



Hawaii Algebra Learning Project

PROGRAM DESCRIPTION

The Hawaii Algebra Learning Project (HALP) resulted in the development of Algebra I: A Process Approach, which is a first-year algebra program developed by the Curriculum Research & Development Group, University of Hawaii. The purpose of the program is to foster both the development of problem-solving processes and student understanding of algebra. This algebra program consists of research-based components that change the roles of the students and the teacher. Students explain their thinking, make generalizations, and take an active role in concept development. Problem tasks promote the problem-solving processes of reversibility, flexibility, and generalization. The instructional approach develops communication and reasoning skills.

In the required professional development component, teachers learn with the instructional model that is the basis of the program. Teachers become more competent problem-solvers and better understand student conceptions and misconceptions about algebra. The teacher becomes a guide and a facilitator of learning rather than a lecturer or dispenser of mathematical content.

The goals are consistent with the standards of the National Council of Teachers of Mathematics (NCTM) regarding content, instructional practices, and assessment techniques. Standards for problem-solving, communication, connections, reasoning, algebra, and functions are the basis of the mathematics in Algebra I: A Process Approach.

PROGRAM CONTEXT

The Hawaii Algebra Learning Project has been implemented at a variety of sites in 16 states. Implementation sites' demographics have varied but all have similar results. The students from the Hawaii site were very ethnically diverse. The student populations of the two predominantly middle-class Mississippi sites are similar and racially and ethnically diverse.

Content

- communication and reasoning skills
- problem-solving skills
- algebra concepts
- change in teachers' role

Context

- varied settings including middle schools, community colleges, and universities
- used with large populations of ethnically diverse students

STAFF DEVELOPMENT PROGRAM



A required two-week, 45-hour professional development institute is taught by certified Hawaii Algebra Learning Project staff. It gives a new look at both algebra content and instruction. Teachers learn the problem-solving processes of reversibility, flexibility, and generalization; ways to develop these processes through non-routine tasks; the use of computers, calculators, and manipulatives in teaching algebra; collaborative and cooperative group techniques; and how to incorporate writing into algebra class.

Participants in the institute experience algebra as their students will by using the student text as the basis of the algebraic content, while at the same time expanding their content knowledge with open-ended tasks. Participants also engage in interview tasks to explore problem-solving development and discuss how to create the learning environment necessary to help students acclimate to their new roles. Additionally, teachers learn to construct questions that promote higher-order thinking and problem-solving processes, facilitate discussions, change classroom management techniques to accommodate a student-centered environment, and assess students using new techniques.

Each school is encouraged to plan for follow-up support that will best meet the school's and teachers' needs. Follow-up support *can* include: users' meetings in the school or district; visits by instructor and/or project team members for classroom coaching or demonstration teaching and debriefings; release time to observe other teachers' classes; electronic bulletin board and e-mail; newsletters; and phone calls to individual users and the developers.

Process

- training
- demonstration lessons
- coaching
- debriefing
- electronic support
- newsletters

Intended Audience

- entire school
- entire department or team

SUMMARY OF RESULTS

At all sites, large gains beyond expectation were found. All pre/post-percentile scores were statistically significant at the $p < 0.001$ level. Even though there were large differences in pre-test means at the three sites, the gains shown at each site were very similar in magnitude, indicating a significant value-added component. Percentile gains ranged from 15 to 21 points.

EVIDENCE OF INCREASED STUDENT ACHIEVEMENT



Success Indicators

- norm-referenced assessment

In 1995-96, the Curriculum, Research, and Development Group conducted an evaluation (Young et al., 1998) using a pre-test, post-test, norm-referenced design. The Harcourt-Brace *GOALS: A Performance-Based Measure of Achievement* was used because the items cover topics beyond first-year algebra, including geometry, probability, and statistics. The test's open-ended format matched the format of HALP's classroom instruction. *GOALS* emphasizes justification and explanation for answers, so students can demonstrate their thinking and reasoning. Although not a true control group, the national norming group provided an acceptable comparison group for statistical analysis.

The tests were administered in fall 1995 and spring 1996 to HALP students at three sites. Two sites were in Mississippi, and one was in Hawaii. The sites represent a wide diversity of socio-economic and achievement levels.

To ensure that all students had adequate opportunity to learn, each site was examined. The teachers involved had all successfully completed the required 45-hour institute. All teachers were either directly observed or videotaped during the year to assure that the quality of instruction was aligned with the goals of the program, that teachers covered the expected amount of course material and concepts, and that they used a variety of instructional strategies consistent with the program and designed to meet student learning needs.

To compare the scores, the means of the raw scores were converted to their corresponding scaled scores. These scaled scores each corresponded to a percentile whose value depended on whether the test was administered in the fall or the spring. Students who participated in HALP performed significantly better than the comparison group.

The Hawaii Algebra Learning Project is a combined curriculum and staff development effort. The use of the teacher resources, student texts, and assessments, coupled with the intensive staff development program, have led to significant improvement in student achievement in mathematics with students of diverse backgrounds.

**THE
BOTTOM
LINE**





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DOCUMENTATION

Young, D.B., Dougherty, B., Lai, M.K. & Matsumoto, A. (1998). Addressing equity through curriculum development and program evaluation. *Journal of Women and Minorities in Science and Engineering*, 4, 269-281.

