

PROGRAM EVALUATION SUMMARY: NWESD ASSESSING LEARNING PROGRESSIONS IN SCIENCE

Applied Research Northwest

In Summer 2011 the Northwest Educational Services District (NWESD) began work on a project to improve science teaching in elementary schools. The project focuses on teachers' common use of school-district supplied science kits which address a wide variety of science subjects and include comprehensive guides, handouts, materials and supplies.

Because these kits are designed for use in schools nationwide, they are not explicitly aligned with Washington State's grade-level standards for learning in science (<http://www.k12.wa.us/Science/Standards.aspx>). What the NWESD sought to do is provide training for teachers to:

1. Align the kit activities to state standards
2. Develop learning progressions around kit activities that would properly scaffold student learning of the big ideas in the standards that were being addressed
3. Create formative assessments that would help the teachers identify how students were progressing in their understanding of the materials.

If deemed effective, these learning progressions with their accompanying formative assessments are intended for dissemination and use throughout the state.

Trainings took place over seven multi-day sessions throughout the school year. Expert facilitators, faculty from a local college and experienced trainers helped teachers better understand a range of scientific principles related to each kit and develop learning progressions and formative assessments.

THEORETICAL MODEL AND EXPECTED OUTCOMES

The NWALPS program design is based on the theory that student achievement will improve when teachers better know the content that is needed to teach their curriculum, create learning progressions based on that content knowledge and implement those learning progressions while applying formative assessments of their own teaching as well as student understanding.

The NWALPS training was expected to have the following outcomes:

- Increased science content knowledge for participating teachers and their students
- Improved engagement and more positive attitudes toward science learning for participating teachers and their students
- Improved scientific inquiry skills for participating teachers and their students

RESEARCH METHODS

Content tests were developed by a team of education experts based on state standards and drawing primarily from a pool of already existing validated science questions. All together nine content area tests were created (teacher tests included all the student questions, plus some higher-level questions). Eight attitudinal questions were used, and questions testing inquiry skills were also compiled.

Teachers were tested at the beginning and end of the training for both of their content areas, inquiry skills and attitudes. Student attitudes and inquiry skills were tested at the beginning and end of the school year, and content knowledge was tested just before and after each kit was used in the classroom. All together 548 students completed tests. On average, 80% of all students took both pre and post tests for the NW ALPS assessment.

To avoid diffusion effects, control group classrooms were recruited from within the participating school districts but from non-participating schools. Five control teachers were recruited and three participated in the full testing regimen during the school year, testing themselves and students on a total of four content areas.¹ All together 143 students completed tests from control group classrooms with more than 80% completing both pre and post tests on all topic areas.

Since these tests are newly constructed, this year's program serves as a pilot of the measurement tools. Test quality assessments were completed and reported in the findings below.

FINDINGS

Teachers' outcomes

Teachers were expected to experience gains in content knowledge, shifts in attitudes and increased inquiry skills. Table 2 shows the average test scores for each group of teachers in each of the nine subject areas, plus inquiry skills. Overall, teachers significantly improved their test scores. Inquiry skills did not increase significantly, though teachers scored an average 91% on those items prior to the training.

In addition:

- Teachers' confidence in teaching science increased substantially on seven different measures.
- 41% considered themselves master science teachers at the end of the program compared to 12% at the beginning.
- Teachers' use of informal assessment techniques (observation and discussion) increased dramatically, from 53% using such techniques "a lot" to 88% using them as frequently.

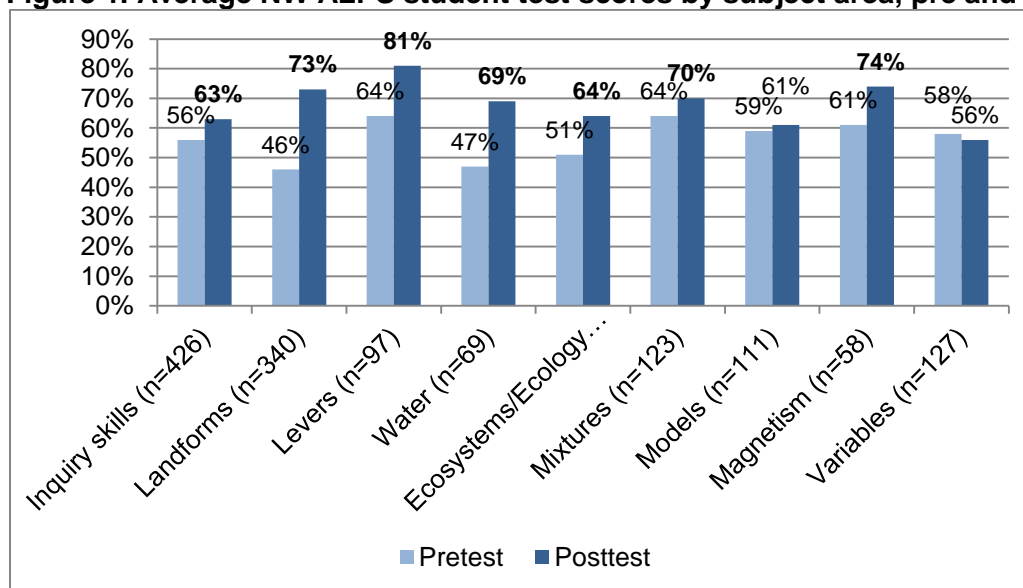
¹ Inadequate incentives were provided to the recruited control teachers. This clearly impacted their willingness to participate, even with encouragement from their building or district administrators. Discussion of remedies is provided in the conclusion to the report.

Student outcomes

Like teachers, students were expected to experience changes in content knowledge, inquiry skills and attitudes toward learning science. Students showed significant gains on all subject area tests but two (see figure 1 below). In addition:

- Students' attitudes toward learning science improved significantly from an average of 12.6 to 13.1
- Inquiry skills, also tested at the beginning and end of the school year, increased from an average score of 56% of questions answered correctly to 63% at the end of the year

Figure 1. Average NW ALPS student test scores by subject area, pre and post-test

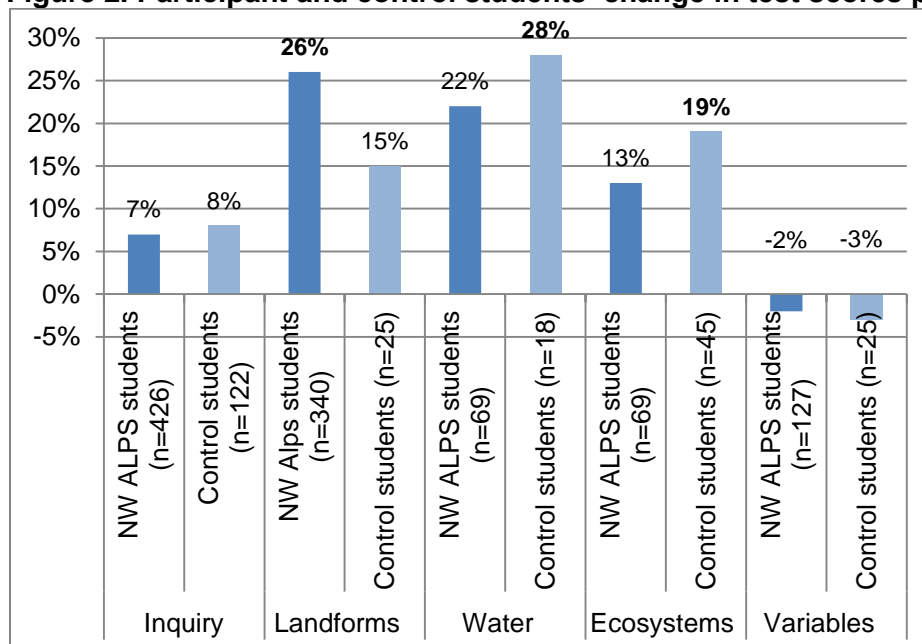


Bold type indicates a significant improvement in test scores ($p < .05$).

Control group students saw a similar magnitude of increase in attitudes toward learning science from 12.1 to 12.6 points on average, though this shift among the smaller sample was not significant.

Control group students also saw a similar gain in inquiry skill scores from 49% to 57% (compared to a shift from 56% to 63% for NW ALPS students), and this change was also statistically significant.

Content area findings were mixed. NW ALPS students out performed control group students in Landforms, but control group students out performed NW ALPS students in learning in water and ecology/ecosystems (see figure 2).

Figure 2. Participant and control students' change in test scores pre-post

Bold numbers indicate control and program group differences are statistically significant ($p < .05$)

DISCUSSION

At the close of the NWALPS Program's pilot year the evaluation findings indicate that teachers experienced a robust training that improved their content knowledge, increased their confidence in teaching science and dramatically increased their use of formative assessment in the classroom. Teachers reported having a deeper understanding of the connections between state standards, their teaching and the content of the science kits.

"It's given me a better understanding of what the important concepts of science are, and how the different learnings that we do lead to those big ideas."

-NW ALPS Teacher

They also reported a more robust classroom experience for the students and more focused learning.

Student outcomes are very positive, but when seen in comparison to the three control classrooms, the relative effectiveness of the training on student test scores is inconclusive. Random assignment of classrooms to control or program status, increasing the number of control classrooms, and revising and improving the tests (particularly for the Variables kit) are essential future steps to appropriately measure program effectiveness.