Assessing the Impacts of Professional Development on Content Area Academic Literacy of High School Students in Rural California

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Abstract

The Redwood Area Academic Literacy Initiative (RAALI) is focused on enhancing literacy skills of Title 1 high school students through professional development for teachers in Northern California. This study aims to assess the effect of the RAALI program on student performance in science, mathematics, history, and language arts based on California Standardized Test scores. Results indicate among Title 1 students, English and Language Arts and World History scores showed significant positive correlations ($p = 0.015$ and $p=0.049$ respectively) with respect to the level of RAALI intervention.

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Introduction

High schools are struggling to meet annual student academic achievement targets. The need to address adolescent literacy has become a focal point nationally (Jacobs, 2008). Such concerns have led to initiatives to work with teachers to rethink methods of teaching and learning, focused on academic literacy development, to aid in closing the achievement gap among students. To address these concerns the Redwood Area Academic Literacy Initiative (RAALI) provides a professional development program for teachers of science, mathematics, and history. The RAALI program aims to enhance literacy skills among high school students by working with teachers to implement academic literacy curricular interventions in high school classrooms. As a part of RAALI, teachers participated in summer institutes and follow-up meetings in which they received training and support to develop ways to strengthen students' academic literacy skills specific to science, mathematics, and history. This initiative primarily focuses on high need schools in the RAALI region and the teachers of high need students within these schools.

Academic literacy in the context of RAALI refers to the skills, knowledge, and dispositions that secondary students must develop to fully access college-preparatory curricula, to participate in the discourse community of advanced content area classes, and to succeed in university courses in the future. The RAALI Academic Literacy Framework is comprised of three interdependent aspects: content area genre study, academic language development, and cognitive collaboration. Based on scientific research, these framework aspects guided site-specific curriculum development and implementation and professional development activities.

In this study we explore and assess the main effect of the RAALI program on student performance in the content area classes of history, science and mathematics and in English/Language Arts (ELA) using California Standards Test (CST) scores. Specifically, how does student achievement on standard tests compare between students who receive RAALI interventions and those who do not receive the interventions? We hypothesized that students who received RAALI interventions, called "doses" in our study, would perform better on content achievement tests than those who did not receive "doses" of RAALI interventions. In summary, the treatments for this study are academic literacy interventions provided by science, mathematics, and history teachers who have participated in RAALI professional development and have implemented RAALI plans during the academic year with their students. These are considered "doses." Our study design takes into account the fact that teachers have self-selected to participate in the RAALI program and is thus quasi-experimental in nature. Planned comparisons take into account correlations in student performance based on Title 1 status. In this study Title 1 status is used as an identifier for higher need students, generally associated with higher poverty rates, English Learners, and other factors generally linked to higher need students.

We also explore the utility of our research design and methodology as a potential model for assessing causal effects between professional development intervention and student achievement. Ordinarily, research of the kind conducted in this study focuses at the school-level or teacher level. This study is evaluating data at the student-level. We have pooled student data from numerous schools participating in RAALI to analyze outcomes.

Theoretical Framework

A key aspect of improving teaching methods at the secondary level involves rethinking the role that language and literacy practices have in content learning. In other words, teachers of science, mathematics, history, art, and English must also be teachers of language (Intersegmental Committee of Academic Senates, 2002). Academic literacy includes competency in reading, writing, listening, speaking, critical thinking, use of technology, and habits of mind. Furthermore, each content area such as science, mathematics, and history has a specific way of using reading, writing,

speaking, and listening (Gee, 1996; Lemke, 1990; Moje, Young, Readence, & Moore, 2000).

Content Area Genre Study – Academic literacy incorporates the knowledge of how lines of inquiry and reasoning are developed and produced in each discipline. As Barton et al (2002, p.27) explain, "Text style---the organization and presentation of content---affects reading comprehension. Teaching students to recognize a text's style and then use it to aid comprehension can improve student learning. Genre study incorporates the following key elements of effective adolescent literacy programs outlined by Biancarosa & Snow (2004, pp.12-17): teacher modeling, apprenticeship and diverse texts. Genre study within content areas allows students to gain experience with a wide variety of texts and their purposes. Further, students' explicit understanding and application of the notion of genre itself is a literacy skill that translates to content areas other than the three focused on by RAALI.

Academic Language Development – Scarcella's (2003, p.19) definition of academic English helps to parse out aspects of the development of academic language generally. She writes, "Academic English is a variety or register of English used in professional books and characterized by specific linguistic features associated with academic disciplines…Reading, while an important component of Academic English, is just a part of it. Academic English requires not only the development of those advanced reading skills which enable learners to access complex words, but also those advanced skills which enable learners to understand and use these words in spoken and written communication" (2003, p.19). This aspect of the framework incorporates reading apprenticeship, vocabulary development, intensive writing and formal speaking (Biancarosa & Snow, 2004; ICAS, 2002).

Cognitive Collaboration – We use the term "cognitive collaboration" (Langer et al, 2000) to describe a range of possible strategies teachers can use to enhance academic literacy. Primarily, cognitive collaboration describes interactive classroom dialogue that focuses on knowledge and skills development. To this end, practices of eliciting prior knowledge, comprehension

monitoring and metacognition instruction, participating in a discourse community, and apprenticeship models are examples of how teachers can enhance academic literacy in the content area. Cognitive collaboration emphasizes developing students' abilities to understand their own thinking and also their abilities to identify features of academic content knowledge. Ongoing formative assessments determine the efficacy of cognitive collaboration. Additionally, a cognitive collaboration model was used with the teachers during the RAALI professional development.

Academic Literacy Interventions – Interventions focused on academic literacy have successfully addressed student deficits in reading and learning. Some of the scientifically-based research includes: 1) Greenleaf, Schoenbach, Cziko, and Mueller (2001) found that highly diverse ninth graders who participated in their Academic Literacy course improved significantly on the Degree of Reading Power (DRP) test, gaining 4 units from fall to spring when the national norm is 1-2 DRP units. In other words, the students made two years of growth in reading performance after only seven months of participation in their academic apprenticeship model; 2) Yerrick (2000) found that low-achieving, marginalized high school students were able to make stronger knowledge claims and make better use of evidence when classroom norms regarding scientific discourse were renegotiated; 3) Macken-Horarik (1996) found that junior high students developed a high level of technical understanding and the ability to critically assess content on the topic of reproduction technologies after 10 weeks of instruction with explicit teaching of the language of science texts; and 4) Miller and George (1992) found that students who were taught about text structures used their knowledge to improve the coherence of their writing.

Generalized Causal Inference – This study is grounded in generalized causal inference theory which originally developed from discussions from construct and external validity literature (Shadish, Cook and Campbell 2002). Generalized causal inference theory is aimed at understanding what can be generalized from a sample of instances and the data patterns connected with them to the targeted constructs

that they represent. In addition, this theory considers whether a causal relationship can be generalized with changing settings, participants, treatments, and outcomes. The RAALI study uses a quasi-experimental design as described by Shadish, Cook, and Campbell 2002 to examine causal inferences. Teachers have self-selected to be RAALI teachers and school administrators selected teachers and classes for students rather than random assignments to treatment groups.

Methods

During RAALI professional development institutes and workshops teachers received intensive training in academic literacy strategies specific to helping students access science, mathematics and history content and to improve content specific skills. This included analyzing the linguistic demands of their content instructional materials, developing strategies to make content accessible to a wide range of students, and cultivating approaches that foster student independence in the comprehension and production of content related text. RAALI institutes focused on techniques for building academic literacy that can be employed with any variety of content specific curricular materials. Additionally, institute participants worked collaboratively to develop a series of customized interventions specific to their school context and student needs. In general, the interventions focused on vocabulary development, reading comprehension, writing, and the use of multi-media. For example, one teacher developed a plan to look at the influence of journal writing on metacognitive skills and student's ability to communicate mathematically. Another teacher developed a plan to explore if grouping English Learners for cooperative learning maximized language acquisition, content learning and social development. While a third teacher developed a plan to teach vocabulary to support concepts in science in a way that moved away from stand alone student memorization of terms and definitions. Each RAALI Teaching Fellow included in this study, implemented the plan they developed in the academic year following participation in the professional development institute.

Science, mathematics, and history teachers were recruited for participation in RAALI professional development from high schools across the RAALI region based on an analysis of needs and on geographical representation. The RAALI region included six counties in rural areas of Northern California, representing 9% of the state's total area. The region is characterized by low population density, daunting travel distances, lack of access to professional development opportunities, wide variation in socioeconomic and cultural characteristics, and a student population that frequently does not continue studies past high school. Five of the six counties have poverty rates of school aged children over 20% -- more than 18,000 children living in rural poverty (U.S. Census Bureau, 2002).

Teachers in the research cohort met the following criteria. They were: 1) a high school teacher in the RAALI region; 2) completed RAALI professional development; and 3) developed and implemented an intervention plan during the academic year. Students in classes with a RAALI Teachers were considered to have received a RAALI 'dose.' A 'full dose' resulted from a student taking a class with a teacher that implemented a RAALI intervention in that class. A 'partial dose' resulted from a student taking a class from a RAALI teacher in which a RAALI intervention was not given. This later level of dose was used to account for spill over effects from RAALI teachers in their classes without a RAALI implementation.

To assess the impacts of RAALI interventions on student performance, the research team used state test scores in the content areas of science, mathematics, history, and language arts. California state test scores of students who received at least one RAALI dose were compared with students who did not receive a RAALI dose. Participating school districts collaborated with RAALI by supplying student datasets on disks containing student demographic data and CST data. The research study has been approved by the Humboldt State University Institutional Review Board (# 07-13) and ensures that all students, teachers, and schools remain anonymous.

In all, 21 RAALI teachers (science, mathematics, and history) from 14 high schools

met the criteria for inclusion in this study during academic year 2006-2007. Test data for all of the students at the 14 high schools (over 7,000 students) have been pooled across all schools for analysis. Students who received a RAALI intervention were tagged with an indicator of the content area course in which they received the intervention. Test data used for the analysis included ELA, Science, Mathematics, and World History scaled scores grouped by grade level for analysis.

Variation in the CST ELA scores for academic year 2006-2007 were significantly associated with a number of demographic variables including Title 1 status, parent education level, Gifted and Talented Education (GATE) program status, migrant status, and others. To understand RAALI intended impacts, we chose Title 1 status as a primary lens through which to conduct analyses because this status is associated with the high need students our project aims to serve. This status can also change as a result of positive impacts in the school and classroom.

We conducted analyses of variance (ANOVA) to test whether scores on individual standardized tests differed as a function of their teacher's implementation of the RAALI academic year interventions. Planned contrasts focused on comparisons among Title 1 students who received RAALI doses versus those who did not. Comparisons with respect to mathematics, science, and ELA performance were conducted with controls for grade-level effects. The World History test is grade specific. All quantitative analysis were conducted using the Statistical Program for the Social Sciences (SPSS), version 12.0.

Data sources included CST data files with student demographic data from each school district in the study and student datasets with class listings. In addition, each teacher was surveyed to determine their class schedule and to identify the classes in which they implemented a RAALI intervention plan. CST data used for analysis were the English and Language Arts, Science, Mathematics, and World History scaled scores and student demographic data.

Findings

Results indicate CST ELA scaled scores for academic year 2006-2007 showed a significant correlation ($p = 0.015$) with respect to RAALI dose level among Title 1 students (Table 1). Students who received a full RAALI dose performed 9.5 points higher (mean=320.6) than those who did not receive a dose at all (mean=311.1). Table 1 shows ANOVA results. When evaluating RAALI dose level by content area, CST World History tests showed significance (p=0.049) between students who received a full History dose versus those who did not (Table 2). The difference in Mean test scores for those who received a full History dose versus those who did not was 13.6 (No dose = 314.03 versus Full dose = 327.65). For this analysis, all students were pooled together because Title 1 students showed no significant difference in mean test scores compared to non-Title 1 students.

Table 1.   ANOVA results of RAALI dose with respect to English/Language Arts test performance.

Tests of Between-Subjects Effects					
SOURCE	Type III Sum of Squares	df	Mean Square	F	Sig.
Model	147,765,547	9	16,418,394	5,120.41	0.0000
Test Grade Level	51,257	2	25,629	7.99	0.0004
RAALI Dose	27,012	2	13,506	4.21	**0.0150**
Test Grade Level * RAALI Dose	37,311	4	9,328	2.91	0.0206
Error	4,748,764	1,481	3,206		
Total	152,514,311	1,490			

Table 2. ANOVA results of RAALI History dose with respect to World History test performance.

Tests of Between-Subjects Effects					
SOURCE	Type III Sum of Squares	df	Mean Square	F	Sig.
Model	240,059,061	4	60,014,765	19,368.5	0.000
RAALI HISTORY Dose	12,006	1	12,006	3.9	**0.049**
Title1	2,313	1	2,313	0.7	0.388
RAALI HISTORY Dose * Title1	74,595	1	74,595	24.1	0.000
Error	7,179,383	2,317	3,099		
Total	247,238,444	2,321			

We were unable to detect a significant correlation between CST Math and Science tests and RAALI dose. Unlike ELA and World History tests which are grade level specific, science and math test vary by specific sub-disciplines (i.e. biology vs. chemistry, and Algebra vs. Geometry) and are given at different grade levels. This results in smaller sample sizes for comparable tests and grade level combinations. Thus, the power to detect differences is more limited than for ELA and World History tests.

We note here that related research from this professional development initiative has found clear evidence that the RAALI professional development impacts teachers' attitudes about academic literacy strategies in the classroom and student recognition and enthusiasm about the use of these teaching strategies *(See Grady, Lane, and White, "You Talk About It and You Learn Better" NRC Session Friday, December 04, 3:00 - 04:30 in Acoma.)*

National attention has been drawn to adolescent literacy (Jacobs, 2008) suggesting the need for increased research on the effectiveness of teacher's literacy practices on adolescent learning. Our research study addresses this issue by working with teachers in science, mathematics, and history to implement academic literacy curricular interventions in their classrooms to increase high school student's literacy skills. The preliminary findings suggest among Title 1 students, the RAALI intervention is having a positive impact on CST scores in ELA and World History.

Research Design as a Model **–** Our study focuses on a professional development model that provides academic literacy interventions to a large number of high need schools with self-selected participation by the teachers. This professional development model is ideally suited for schools in semi-rural areas where school size is small and widely dispersed. In conducting the research, we "experimented" with a study design that accounted for this model of recruitment as part of professional development and the rural nature where these schools are found. Can this research model adequately address relevant questions about teacher professional development with respect to student performance as measured by standardized test data? Our preliminary findings suggest this model can detect the effects of professional development on student achievement.

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RAALI Website
www.humboldt.edu/~rsp/RAALI.html

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