Washington University Life Sciences Teacher Institute: Education for a Global Community
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1 PROJECT DESCRIPTION

The primary goal of the 'Life Sciences for a Global Community' content institute for high school biology teachers is to support and develop a teaching force capable of educating young people toward a deeper understanding of the impact of life sciences on issues facing a global community. There are three main categories of activities that support this outcome:

1. A leadership institute for a national cohort of teachers that makes the most current, relevant scientific content accessible to high school biology teachers, their curriculum and students,
2. A design process that supports research faculty in the life sciences to share both their content knowledge and the implications of their research to the health of humans and the broader ecological environment,
3. A sustainable network of high school life science teachers interested in connecting scientific research and global issues to their teaching; disseminating their expertise to improve the teaching of others; and advancing national efforts to reform high school life science teaching.

The project is organized around the development of a new master's degree in biology, a major component of the infrastructure of the institute. The degree program is designed to be completed in two years, through two intensive three-week summer sessions in residence at Washington University, four semesters of online courses, and a year long capstone course offered during the academic year.

An integral element of the Life Sciences for a Global Community (LSGC) Institute is a comprehensive assessment program targeting the learning of participating teachers and their students. One goal is to document content knowledge changes as teachers progress through the institute. Student content knowledge is also assessed to examine the relationship between teacher and student content knowledge. The underlying rationale for this work is that a relationship exists between teacher and student content knowledge. Thus, developing teacher content knowledge is a worthwhile strategy for improving student performance in science.

2 INDICATORS OF SUCCESS

Teacher knowledge gains affect student knowledge gains

Content knowledge gains are an important outcome of the summer residential courses, but the success of the Institute rests on the effective transfer of new knowledge and associated teaching strategies to benefit high school students. The LSGC has implemented an extensive pre/post assessment program for Institute participants (teachers) and their students. Teacher assessments are aligned to student assessments by content area, which provides an analytical opportunity to see overall effects of the teacher learning in the Institute on gains in student learning. Teachers from all Cohorts demonstrated knowledge gains from the pre to post-test for content from the first two summers.

For test results from 2007-08, only Cohort 1 teachers had attended the institute, while Cohort 2 and 3 teachers were awaiting the start of their program. Thus, students of teachers in these cohorts serve as comparison groups to students of Cohort 1 teachers. At the same time, students take the content test that is aligned with the summer institute content taught to teachers during the preceding summer.

Project directors used hierarchical linear modeling (HLM) to understand what proportion of variability in student test scores could be attributed to teacher differences. They isolated the variability in student content knowledge due to teacher (i.e., classroom) level variables. Results of this analysis indicated that approximately 45 percent of the variability in student test score gains can be attributed to teacher level variables.

Once it was determined how much variability was due to between teacher differences, a *conditional model* was fit using teacher post-test score as a teacher level (i.e. Level 2) predictor to help explain differences in student test scores. This was based on the fundamental premise that teacher content knowledge contributes to student performance. Results indicated that teachers who had higher post-test scores were more likely to have students with higher spring test scores ($t = 2.23$, $p = .03$).

These results provide initial evidence that the LSGC Institute is positively impacting student performance—teacher content knowledge is being impacted by participation in the Institute, and teacher content knowledge helps to explain a statistically significant amount of the variability in student test scores (13 percent of 45 percent).

Using social network analysis in assessing online graduate courses

The development of a national professional learning community is another major component of the institute. However, the geographical dispersion of teachers within each of the three cohorts presents a unique challenge to the development of a leadership program based on collaborative models. The vehicle used to develop and maintain communication and collaboration between teachers across the nation is a series of online academic year courses.

Assessment of progress toward development of a national PLC is framed by the dimensions outlined by Hall and Hord (2006):

1. Shared values and vision;
2. Collective learning and application;
3. Supportive and shared leadership;
4. Supportive conditions; and
5. Shared personal practice.

Social network analysis provided an opportunity to analyze teacher interactions and quality of discussions online graduate courses that assumed the characteristics of a PLC. Of the three courses analyzed, all, to varying degrees, were effective in supporting development of all but one of the PLC dimensions. Not surprisingly, this was number 3, supportive and shared leadership. Institute leaders are developing means for incorporating shared leadership into the distance learning environment (Balcerzak, May, & Schaal, 2009).

Identifying characteristics of teacher-leaders

One of the goals of the LSGC is to develop a cohort of teacher-leaders that can navigate school and community institutions in a collaborative fashion. New theoretical and empirical models of leadership have in common the recognition that leadership is relational, not an individual phenomenon and that it would be beneficial for teachers to be instructional leaders, beyond the typical 'sharing of best practices' (Grossman, et.al., 2001). They suggest a teaching force that can engage with the larger issues confronting society and envision how a strong science curriculum could support the next generation to become effective problem solvers.

Written responses by 200 high school biology teachers were analyzed for characteristics of traditional leadership and new theoretical leadership. The question teachers responded to is: Describe your professional growth over the years. What would you like to contribute to the field of science education, as a teacher, a department member, and as a professional?

A conceptual analysis suggests that most teachers in this subset of high school teachers (78%) perceive themselves as leaders, primarily because they excel in teaching, have occupied roles defined by their districts to be leadership roles and secondarily, interact with their colleagues. This current conception is most closely aligned with the traditional theoretical models of leadership. A smaller number of respondents (22%) viewed leadership as collaborative and/or expanding beyond their responsibilities in their district. This discussion encourages a conversation about leadership that spans both the current discourse of leaders as isolated individuals to those capable of facilitating teams of experts promoting organizational change relevant to societal reforms in science education (Balcerzak and May, 2008).

References

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