EXPERIENCES AND LEARNING FROM PARTICIPATORY ACTION RESEARCH WITH A LOCAL SCHOOL

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We report on an intervention in the Environmental Studies (EVS) curriculum of a lower-income elementary school. The intervention was carried out through collaboration between members of our R&D Centre in science education and teachers of the elementary school. The paper overviews the first two years of this ongoing long-term collaborative association. We consider the motivations and driving forces behind the collaboration and also discuss and reflect on our learning so far – the small successes and the continuing hurdles that challenge this association as well its joint objectives.

Introduction

For researchers and developers in science education, direct and continual engagement with students and teachers in science classrooms can provide valuable learning and insights. This particular project is planned as a longitudinal engagement with students as they progress from grades 3 through 10. The school and its teachers, our partners in this project, seek to practice constructivist methods and student-centred learning in their classrooms, which is the mandate of the State Curriculum Framework. They are interested to discuss, plan, try out and evaluate feasibility of constructivism-based teaching strategies to help address challenges in science teaching, mostly within the existing academic settings. It was with these shared aims that a collaborative action research project was planned.

Motivation

This participatory collaborative action research project was initiated by the R&D Centre as a result of a self-review which brought out the need for fostering close connections between research, resource development, outreach and advocacy (HBCSE, 2014, p.96). The review recommended continuing engagement with 1-2 schools and colleges which would keep R&D efforts informed by the practice of teaching. Building and nurturing linkages with school systems would provide avenues to examine our ideas; further, such relationships could offer opportunities to seed science education capacity in schools (HBCSE, 2014, pp. 101-102).

Collaboration of the R&D Centre with this particular school came about on the background of occasional contacts in previous decades in which students and teachers from the school had participated in workshops or in testing of materials or consented to serve as samples in research

projects. Publications of the R&D Centre were used by the teachers as resource materials. As a result of familiarity and mutual regard, the principal and teachers of the school readily agreed to participate in the project. The participatory collaborative nature of the project required the nurturing of an equal partnership between teachers and researchers/developers. Our efforts and learning in this regard are described below.

Participatory action research

Research involving schools, or teachers, is routinely carried out by researchers who are total outsiders to the school and/or community of teachers. Often, relevant communities are not even consulted for inputs that could inform cost-effective research investigations. Even if a concerned community does get some say, they hardly possess any control on the subject matter or agenda governing the research (Campos, 2005). We envisaged conducting this particular project differently from conventional research. The core team chose to adopt the participatory action research (PAR) approach and work "with" rather than "on" school teachers (McIntyre, 2008; Weingarten 2012). The PAR approach, based on a process of collective self-inquiry, is recognized to be empowering, democratic and driven by the intent to develop knowledge and action that is relevant to all participants (Gayford, 2003; McIntyre, 2008).

Marshall and Rossman (2006) termed PAR as a dynamic educative process, an approach to social investigation, and an approach to take action to address a problem or to engage in sociopolitical action. Moreover, as in all kinds of action research, PAR involves a cyclic process of research, reflection, and action. In PAR, the emphasis is on research for change and development of communities rather than for its own sake, i.e., importance is given to knowledge that is useful in improving lives rather than for the interest of academic research and being under the control of academics (Cohen, Manion & Morrison, 2011). PAR is a research methodology which enables researchers to work in partnership with communities in a manner that leads to action for change. In this project, we proposed to work together with participation of all stakeholders – the school authorities, teachers, students' parents, students and researchers – to address mutually identified problem areas in elementary science education. The discussion below focuses on the initial processes in development of this project, the approach adopted to implement collaborative participation and action and our continual learning from the experience.

The project: getting started

The project began in mid 2014 and a team from the Centre met the partners from the school numerous times either at the Centre or sometimes in the school where due to lack of space fewer meetings were held. During the first meeting, the school team was requested to respond to a questionnaire, which sought their views on the challenges they faced in science teaching, their teaching strategies, students' classroom participation, science content, as well as the school's expectations from the collaboration. Some responses from the teachers are described in the section "experiences and learning".

Further, we obtained the school's consent to observe some classroom sessions conducted by the teachers. These class observations were aimed at obtaining first hand information about how a new topic is introduced to students, teachers' questions to students, frequency and nature of students' questions and talk or discussions during the formal delivery of science content. It was anticipated that findings from our observations of classroom teaching would inform the approach and strategy for this

project. Additionally, the team also obtained permission to conduct some science sessions for grade 3 students. We thus hoped to acquire a direct feel and understanding of the school context and environment, in addition to the nature of science content and its delivery to young students in classroom.

Initial interactions with the school, described above, led to the idea of conducting a month-long summer vacation camp (May 2015) for the students entering grade 3. The proposal, which was welcomed by the school, gave us an opportunity to interact with young children (7-8 years) and try out different teaching strategies to support science learning, language development and creativity in students. We explored methods that would create interest and engage children, stimulate dialogue, asking of questions, sharing of views with peers and instructors etc. During the camp, students participated in planning and conducting science experiments, creating design patterns, animated stories, drew to express their thoughts/understanding, were engaged in critical reading, story writing and narration, model making, etc. These interactions with the children helped develop a rapport and understanding of their learning needs. The number of attending students was however quite small – only 10-15 – due to the fact that most students went away to their villages during vacation. (On the participant students' interest and request another camp, for grade 4, was organized during summer vacation of the following academic year too).

Approach

The actual classroom sessions on EVS teaching and learning started in the academic year commencing June 2015. The school has four sections for a total of more than 200 students studying in grade 3. The school designated one of the four grade 3 sections, consisting of 53 students, to the project. In grade 3, one class teacher (CT) deals with teaching of all academic subjects; namely, language, math and environmental studies (science). In the first year, this particular CT was the person with whom Centre representatives interacted. Responsibility for classroom delivery of the twenty six chapters in the EVS textbook was distributed among the Centre's team members. At least one week prior to the classroom sessions scheduled for a chapter, the concerned member would seek and meet the CT. These meetings offered space and time to share perspectives and ideas, discuss chapter content and its contextualization, deliberate on teaching strategies (keeping direct instruction to the minimum), and come up with a collaboratively designed lesson plan and activities for the chapter. The meeting was an opportunity for the CT to share any concerns related to teaching, teaching-learning material, concept clarifications, etc. One week (total of six sessions of 45 minutes each) was assigned to the teaching of each chapter in the text book. Every week, four of these science sessions were led by a team member from the Centre and two were conducted by the CT, though the CT and the Centre's members were present for all sessions, which were documented. Thus, in the initial stages, the burden of teaching was largely on us.

In the second year, our collaborative work on school science teaching advanced to the next grade. As in the previous year, the school designated one of the four sections of grade 4 to the project. A majority of the students in this section belonged to the batch we had interacted with in the previous academic year. In this grade too, there is one CT who deals with the teaching of all academic subjects. In the second year of the project, the school team included CTs of all four sections of grade 4. The responsibility of designing the lesson plan and activities for the 28 chapters in the EVS textbook of grade 4 was distributed among the four CTs. (This was different from our first year interaction with grade 3, where only one CT was involved in planning for all chapters. It was expected that this CT

would share her experiences and material from the project with CTs of the other three sections of grade 3, though the implementation mostly took place in the selected section). This change was introduced in response to feedback obtained from students' parents and communicated to us through the head mistress (see below). Inclusion of all grade 4 teachers in the PAR aimed to facilitate simultaneous implementation of the designed lesson plan and activities in all the four sections of grade 4. As in the first year, the CT and Centre representative responsible for leading the work of planning and preparation for a chapter would meet to discuss and finalize the lesson plan and classroom sessions, at least one week prior to the chapter's schedule. This included deciding on activities to be conducted or demonstrated in class, content and design of worksheets, selection of desired audio-visual material etc. These discussions were shared with the entire PAR team (all 4 CTs and Centre members) during monthly meetings. Feedback and suggestions thus obtained were considered during finalization of specific sessions on the chapters. Another change in the second year was that the CTs' lead in conducting classroom sessions was increased from two to five sessions per week, while the Centre members now led only one classroom session per week. We however continued to collaboratively contribute to the design, planning and observation of science teaching in the designated class. The increase in number of sessions to be conducted by the CT was anticipated to increase the teachers' involvement and ownership of strategies being attempted for science teaching. With involvement of all the four teachers from grade 4, the collaborative effort was extended to include all the students of grade 4 (approx. 200 students versus 53 earlier). This was possible because all lesson plans, activities, worksheets etc prepared for the designated section of grade 4 were immediately shared with the other three divisions for simultaneous use.

One strategy suggested by us and adapted by the school included the design and use of worksheets to support students' learning. This suggestion aimed to address concerns about involving every single child in the learning-teaching process, as well as to provide students with opportunities for language practice and development. Use of worksheets can be a useful strategy to identify and address student misconceptions and facilitate learning for understanding (Griffin and Symington, 1997). Worksheets used in this project were mostly designed by Centre members with inputs or modifications suggested by the teachers. We drew on previous research that suggests that simplifying language of textbooks can improve teacher-pupil interaction in classrooms (Kulkarni & Gambhir, 1981). Research in science education has studied how students' learning follows from doing experiments or watching demonstrations (NCF, 2005). Experiences of team members from the Centre in developing simple low-cost experiments helped bring experiments and demonstrations to the classroom sessions at our partner school. A good pedagogy must essentially be a judicious mix of approaches, with the inquiry approach being one of them. Some variations from the conventional instructional mode for teaching, introduced through the collaborative project, included model making, intentional creation of an experience or situation, role play, interviewing, visit to community utilities, etc. These activities were collaboratively planned by us and implemented by teachers who received facilitative support from the members of the Centre. In addition to documentation of the ongoing project, it is envisaged that the data will also support the meta-objective of developing a model for participatory action research that involves teachers and researchers working collaboratively with inputs from parents and students.

Sources of data

Data for this project consisted of written records as well as video and audio recordings. The written data included minutes of all PAR meetings among the Centre participants, joint meetings between teachers and Centre participants, questionnaire responses and feedback provided by teachers, notes and

reflections from lesson-planning related discussions and interactions, actual lesson plans and documented observations of classroom delivery sessions. Besides there were worksheets developed and students' work on these sheets was also a source of data. While a great deal of data has been generated, we have so far analyzed only a limited amount of the data.

Experiences/ Learnings

We share below some thoughts based on the school teachers' response to our questionnaires, preliminary analyses of our documentations of the initial class observations (prior to commencement of the collaborative classroom sessions at the school) and the EVS sessions conducted collaboratively in grades 3 and 4 and the summer camp sessions. Our initial interactions and classroom observations and teachers' comments suggest the difficulties in classroom teaching-learning (Tables 1 & 2).

Teachers' responses to questionnaires

When the teachers were asked about the difficulties faced in science teaching, their responses related to concerns regarding students' ability to understand textbook language. They thought the formal science language, vocabulary and terminology to be too complex for their students who mostly speak different dialects of the state language. The query about the kind of questions students ask in class told us that students ask questions (usually only when asked to do so) to satisfy their random curiosities, like, 'Why does kerosene smell?' The projects students worked on were usually in the nature of collecting pictures on given topics – animals, birds, medicinal plants, etc. Sometimes there were weekly themes with related activities, e.g. nutrition. Teachers also mentioned writing essays on various topics (eg. cleanliness) as project work. In response to our question about their own expectations from our Centre through this project, the teachers mentioned being interested in workshops on different pedagogical strategies, and designing of activities for science teaching and learning. The teachers also mentioned that they would welcome opportunities for meetings with researchers at the Centre to discuss and share ideas about science content and its teaching.

Our learning from classroom observations

We found that the teachers were interested in use of audio-visual resources, largely PowerPoint presentations and videos or pictures, to support their teaching. Our role, with the advantage of better resource access, was in the selection of relevant pictures that were clear to view and understand. Also, such pictures could be colourful and attractive so as to draw students' attention and interest to the subject being depicted. Later in grade 4, we found that teachers too obtained appropriate and attractive illustrations. Language related difficulties were noticed among students in most classes we observed. For example, some students found it difficult to write and read '*jodhakshare*', i.e. words that combine 2 or more words; for example, '*shwasochawaas*' was referring to breathing. This problem was addressed by the use of simpler words, making it easier for students to understand the content. We also noted initially that students rarely had the opportunity to ask questions. Encouraging students to ask questions is necessary to motivate and nurture their curiosity. Direct involvement of students in classroom proceedings and learning seemed to be initially missing. This was addressed, for example, by inviting students to participate in experiments or demonstrations being shown in class. Also, there were more explicit attempts to connect science concepts being taught in class with instances from routine day to day life. We observed that students did talk and respond whenever opportunities were provided. Teachers need to create or enable experiences, situations or activities to motivate students to

speak. Tables 1 and 2 depict the difficulties faced by teachers and students as derived from the questionnaire responses and from our observations.

Feedback from the school

Through observing the CT, we came to appreciate her exceptional skills at keeping the students engaged – with a fund of stories, songs, drama and action. On the other hand, the mid-term (September 2015) meeting highlighted the drawbacks in our teaching skills. At this review meeting, we faced much criticism from the CT. We realized that by taking on the task of teaching we had subjected ourselves to judgment by the CT regarding our teaching skills. It may have distracted her (and us too, perhaps) from what we meant to do – demonstrate the implementation of various teaching strategies. Our documented observations substantiated the teachers' claims about our struggles – though mostly in class management.

In the mid-term review meeting the CT's comments indicated that she considered direct mention of each and every part of the text-book content, in classroom sessions, essential. However, in the year-end meeting the teacher showed more openness and even praised methods that didn't directly involve stating every single bit of text-book content in the classroom. Of course, whether such lesson sessions have still conveyed to students the content remains to be evaluated. Initially the CT seemed unhappy with our methods of eliciting students' responses and participation by asking questions. The teacher felt that students should not be asked too many questions, probably as it takes times and disrupts the discipline and flow. This stance appeared to change by the end of the academic year. The teacher shared that she had learnt (from us) how to get students engaged in learning by asking them questions. This is one of the instances where the CT directly acknowledged having gained from the collaboration.

Number & diversity of students in class	• Average number of students in each class is more than fifty- rendering class management a challenge. Some students did not pay attention in class and some at the back of the class were fidgety and disturbing others. • Students in each class varied with respect to cultural, social, parents' education and economic backgrounds.
Subject knowledge & teaching for understanding	• Teachers find it difficult to understand some science concepts. They may be limited by their own or students' language and struggle to frame/explain concepts. • Teachers are expected to provide students with variety of examples to complement limited material in text books. At times teachers may find it difficult to go beyond the textbook and link content to student contexts and day-to-day life situations. • Not all teachers can create conditions that facilitate questioning among students.

Activities & evaluation	• Teachers are unable to pay attention to individual students as they are bound by the need to complete the syllabus on time. This may also be the reason for not conducting any activities in class. Another hurdle related to this is the fear of disrupting class discipline. • Teachers rarely receive the support, guidance and help they need from the school principals, school management committee, colleagues, etc. • The time for completing desired evaluations/ assessments may also be limited. Preparing evaluations and assessing students is also challenging. Emphasis on scoring and teacher accountability may lead to 'teach to test'.
Miscellaneous	• Teachers are expected to perform tasks unrelated to education, for example, collect information for government during census and elections. These tasks take up a lot of time and energy that could be used for educational purposes.

Table 1: Difficulties faced by teachers in science teaching at grade 3

Language difficulties	• Students seem to connect with or understand science content that is being discussed in class but may not be able to express the same due to difficulties with language. • Textbook language may not be the students' mother tongue or is quite distant from the spoken language making it difficult for students to comprehend. • In grade 3 students are often struggling to learn to write.
Teachers' perspective of students	• Teachers may pay attention to certain students in a class and ignore others, resulting in de-motivation. • While corporal punishment is illegal, teachers may still use it and/or harsh language resulting in young students not being able to connect with teachers or the subject being taught.
Student participation and involvement	• The opportunity for students to participate actively and for student voices to be heard in class is rare. Dialogue is neither encouraged nor are students allowed to question or raise doubts. • Student questions often result in unsatisfactory answers or may be ignored. This situation may result in a loss of interest and boredom in class. It also results in an authoritarian climate that induces fear and lack of openness.

Table 2: Difficulties faced by students in learning EVS at grade 3

At the end of the academic year, though less, there still seemed to be some resistance to use of worksheets in the classroom. The CT felt that all children might not be engaged in writing (on the other hand, apparently, the number of students engaged through worksheets seemed more than when responses were elicited via verbal discussions alone). The other issue was that completing worksheets took up more of the class time – but again written expression and language skills had been earlier identified as areas of focus for this batch of students. We need to find a way to show that worksheets have helped (if at all) in improvement of language skills among students.

In the project review meeting at the end of the first year of the project, the head mistress (HM) provided positive inputs regarding the effectiveness of the project and its impact on students' participation in class. The HM shared that parents of students from sections (grade 3) other than the one designated for the project had heard about the happenings in the collaborative project and expressed the desire that their children's classes also be a part of the PAR project. It appeared that parents anticipated some benefits to their children's' learning from the project and wished the same opportunity for their children too. The HM supported the views of students' parents. She suggested that all four sections (of grade 4) participate in the second year (see approach) and benefit directly from the resource materials and teaching-learning strategies developed as a part of the PAR project. She conveyed her belief that the PAR team can help bring something new and useful to enhance existing teaching methods in the school. It was suggested that the Centre members and teachers meet after every classroom session and exchange feedback/suggestions to add value to what was being done in the ongoing sessions. The HM also made observations about some (newly developed) desirable characteristics in students of the section assigned to PAR project in comparison to students in other sections. The HM shared that on interacting with students of all four sections, she found that the section designated to the project seemed to be (i) quick in responding to questions (ii) actively participating during class room interactions /discussions with the teachers (iii) speaking spontaneously to share their thoughts and ideas and (iv) asking questions with some understanding and not just for seeking attention. This may be considered an improvement over the September 2015 comments where the only mention of student improvement by the CT indicated students having become bold.

Reflections

This participatory action research project is different from our earlier research projects and our understanding of research projects. Here, each stakeholder is expected to contribute through her/his field of expertise. Thus, while members from the Centre could provide research and development based inputs, the school teachers contributed through their experiential understanding of classroom teaching in formal schooling. However, in practice we perhaps had to keep reminding ourselves that this is a participatory project. Especially when we decided to take up the role of class-room teaching, which was not our strength. In fact, in the summer-camp itself some of us realized our limitations – of lack of teaching experience, especially in the local language, or of toning down our teaching to children as young as 8-9 years. These limitations got magnified in the actual classroom which had four times as many students as the summer camp. However, the experience was valuable in that it impressed on us the complexity of teaching science to primary school students, in vernacular language. The fact that different individuals of the Centre's team were responsible for planning and implementation of classroom delivery of different textbook chapters demonstrated varied perspectives and approaches to science teaching. That we realize our limitations and strengths is important and this understanding helped us become more realistic during the second year of the project, introducing some changes in our roles during classroom delivery. Active involvement of teachers from all four sections

of grade 4 along with the head mistress, in the second year of the project at every step of planning, designing and implementation of classroom sessions made the project truly participatory in nature.

Conclusions

Based on more than two years of interaction with students and teachers at the school, some basic learnings gained from the project are stated as below:

a) Design and use of classroom activities have potential to encourage students' participation, probe their existing understanding and prompt them to ask questions.

b) Worksheets that consist of few questions, give space for drawing, seek brief answers, may be more effective in supporting desired learning.

c) Activities involving some simple games, use of flash cards, puzzles, blackboard work involving drawings and flowcharts, etc. support learning by creating interest among students. They also provide opportunities for students to think, reflect and question. Equally important, they help break the monotony of a transmission based classroom.

d) The teachers indicated that they learned some newer pedagogic strategies by actually getting to practice them. They mentioned having started to think outside the textbook content to make classroom science relevant to students.

For this project, we also had the added objective of developing materials/modules/ handbooks that can be resources for future use by teachers. This attempt is ongoing, with the work on compiling the worksheets and re-framing them. At this stage in the project, it is difficult to state distinct ways in which students may have benefited from the project. During interactions, some teachers commented that they feel that this batch of students will be quick to acquire the ability to 'think scientifically'. We report concerns and challenges in seeking data that would permit comparison of students who are a part of this project with those who are not. Comparisons are a sensitive issue. Our focus is more on developing a healthy and respectful relationship with the school. As was aptly said by one of the teachers – *'the children are growing now, they are getting mature, we will see the difference in the coming years'*. Implicit in her statement is the confidence that the ongoing changes in classroom teaching of science will impact students in a positive way. For now, based on our classroom observations, we can state that the number of students asking questions, participating in discussions and answering questions has gone up. Some children who used to quietly watch seem to be actively participating. But, these are yet only informal evaluations. One question that needs to be asked is - since our main role is in lesson/activity planning and observations of the same, can we structure these so as to obtain the requisite research data in an implicit manner?

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