The Issue

Primary Science Curriculum Reform in Jamaica is designed to achieve in the child, a solid foundation in the twenty-first century coping skills of critical and creative thinking and problem solving. The 1999 revised child-centred, inquiry oriented primary science curriculum has so far failed to effectively achieve in children satisfactory levels of these intended learning outcomes. This is in spite of millions of dollars being spent on primary education improvement. Stakeholders’ varied informal and ubiquitous explanations of this state of affair have included the teacher among other factors as important influences of this case. However, there is a lack of formal evaluative evidence to effectively guide related practice and policy decisions.

Purpose of the Study

The major purpose of this QUAL-qual sequential mixed methods inquiry was to provide formal evaluative evidence on the process of implementation of aspects of the 1999 Jamaica Revised Primary Science Curriculum (JRPS) on the basis of emic viewpoints of those involved with this process. To this end, Part I of this two-part study employed an evaluative case study methodology. Part 2 of the study explored on-the-job professional development through Participatory Action Research (PAR). This supplemented the case study and permitted a more up-close view of how factors related to one school and one teacher participant initiated and facilitated the enactment of on-the-job professional development activities arising out of the implementation process.

Methodology

Part I of the study employed Robert Stake’s (1967) participant-oriented, countenance evaluation model to guide the process of evaluation. The focus was on full description and judgment of the process by which the unit on Water in the curriculum was put into operation. As such, Stake’s countenance evaluation framework was used to guide data collection, organization and analysis. In accordance with this framework, data had to be collected for three major implementation factors – antecedents, transactions and outcomes for two matrices – Description and Judgments.

Methodology cont’d

Data for intents in the description matrix were obtained through analysis of the JRPS. An analysis of the Grades 1-3 curriculum was also undertaken to determine intended entry behaviour of students coming into Grade IV from Grade III. Standards required for the judgment matrix were compiled from analysis of the JRPS and the literature on science education reform. They were ratified by Jamaican science education specialists and educators in the field of primary science education. The observation column of the description matrix required empirical evidence. These were obtained from three public primary schools in urban Jamaica. Research participants constituted three grade IV teachers and their students; three grade IV supervisors and three vice-principals. Data collection techniques included participant observation, unstructured interviews, group interviews, conversations and analyses of teachers’ and students’ documents.

A total of fifteen lessons, 12 open-ended interviews and various conversations were conducted over a 6 month period. In addition, a pre-test/post-test was developed to gather evidence on students’ actual entry behaviour before instructions and learning outcomes acquired after instructions. Data on existing physical antecedents were acquired through use of an input checklist. Data analyses were by induction; data were analyzed for contingencies among antecedents, transactions and outcomes. Judgments were arrived at by comparison of descriptive data with standards.

Part 2 of the study employed Participatory Action Research (PAR) methodology and focused on changing identified areas of the practice of one of the teacher-participants, at her request, through collaborative efforts on the job. In this, I performed the role of a teacher educator and co-researcher. PAR lasted for another 6 months and involved cycle of planning, implementing plan, observing and evaluating outcomes and documenting success. PAR was the supplemental, incomplete methodology in the Qual-qual sequential mixed methods study.
Findings: Part 1

While there were contingencies among existing antecedents, transactions and outcomes, grave discrepancies existed between what actually occurred for these and were intended by the curriculum and the standards.

**Observed antecedents versus intents and standards:**

- **School factors:**
  - Data from the input checklist revealed that all schools were equipped with technological gadgets such as computers with internet access and multi-media and over head projectors, as required; there was a lack of required science kits; however, one school had a science laboratory;
  - **Opportunities for on-going professional development:** Inadequate in comparison to stipulations by the standards for on-going, on-the-job professional development.

- **Student factors:**
  - Pre-test results revealed that students entered Grade 4 with insufficient grasp of the science content knowledge and the inquiry skills and abilities covered in the objectives of the Grade III curriculum. These were intended by the standards and also required for further development at Grade IV.

- **Teacher factors:**
  - **Science background, attitudes towards science and the teaching of science:** Limited science background; mixed attitudes — ranged from dislike, to indifference but in one case interest and aspiration for competence in inquiry strategies for teaching science. Teachers had a concept of science as a body of knowledge only which was at variance with the standards.
  - **Content knowledge:** Teachers had misconceptions about key concepts such as fluids, liquids and condensation, similar to those of students. They expressed feelings of discomfort with other science concepts covered in the unit and showed a lack of clear and in-depth understanding of inquiry and the skills of inquiry which are emphasized by science education reform and as such the curriculum and the standards.
  - **Perspective of Science Education:** Teachers had a traditional-behaviourist perspective of science education as opposed to inquiry-constructivist perspective required by the standards.
  - **Observed transactions versus intents and standards:** Teachers’ approach to instruction was teacher-centred. Their approach to assessment was mainly by direct coaching and left little or no room for problem-solving and application of knowledge to new situations. There was an absence of critical and creative thinking and reasoning which was in stark discrepancy with intents and standards.
  - **Observed learning outcomes versus intents and standards:** Poor performance in the post-test; indicated a lack of mastery of intended higher-order thinking skills. Actual learning outcomes were influenced by existing antecedent factors identified in the foregoing. However, there were areas of strengths.

Small changes: Small changes occurred in the direction towards successful implementation of reform. One significant change occurred in the use of performance assessment through projects in an inter-disciplinary approach as required; teachers achieved best practice in performance assessment. This led to Part 2 of the study.

Findings: Part 2

On-the-job professional development through collaborative action research enabled teacher-participant to acquire deepening understanding of key science concepts. She was exposed to inquiry pedagogy and she successfully used inquiry to teach key science concept.

Conclusion

Significant low performance in the pre-test and again in the post-test indicated that classroom transactions had failed to achieve in children intended learning outcomes, stipulated by both the curriculum unit and the standards. These observed transactions were in turn greatly influenced by existing, observed antecedents. Many of these antecedents, particularly those related to the teacher, fell short of what were intended by the science education standards. These gaps identified by formal evaluation indicate areas where intervention is required to raise the standards of performance in primary science education. Findings from Part 2 of the study provided evidence to indicate the great potential of on-the-job professional development through participatory action research, to raise the standards of teacher performance on the job and as a consequence, learning outcomes in students.

Implications

**For Practice**

- Pre-service training to have greater focus on helping primary teachers to experience the joy of learning science through inquiry; to develop a positive attitude towards science and a commitment to the implementation of primary science education reform;
- Schools need to work harder to facilitate on-going on-the-job professional development through formation of professional learning communities; to extend and structure common planning time for greater performance in the use of reform strategies for science lesson delivery;
- Assessment of teachers should not only be for assigning a grade but also for the purpose of helping them identify weak areas in their practice and to suggest practical ways of addressing these, working within the context of their own classroom;
- Teachers need to be trained in the use of technology so that greater use could be made of available technology to enhance the teaching/learning process;

**For policy**

- The recommendations identified above need to be supported by policies to guide time- table adjustments to facilitate teachers in observing each other’s lessons; in peer assessment and support during lesson delivery;
- Policies also need to be developed by the school to support and guide thinking and action for the development of professional learning communities and action research among teachers as efforts towards on-going professional development;
- The school needs to value, encourage and support professional development activities through policies that could seriously promote them and make them happen. Teachers’ efforts at ongoing professional development need to be recognized in tangible ways and this should also be covered by policy statements.

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An Evaluation of the Implementation of Aspects of the Revised Jamaican Primary Science Curriculum and Enactment of Professional Development

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