yet despite this, there was almost unanimous agreement from participants that CAL lessons were preferable to non-CAL lessons. Students and teachers alike reported improved student attendance and behaviour (e.g. better concentration, less side-talk, less disruption) during CAL lessons than ordinary lessons (although on the day of fieldwork, attendance was similar in CAL and non-CAL lessons. It may be that attendance varies by days when CAL is offered; no evidence was collected about this).

Participants ascribed changes in teaching and learning mostly to the CAL materials themselves – students liked the materials; they found it helpful to be able to see animations, videos or pictures of people, places and things that were otherwise beyond their experience or imagination. Teachers and students reported that this helped students develop a better understanding, more quickly, than ordinary lessons. There was a expressed that consensus that students ask questions less often in CAL lessons than non-CAL lessons, because students watch and listen to the materials intently and understand the content more easily, so therefore require less explanation or clarification from the teacher (again, contributing to making the teachers work 'easier'). Some teachers reported that they thought CAL lessons were more 'student-centred' or 'participatory', but this was not supported by observation data.

The Strengths and Limitations of the Teacher Development Approach

The primary purpose of the teacher development approach was to equip teachers with high quality materials and the ICT skills to use these, in which it was successful. The improvement of teachers' subject knowledge and pedagogic practice was a

secondary aim, for which evidence of success is limited. In relation to pedagogy, only four of eighteen teachers observed consistently created opportunities for student-student talk in their lessons: these were all English teachers, so this is likely a function of these being language lessons. In relation to subject knowledge, two of eighteen teachers felt the CAL materials had helped in this regard, though they gave no specific examples of what they had learned.

The teacher development approach was well aligned with characteristics of teacher development associated with improved teaching and learning in the international literature (see for example, Popova *et al.* 2016; Westbrook *et al.* 2013; Avasolos, 2011; Cordingley, 2013). There was a strong focus on the curriculum and provision of curriculum related materials for classroom use. Teachers were supported over an extended period of time, including through school visits and classroom observation. Teachers participated in groups, including two teachers per subject, which enabled peer support between teachers. In school, teachers had strong encouragement and support from head teachers, to put the training into practice. Whilst follow-on support was ongoing over several years, it took the form of initial training and occasional ‘refresher’ training. Several studies identify more regular support (e.g. meeting together every 4-8 weeks) as beneficial (see Westbrook *et al.* 2013). If the teacher development programme had prioritised the development of teachers’ subject knowledge and pedagogic practice, the positive aspects of programme design suggest successful outcomes would have been likely.

The Strengths and Limitations of the Educational Technology Model

Prior review of international literature on the use of Educational Technology in low-to-middle income countries (Power *et al.* 2014) show that programmes producing positive improvements in teaching and learning are typically associated with:

- ▶ a clear and specific curriculum focus
- ▶ the use of relevant curriculum materials
- ▶ a focus on teacher development and pedagogy
- ▶ evaluation mechanisms that go beyond outputs.

The BRAC-CAL programme clearly meets the first two criteria. Whilst there was also a strong aspect of providing ongoing support to teachers, this had a weak focus on the development of teachers’ subject knowledge and pedagogic practice. Prior evaluation mechanisms went as far as examining use of the technology and materials in schools and participants self-reporting of the effects of this; they did not go beyond these to examine the extent to which teaching and learning practices or outcomes had changed.

There is evidence that the educational technologies provided through BRAC-CAL are being used extensively, at or near full capacity (with respect to time-tabled lessons in the school day, subject to availability of electricity and maintenance of equipment), for teaching and learning of the target subjects. This is a rare finding: in the international literature, there are many examples of much costlier educational technology

implementation, where levels of use for teaching and learning are low (Power *et al.* *ibid*). Students and teachers alike perceive that students understand subject content better and more quickly when the CAL materials are used and students can illustrate this with specific examples. Students and teachers alike prefer lessons where the CAL materials and technologies are used, to non-CAL lessons. However, student learning with CAL remains a largely passive process of watching and listening, due to most teachers' limited understanding or ability of or ability to implement more active learning strategies.

RECOMMENDATIONS

1. Focus on developing teachers' subject knowledge, pedagogic understanding and classroom practice

BEP should shift the focus and content of teacher training from *'how to use ICT and CAL materials'* towards *how to teach your subject effectively, including the use of ICT and digital materials*. In particular, teachers should be helped to think about the nature of student learning activity – i.e. what is it that students are doing in the classroom, beyond watching and listening, in order to learn? What could students be doing, that might help them learn English, Maths or Science more effectively?

BEP should explore whether or how the materials could be used, in training or at schools, to challenge and develop teachers own subject knowledge.

2. Work with schools to explore ways of tackling issues of context: intermittent electricity, maintenance and classroom overcrowding

BEP should prioritise the provision of UPS to schools with the most unreliable electricity supply or explore alternative sources of power. BEP should work with schools to address difficulties in UPS and projector maintenance.

BEP should work with schools to explore options for reducing class sizes to manageable levels (some participants suggested 60 students), perhaps including provision of a second CAL classroom?

3. Take steps to ensure programme sustainability

BEP should consider institutionalisation of the programme in partnership with GoB institutions (e.g. A2I, DESHE, NCTB). BEP should engage with the relevant GoB institutions, to explore inclusion of the CAL resources in the next Sector Wide Approach (SWAP), which is currently in early design, with support from Asia Development Bank.

BEP should also consider whether the programme could be adapted for use in primary, providing higher quality curriculum materials in relation to the governments' MultiMedia Classroom programme. BEP should participate in the 'Educational

Technology round-table' for the next SWAP in primary education, scheduled for late November 2016.

4. Explore opportunities to enable more independent use by students

BEP should work with schools to explore ways in which students might be able to use the materials more independently in or out-of-school, perhaps through provision of student-copies of the CAL discs, or through enabling student access online. One head teacher suggested that students could be trained to deliver CAL lessons for their peers.

5. Explore options for enabling more flexible use of the CAL materials

BEP should explore whether it is possible to organise materials into smaller units, with more flexible navigation, so that teachers feel empowered to use the materials within their teaching, rather than that their teaching is being driven by the materials.

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ANNEXTURES

Field Protocol

A. General Overview of Protocol for Field Visits

Field team consists of:

Lead Researchers

Subject Specialists researchers

1. On entering school, the field team meets with HT (any BRAC-CAL teachers that HT invites to join) and Lead Researchers explain purpose, activities and seek informed consent, using Project Information Sheet and Consent Form. (p6)
2. If informed consent is secured from HT, Lead Researchers proceed to gather School Information (p7) and carry out the Head Teacher Interview (p8)
3. Whilst Lead Researchers carry out HT interview and gather school information, Subject Specialists prepare for and carry out lesson observation (p9) with their respective BRAC-CAL subject specialist teachers.
4. After lesson observation, Subject Specialists carry out post-observation Interviews with their teachers (p10). They also carry out Focus Group Discussions with a small group of students⁴ (p11) who participated in the observed lesson.
5. The research team reconvenes at the end of the school visit, to conduct a Focus Group Discussion, with all BRAC-CAL teachers (p12) from the school.
6. Lead Researchers double-check that we have written consent from all teachers and head teacher. Thank teachers for their participation.
7. Team generally note and/or photograph any other important features of the CAL lab, school facilities or wider context.
8. Thank Head Teacher for permission to work in the school and depart.

⁴ Subject Specialists must orally explain the purpose of the fieldwork and students rights to non-participation and seek oral consent, in a manner appropriate to students age and understanding.

B. DRAFT Project Information Sheet and Consent Form

About the BRAC-CAL Evaluation

The evaluation is being carried out by BRAC Research and Evaluation Department (RED), with support from The Open University UK (OU) and the Institute of Education and Research (IER), to understand the how appropriate CAL is to the contexts in which it works. We want to understand any changes in teaching and learning practice as well as the strengths and limitations of the CAL approach, so that the programme can offer improved to support teachers and schools in future. It is not teachers or schools that are being evaluated, but the support provided through BRAC-CAL.

What kinds of data we would like to collect from your school

We would like to observe one CAL lesson by each CAL teacher. We would like to talk to each CAL teacher individually, and to separately to some of their students, about their thoughts and experiences relating to CAL lessons. We would also like to talk to the CAL teachers together, and separately to the head teacher, about their views and experiences of the CAL programme.

What we will do with data from your school

When we write up the data, we will remove the names of all people and schools, so everything written about the study is anonymous. We will store the anonymous research data securely. We will produce brief case studies and a summary report of our findings. This will not name any teachers or schools. If we would like to use any particular image or recording to illustrate the report, we will contact you specifically to ask your permission.

What we won't do with data from your school

We won't share any information that identifies you or your school individually, with any other party. We won't use any images from your school in any public forum or document, without your specific permission to do so.

It's your choice to participate

You can choose whether or not to take part in the study; if you do not want to take part in the study, there is no problem. If at any point you want to opt out of the study, you can do. Just inform any member of the field team, at any time. If you opt out, we will destroy any notes or recordings already taken, and any observations or interviews with you will be excluded from the report.

Consent

Note: we will explain the purpose of the study and seek consent, orally, in Bangla, for students.

School:..... Date:.....

The undersigned give their permission for data to be collected from the school, in accordance with the guidelines above.

Head Teacher Name:..... Signed:.....

Teacher 1:..... Signed:.....

Teacher 2:..... Signed:.....

Teacher 3:..... Signed:.....

C. General School Information

Section	Questions	Comments
School	Name: Designation: Gender or Co-Ed: Location:	
Students	Total Enrollment: Y7: male: female: Y8: male: female: Y9: male: female: Y10: male: female: Y11: male: female: Y12: male: female:	
Management	Number of classrooms: Number of shifts: Number of teachers:	
BRAC-CAL	Number of CAL classrooms: Equipment fixed or flexible: Monitors or Projectors: BRAC-CAL equipment functional: How many years in BRAC-CAL: How many BRAC-CAL teachers: BRAC CAL CD's available:	
Other CPD	Current training: Training in last 3 years:	
Resources	Grid Electricity: Alternative Power: Other Computers in school: Other digital materials:	
Socioeconomic Status	Geographic setting: Describe catchment area: Describe SES of community:	

Please photograph the school (only with consent) particularly any additional resources, such as staff rooms, libraries, computer rooms, notice board school routine (particularly for CAL Lessons and teachers), or any other unusual or interesting features.

D. Head Teacher Interview

1. THEME: RQ2: How does the BRAC-CAL programme work in this school setting?
 - a. How did the school come to be taking part in BRAC-CAL? Whose decision was it (and now they are taking part in it, was it a good decision)?
 - b. Where are the CAL technologies located? Does this location cause any problems for the BRAC-CAL teachers, the HT or the wider school?
 - c. Are there any issues with infrastructure – such as electricity, security, the retrofitting of classrooms to take the CAL equipment?
 - d. How is access to/use of the CAL resource managed (e.g. timetabled; a designated gate-keeper/organiser; on demand...) and are there any strengths or limitations of organising things this way?
 - e. Who controls/organises this access, for use during lessons or at other times? Can students use the CAL resources outside lessons? How?
 - f. What do they (HT) think about the CAL programme? What are its biggest strengths or drawbacks?
 - g. How do the SMC members and local people perceive CAL materials and classrooms? Has there been a strong response from the school or local community?
 - h. Have the teachers had or needed any ongoing support after initial training – how has the head teacher or the BRAC-CAL programme responded to that need?
2. THEME: RQ3: Effects of the programme, especially on teaching and learning.
 - a. What's the effect of the CAL programme been on their school overall?
 - b. Has the HT or teachers noticed any significant differences in teaching or learning activities in CAL lessons?
 - c. If another HT was considering joining BRAC-CAL, would you recommend it to them? Why? What kinds of evidence would you give for the benefit or difficulties taking part in BRAC-CAL has brought to your school?

E. Classroom Observation

Before the lesson observation and interview, where possible:

- ▶ Record the teachers' name and gender.
- ▶ Record the class (year) being observed (e.g. Class 7)
- ▶ Number of boys and girls (registered and actual present)
- ▶ Duration of the lesson (time of beginning and ending of the lesson)
- ▶ Sketch the class (position of benches/tables/teachers desk/board/resources/ computers/screens/students seating by gender)
- ▶ If possible, photograph the classroom, teacher, and any resources (BRAC-CAL or otherwise)

Time-stamp your notes (e.g. actual time, or lesson time) regularly. You may want to use a table format, such as:

Time	Directly observed (objective) behaviours, especially including use of BRAC-CAL resources	Subjective comments (thoughts/ feelings / reflections) on observed behaviour/language use
e.g. 10.10 am	T: 'hello, sit down'. Writes 'Lesson 17' on board.	~

Note: Teacher behaviours related to pedagogic practices (e.g. greeting learners, asking questions, selection of students, assessment and feedback practice, medium of instruction, nature of teacher-student interaction). Record these in the middle column. Try not to make value judgements here – only record what happens. Value judgements or reflections (e.g. whether the teacher seemed confident and so on) may go in the right hand column only.

Note student activities, practices or materials that may have been promoted by BRAC CAL (e.g. Teaching methods and techniques used, use of materials, use of technology, collaborative learning opportunities etc) also in the middle column. Try not to make value judgements here – only record what happens. Value judgements or reflections (e.g. students seemed happy, enthusiastic; equity of participation; attentiveness etc.) may go in the right hand column only.

Time-stamp your notes (e.g. actual time) regularly.

Discretely photograph any interesting practices during the lesson, if appropriate and possible without causing distraction / disruption.

After the observation, you may want to make some summary reflective notes on the role of technology (whether it is helping or hindering classroom situation??) with your observation. How easily and effectively technologies were being used by teachers and students?

F. Teacher Interview: classroom practice and implementation

After observation of a CAL and non-CAL lesson. Areas of Focus:

1. How did the teacher take preparation for conducting the lessons? Did he use any lesson plan?
2. In which extent the teacher could conduct the lesson according to his plan?
3. How does the teacher think the two lessons went?
 - ▶ Was there anything that went particularly well?
 - ▶ Anything that was difficult to follow/implement– what have made it go better another day?
 - ▶ Did the teacher face any difficulties in using the computer/CDs while conducting the lesson?
 - ▶ What did the teacher think about the nature of
 - Participation (how did students participate in the lesson – in what ways)
 - Did BRAC-CAL training help them to ensure more students' participation? How?
 - Equity & inclusion (did all students have equal opportunity to participate; were they treated with equal respect by the teacher and/or their peers)?
 - Did the teacher have any challenges to promote equal and inclusive students' participation in classroom? What were those? Did the training help them to overcome those challenges? How?
4. Did the teacher find any difference between the BRAC-CAL lesson and the ordinary lesson, for them or their students?
5. Has their teaching practice changed over recent years, since they started BRAC-CAL? In what ways? What difference has this made to students?
6. What positive changes have come to teachers' regular practice as a result of BRAC-CAL training?
7. In which way the training can meet their needs better? Did he face any particular problem for these two lessons where BRAC-CAL training could help them to overcome those?

G. Student FGD

- ▶ What do students think or feel about the CAL lessons?

- ▶ Are CAL materials helpful for them to understand the lessons?
- ▶ Is there any particular thing about CAL classroom that seems difficult to them?
- ▶ Are CAL lessons different to ordinary lessons? How? What difference does that make for the students?
- ▶ Which lesson is more appreciated by the students? CAL or ordinary? Why?
- ▶ How often do they have CAL lessons?
- ▶ Do the teachers invite them to participate in teaching-learning activities? How? Do the students ask questions to the teachers? How frequently?
- ▶ Can students use the CAL resources themselves? How?
- ▶ Do student actually use the CAL resources themselves? How, when, where and how often? What do they think or feel about this?
- ▶ Are there any changes that might make CAL more beneficial for the students?

H. Teacher FGD

1. Theme: RQ2: Reacton to / Experience of BRAC-CAL training / support
 - a. CPD histories of the teachers, other than BRAC-CAL
 - b. About the BRAC-CAL training– initial training events and materials– what happened? What did T's think or feel about first experience of BRAC-CAL?
 - c. After their initial training, what happened in relation to BRAC-CAL, back in school?
 - d. Has there been any follow-up training or support since the initial BRAC-CAL training (e.g. ongoing meetings or mentoring; peers in school; networks beyond school).
 - e. Who do they go to now, if they need help in using the technology or materials?
2. Theme: RQ2: Experiences of / reaction to using BRAC-CAL as a teacher
 - a. How easy is it to practice / become confident in using the computers / resources?
 - b. How is use of the CAL resources organised: (e.g. timetabled CAL lessons; on demand; other) and who controls access?
 - c. How often do you use CAL resources personally, or in teaching? What's the pattern of use in a usual week or month?
 - d. Are there any problems in being able to access CAL resources when you want to use them? Can anything be done to make access work better?
 - e. How well do CAL lessons fit with the normal time tabled periods?
 - f. Would you say CAL lessons help or hinder you in covering the curriculum? Why?

3. Theme: RQ3: Teachers' professional learning

- a. What if anything, do you think have they have learned from BRAC-CAL? How has this helped them?
- b. Did you learn any special methods or techniques for teaching?
- c. Is there anything you wish BRAC-CAL had helped you to learn, that you haven't learned yet?

4. Theme: RQ3: Effects

- a. Are there any important differences in your lessons, because of BRAC-CAL?
- b. What difference do they think this has made to quality of teaching and learning?
- c. Did students' engagement increased? How?
- d. Do you think students' learning has changed in anyway – how – and how do you know?

5. Summary:

- a. What are the main strengths or limitations of BRAC-CAL?
- b. How could BRAC-CAL be improved in your school?

About

BRAC Research and Evaluation Division

The Research and Evaluation Division was established in 1975 as an independent unit within BRAC to provide research support to strengthen BRAC's multi-faceted development programmes. Although RED concentrates on BRAC programmes, its analytical work goes beyond and includes research on various development issues of national and global importance that contributes to evidence-based policy dialogue and discourse. For more information, please visit, research.brac.net

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