Project Title
Alignment of Intended, Implemented and Achieved Science Curriculum Focusing on Inquiry Skills

About the Study
This study explores the extent of alignment of the new science curriculum with what is taught in classrooms and what is learned by students. It examines the extent to which the newly introduced standards relating to inquiry skills are achieved by students. Phase 1 of the study collected data from 44 Grade 8 Science classes across 11 schools in six divisions through 250 classroom observations and from interviews with 22 Grade 8 Science teachers and 11 Science department heads during the Fourth Quarter of school year 2013-2014. The Science Inquiry Skills Test was developed for this project and administered to 1769 Grade 8 students to measure skills in scientific investigation.

Project Milestones
Phase One
November 2013: issuance of DepEd Advisory
December 2013: pilot testing of the Science Inquiry Skills Test (SIST)
January 2014: training of research field work team
January to March 2014: class observations and interviews
February to March 2014: administration of the SIST
April to July 2014: data entry and analysis
July 2014: Curriculum Forum for dissemination of research findings

Project Staff
Dr Marlene Ferido
Benedict Barayuga
Pam Robertson
Dr Susan-Marie Harding
Dennis Danipog

Fieldwork Staff
Dr Amelia Punzalan
Dr Rosanelia Yangco
Rachel Patricia Ramirez
Zenaida Bojo
Jacqueline Rose Gutierrez
Pia Campo
Arlene de la Cruz
Ivy Mejia
Sally Gutierez
Benedict Barayuga
Keven Lee Galanida
Merry Ann Ilagan
Francia Olayon
John Erwin Casia

Approvals
DepEd Advisory No. 476, s. 2013 dated November 4, 2013
University of Melbourne Human Research Ethics Committee No. 1340509
Consent from participating principals and teachers

Assessment Curriculum and Technology Research Centre
College of Education | University of the Philippines Diliman |Quezon City 1101 Philippines
T: +63 2 926 3996 | W: www.actrc.org | E: info@actrc.org

Research Questions

1. To what extent are the intended, implemented and achieved science curricula aligned in terms of science inquiry skills?
2. What factors influence implementation by teachers of the science curriculum in terms of inquiry skills?
3. What factors influence students' achievement of the curriculum standards relating to science inquiry skills?

Answers to these questions will inform teachers, principals and DepEd more broadly concerning important aspects of implementation of the initiative, and can facilitate improvements in delivery.

Rationale for the study

Recent curriculum reform in the Philippines has resulted in the release of the Enhanced Basic Education (K to 12) Program (Department of Education, 2012). The enhanced Science curriculum now includes statements outlining the progression of science inquiry skills and expectations of the rate at which students will develop these skills. These new elements of the curriculum address some of the recommendations resulting from a comparison of the Philippines curriculum with those of three other countries (Care & Griffin, 2011). The organisation of the Science curriculum has also changed so that concepts and skills are now revisited at each grade level with increasing depth, whereas previously, science was taught by discipline per grade level. The intention of this change is to better equip school leavers to make a contribution as "scientifically, technologically, and environmentally literate and productive members of society" (Department of Education, 2013). The new curriculum has been accompanied by changes to the recommended assessment practices to support the assessment of such skills (Department of Education, 2012).

Alignment between the intended, implemented and tested curricula has been found to have a positive effect on student achievement (Squires, 2012). This study seeks to identify factors that influence implementation of the new science curriculum with a specific focus on students' development of inquiry skills in response to curriculum delivery. It investigates the classroom factors that influence the attainment of science inquiry skills. The investigation collects data from 22 teachers within 11 schools via classroom observations, interviews with teachers and an examination of documents and assessments. Phase 1 of the study has focused on the first year of implementation of the new Grade 8 curriculum for school year 2013-2014.
The extent of alignment and the factors that promote effective implementation are of interest to inform the implementation of curriculum change at grades 9 and 10 and the introduction of grades 11 and 12, which are scheduled to take place between 2014 and 2018.

The "alignment" approach

Intended curriculum

The 'intended' curriculum refers to what is included in the curriculum documentation. The specific documents used within this study are the K to 12 Science Curriculum Guide, the Teacher's Guides and the Learner Modules.

Implemented curriculum

Classroom observations were carried out to provide information about the extent to which implementation reflects the curriculum intentions, the ways in which science inquiry skills are being taught, and any relevant classroom contextual factors, such as class size and classroom resources. Each teacher was observed for up to 8 one hour observations across two different classes of students and across two different science topics in order to increase the likelihood that the data collected represents characteristic teacher behaviours rather than behaviours peculiar to the dynamics within one class or one content area. Lesson plans and other teacher-generated classroom materials for the quarter of observation were collected and analysed in conjunction with the classroom observations to describe the implemented curriculum.

Achieved curriculum and the extent to which science inquiry standards are being met

Teachers were asked to provide copies of assessment tasks and tests and de-identified student results from science assessments. These were analysed to determine which aspects of the curriculum are assessed and the extent to which the curriculum standards relating to science inquiry skills are achieved by students.

Models of Science Inquiry to inform the research

Some of the existing models of science inquiry that can be used to facilitate teaching are the NSES five essential features of science inquiry (NRC 2000), guided inquiry science instruction (Magnusson et al., 2004), the BSCS 5E instructional model (Bybee, 2006), and the 4E x 2 instructional model (Marshall et al., 2009). Among these models, the NSES five essential features of science inquiry are the most widely used as a framework for empirical research focusing on inquiry-based instruction. The essential features are to (1) involve a scientifically oriented question, (2) give priority to evidence in responding to the question, (3) use evidence to develop an explanation, (4) connect explanation to scientific knowledge, and (5) communicate and justify the explanation.

When it comes to learning outcomes, most research studies represent science inquiry as student development of science process skills. Recently, eight key scientific practices have been introduced as important learning outcomes in science for K to 12 students (NRC, 2012).

Findings

Teachers' Understanding of Science Inquiry

Teachers were asked about their understanding of science inquiry. Most responded with ideas consistent with science inquiry as a teaching approach used to develop students' science inquiry skills, but their views of science inquiry varied. These included allowing students to: perform tasks on their own; engage in activities and hands-on work; gather evidence through observations and experiments; and derive answers, explanations and conclusions. Most teachers viewed science inquiry as a 'discovery' approach.

Types of Science Inquiry Practices

Teachers most frequently demonstrated the following types of science inquiry practices: posing scientifically oriented questions about the natural world; instructing students to obtain information through observation and measurement; directing students to describe observations and measurements; and asking students to connect explanations to existing scientific understanding.

Assessment of Student Inquiry Skills

The Science Inquiry Skills Test (SIST) was developed to assess student skills. The SIST included 39 items administered to 1769 Grade 8 students. After removal of 3 problematic items, 36 items were finalised into the test to be used as the basis for determining students' levels of skills. Item response theory was used to determine students' ability estimates using ConQuest (Adams, et al,. 2012). The statistical characteristics of the test indicated that it is sampling a clear construct and has the capacity to differentiate between students – good bases for establishing both validity and reliability. The test was well targeted for the students' abilities at the Grade 8 year level. Students in top and second top classes had the highest SIST ability estimates. Students from the Engineering and Science Education Program (ESEP) had statistically higher ability estimates compared with students from top classes who received the regular science curriculum.

Summary

The Science Inquiry project explores the extent of alignment of the new science curriculum with what is taught in classrooms and what is learned by students. Results indicate that the teachers had quite varied understanding of science inquiry and how they practiced science inquiry in the classroom. Similarities among teachers are evident from the data collected. These include access to training, resources available in their respective schools, and access to Learner's Materials and Teacher's Guide.

This is a scoping study involving only an adhoc sample. The results do not in any way show generalizations about alignment between the intended, implemented and achieved curriculum in Science. Issues that have arisen from the study direct us to investigate our research questions in more detail across large samples. We now know the issues that require investigation.

References

Care, E., & Griffin, P. (2011). Curriculum Comparison Study for the Philippines Basic Education Sector. Melbourne: Assessment Research Centre, The University of Melbourne.

Department of Education. (2012). Guidelines on the Assessment and Rating of Learning Outcomes under the K to 12 Basic Education Curriculum. Pasig City: Republic of the Philippines.

Department of Education. (2013). K to 12 Curriculum Guide: Science. Pasig City: Republic of the Philippines.

Contact

Dr Marlene Ferido m.ferido@actrc.org