

FOSS (Full Option Science System) Research Database—Selected publications or studies (updated August 2017, FOSS Project, Lawrence Hall of Science, University of California, Berkeley. For more information on this list, contact Project Co-Director Linda De Lucchi)

Preservice and Inservice Professional Development

Nowicki, B.L., Sullivan-Watts, B., Shim, M.K., Young, B., & Pockalny, R. (2012). Factors Influencing Science Content Accuracy in Elementary Inquiry Science Lessons. *Research in Science Education*, Published online: 03 July, 2012, Springer.

Description: Elementary teachers face increasing demands to engage children in authentic science process and argument while simultaneously preparing them with knowledge of science facts, vocabulary, and concepts. This reform is particularly challenging due to concerns that elementary teachers lack adequate science background to teach science accurately. This study examined 81 in-classroom inquiry science lessons for preservice education majors and their cooperating teachers to determine the accuracy of the science content delivered in elementary classrooms. Our results showed that 74% of experienced teachers and 50% of student teachers presented science lessons with greater than 90% accuracy. Science content accuracy was highly correlated with the use of kit-based resources [including FOSS] supported with professional development, a preference for teaching science, and grade level. There was no correlation between the accuracy of science content and some common measures of teacher content knowledge (i.e., number of college science courses, science grades, or scores on a general science content test). This study concluded that when provided with high quality curricular materials and targeted professional development, elementary teachers learn needed science content and present it accurately to their students.

Categories: Preservice, FOSS, Science content knowledge

Type: Research Study

Sullivan-Watts, B.K., Nowicki, B. L., Shim, M.K., & Young, B.J. (2012). Sustaining Reform-Based Science Teaching of Preservice and Inservice Elementary Teachers. *Journal of Science Teacher Education*, Published online: 03 August, 2012, Springer.

Description: This study examined the influence of a professional development program based around commercially available inquiry science curricula [including FOSS] on teaching practices of 27 beginning elementary school teachers and their teacher mentors over a two year period. A quantitative rubric used to score inquiry elements and use of data in videotaped lessons indicated that education students assigned to inquiry-based classrooms during their methods course or student teaching year outperformed students without this experience. There was also significant positive effect of multi-year access to the kit-based programs on mentor teaching practice.

Categories: Preservice, Mentor teaching, Science content knowledge, Inservice professional development

Type: Research Study

Ferguson, G., Long, K., & Kennedy, C. (2009, September). *Assessing Science Knowledge implementation through teacher research final report*. For a copy of this report, please email klong@berkeley.edu.

Description: In this project, the researchers hypothesized that teaching practices would improve and that students would learn more by having teachers receive training in the formative assessment techniques developed by FOSS's assessment group, by having them participate in Professional Learning Communities, and by having them spend more time teaching science. There were six schools in Washington that participated in this study (3 treatment and 3 control). The classrooms that participated were 4th and 5th grade students who all used the FOSS curriculum in their science classes. The treatment group received professional development support including an initial 2-day workshop each year to understand formative assessment strategies, Professional Learning Community facilitator support, and a showcase for teachers to share their experiences. The results indicated that the students in the treatment group performed better than the control group on the FOSS modules. In addition, there were more improved outcomes in the second year of the study which indicates that the teachers were gaining experience. In regards to the state test, there were no significant differences between the groups in regards to performance. The results also indicated that the Professional Learning Communities did not work as well as expected. There were many differences in how the schools supported these Learning Communities and also as time went by, schools were less likely to meet because of time pressures from other things. The results indicated no significant differences between treatment and control teachers in their attitudes or use of formative assessment. However, the teachers (whether treatment or control) who did use formative assessment in their classrooms, had students who had higher gains in performance.

Categories: FOSS, Assessment, Professional development

Type: Research study

FOSS Pedagogy and Efficacy

Timms, M., Ringstaff, C., Schneider, S., Huang, K., Li, L., Tiu, M. (2013). *ASK/FOSS Efficacy Study—Student Outcomes*. Paper presented at the meeting of the American Educational Research Association, San Francisco, CA.

Description: This paper presents findings from an IES-funded efficacy study to examine the impact on student learning of adding systematic, curriculum-embedded assessment to a hands-on, inquiry-based science curriculum (FOSS). The conclusion to be drawn from the study is that the use of the ASK/FOSS embedded assessment system produces significant learning gains that are detectable by assessment that use open-ended items that prompt students to construct a response that shows their understanding of the science phenomena studied. However, multiple-choice items targeted at the same content areas did not detect the improved learning gains.

Categories: Assessment, FOSS, science content knowledge, student achievement

Type: Conference presentation

Osmundson, E., Herman, J., & Dai, Y. (2013). *Teacher's Use of an Embedded Assessment System: Impact on Teacher Knowledge and Practice.* Paper presented at the meeting of the American Educational Research Association, San Francisco, CA.

Description: This study found that the addition of the embedded assessment system resulted in substantial benefits for teachers, including increased content, pedagogical and assessment knowledge and higher quality assessment practices. The embedded assessment system helped teachers deepen their understandings of central concepts and principles addressed by the curriculum. More systematic elicitation and analysis of student understandings, driven by the use of on-going assessment, supported the development of teachers' content and pedagogical knowledge as well as their assessment practices.

Categories: Assessment, FOSS, science content knowledge, professional development
Type: Conference presentation

Getty, S., Taylor, J., Mooney, L.B., & Kuerbis, P. (2009, April). *Science notebooks as a predictor of achievement in reading, writing, math, and science on state standardized tests.* Paper presented at the meeting of the National Association of Research in Science Teaching, Garden Grove, CA.

Description: In this study a comparison between two schools using kit-based science programs was conducted. Both of these districts were part of a STEP-uP project. They used the same curriculum (FOSS, Insights, etc.), but one district also included science notebooks as part of their program. The authors had a list of 7 categories for the science notebook rubric. This study showed that the students who had the science notebooks showed much larger gains from fourth to fifth grade on the Colorado State Assessment Program (CSAP) than the students who did not have the science notebooks. The biggest differences were in writing and math.

http://www.bsos.org/pdf/NARST09/BSCS-NARST09-Science_Notebooks_as_Predictor_for_Achievements.pdf

Categories: Science notebooks, Student achievement, FOSS
Type: Conference presentation

Revak, M., Kuerbis, P., & Mooney, L. (2008, January 10). *Linking professional development and classroom practice in science to student achievement in reading, writing, and math.* Retrieved February 26, 2010, from http://pikes-peakscience.lewispalmer.schoolfusion.us/modules/groups/integrated_home.phtml?gid=993443&view_cid=55361&sessionid=42dc7eabb5f7cb70462347a86b29f1db#cid_55361 (The link to the article is "JRST Article In Progress Jan. 10, 2008.doc")

Description: This study examined the relationship between teacher professional development and fifth grade students achievement in reading, writing, and mathematics. This study was part of the STEP-uP program that involved educational reform in central Colorado. The STEP-uP program involved adopting inquiry-based kit science programs including FOSS, STC, and Insights. It then involved having the teachers adopt this inquiry-based approach, help them get to a higher level of kit utilization, and support leaders in the district. Much of the program focused on professional development. The results indicated that students performed better when their teachers had certain types of professional development. The teacher courses that had the largest impact on student

scores were the Power of the Science Notebook, Basic Integration of Literacy and Science, and Graphing in Science. In addition, if students had teachers that had a combination of all three of these courses, there was an even higher relationship between the professional development and the student test scores.

http://pikes-peak-science.lewispalmer.schoolfusion.us/modules/groups/integrated_home.phtml?gid=993443&view_cid=55361&sessionid=42dc7eabb5f7cb70462347a86b29f1db#cid_55361

Categories: Professional development, Student achievement, FOSS

Type: Research study

Valadez, J., & Freve, Y. (2001). *The effect of inquiry-based science teaching on standardized reading scores*. Fresno, CA: Fresno Unified School District-Urban Systemic Program.

Description: In Fresno Unified, the fourth-largest school district in California, efforts began to reform science education. One of the ways the district began to reform science education was by including more inquiry-based science teaching that integrated language arts and reading with science. This article included two studies that were done to look at the effectiveness of this program on student achievement in elementary school. One study examined a summer program that was established in the school district that involved students receiving instruction in literacy and science. FOSS was the curriculum that was utilized. The students improved in writing and reading. In the second study, teachers were using FOSS in their classrooms and a comparison was made between students who had 4 years of FOSS versus those who had less than 4 years. The results indicated that students performed better in science and reading (based on the SAT9) who had more exposure to FOSS.

Categories: Science and language arts, Student achievement, FOSS

Type: Effectiveness study

Ying-Fang Checn and Matthew A. Cannady (2017). *Research brief: A study of the impact of using FOSS-CA on California 5th graders science test scores*. A report prepared by the Research and Impact Group, Lawrence Hall of Science, University of California, Berkeley. For a copy of this report, please email klong@berkeley.edu.

Description: This study sought to determine if students in schools who had adopted FOSS-CA materials in 2007 had different state test scores than students using other materials from 2008 to 2013. This question was addressed in two studies. In Study 1, the trend in science test scores of 5th grade students from 2004 to 2007 was compared to their scores after adoption. In Study 2, the research group examined whether the CST scores in schools that adopted FOSS-CA are different than those in similar schools that did not adopt FOSS-CA. Results show that the deviations of science scores from the trend were significantly higher in FOSS-CA schools than that in matched non-FOSS-CA schools, in 2008 and 2012. In other words, in 2008 and 2012, schools that had adopted FOSS-CA in 2007 outperformed schools that did not adopt FOSS-CA on the state test scores. In other years, there were no differences in the state test scores.

Categories: Student achievement, FOSS

Type: Research study