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Inquiry in Motion: Increasing the Science Achievement of All Students by Improving Teacher Inquiry-based Instruction

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ABSTRACT

Student performance in science classrooms has continued to falter throughout the United States. Even though proficiency rates on national tests such as National Assessment of Educational Progress are higher for Caucasian students than African Americans and Hispanics, all groups lack achieving desired proficiency rates. Therefore, much work is needed in our classrooms to achieve the new more rigorous performance expectations found in the Next Generation Science Standards (NGSS). This five-year professional development study sought to link the involvement of teachers in a sustained intervention, designed to improve the quality and quantity of guided-inquiry-based instruction in middle school science classrooms, to student academic growth. Specifically we wanted to see if we could link higher quality inquiry-based instruction with the narrowing of the achievement gap between student groups. Findings show statistically significant gains for all student groups (aggregate, males, females, Caucasians, African Americans, and Hispanics) on all three science MAP tests (composite, science practices, science concepts) when compared to students of non-participating teachers.

INTRODUCTION

According to several indicators, American students have continued to perform abysmally in science education (Lauko, Grigg, & Brockway, 2006; Martin, Mullis, Foy, & Stanco, 2012; U.S. DoEd, 2006; Marshall, J. C. (2013). Succeeding with Inquiry in Science and Math Classrooms. Alexandria, VA: ASCD & NSTA). For example, large achievement gaps continue to persist (Lauko et al., 2006, US DoEd et al., 2011). Within the current condition of languishing performance, a new benchmark for learning, NGSS, has been introduced that effectively raises the performance expectations for all students in K-12 science classes should know and be able to do (Achieve, 2013; National Research Council, 2012). For decades, inquiry-based instruction has been encouraged as a teaching strategy that provides a vehicle by which teachers can engage their students in experiences that go beyond low-level thinking (Marshall, 2013). Despite knowing this, it is evident that effective inquiry-based instruction is far from the norm in most classrooms (Marshall, Horton, Igo, & Switzer, 2009).

PURPOSE

Our research builds from the need to improve student achievement for all groups of learners in science classrooms. The professional development that this research focuses on sought to transform teacher practice relative to inquiry-based instruction with the expectation that student achievement would increase for all groups of students. Specifically this study addresses three research questions:

RQ1: Do student proficiency levels increase for those engaged in effective inquiry-based instruction?

RQ2: Do classrooms that utilize inquiry-based instruction demonstrate a narrowing of the achievement gap for minority students?

RQ3: Do proficiency rates for both males and females increase in classrooms where teachers utilize inquiry-based instruction?

RESULTS

When comparing proficiency rates of students of non-participating teachers with students of second year participants, all groups (collective, male, female, Caucasian, African American, and Hispanic) showed significant growth (See Fig. 1 & 2).

The achievement gap was narrowed, but perhaps the greatest accomplishment is that all groups: male, female, Caucasian, African American, and Hispanics grew significantly.

Therefore inquiry-based instruction provides a solid means to achieve the performance expectations set forth by NGSS (Achieve, 2013; National Research Council, 2012) and other state standards that emphasize having students model complex ideas, plan scientific investigations to test ideas, communicate and justify ideas, and think critically and deeply about concepts.

DISCUSSION AND IMPLICATIONS

Increases were noted for all groups on all three MAP tests (Science Composite, Science Practices, and Science Concepts)—see Figure 1.

Inquiry-based instruction can effectively increase student learning in both the Science Practices (e.g., interpreting graphs, analyzing data) and the Science Concepts (e.g., understanding concepts such as energy or genetics). Therefore inquiry-based instruction provides a solid means to achieve the performance expectations set forth by NGSS (Achieve, 2013; National Research Council, 2012) and other state standards that emphasize having students model complex ideas, plan scientific investigations to test ideas, communicate and justify ideas, and think critically and deeply about concepts.

REFERENCES


