Impact of Professional Development on the Classroom Practices of Adjunct Faculty

This project examines the impact of a professional development workshop on six of its volunteer adjunct instructor-participants. Participants were observed teaching their courses during the following year, and surveys were collected from the instructors and their students. Preliminary findings reported based on the first semester of observations revealed that five observed instructors were implementing or attempting to implement cooperative learning, while just 3 of 5 were emphasizing multiple representations and using high-level questions with their students. The authors will present qualitative and quantitative findings based on triangulation of observation data with instructor self-reports and student surveys, including data trends over time.

Adjunct collegiate mathematics instructors are playing an increasing role in providing instruction to students. According to the National Center for Education Statistics, in 2003, 43.7 percent of instructional faculty members were adjunct faculty (quoted in Landrum, 2009). Yet adjunct faculty members often receive very little training in how to teach. At the same time mathematics departments seek to be more successful in attracting and retaining majors, a problem that can be addressed in part by more effective and engaging classroom pedagogy (Holton, 2001; Seymour & Hewitt, 1997). Partially in response to these issues, professional societies are now advocating more interactive and engaging instructional styles (American Mathematical Association of Two-Year Colleges, 2006; Conference Board of the Mathematical Sciences, 2001). Meanwhile, the vast majority of mathematics departments at doctoral institutions train their teaching assistants, but this training may be limited in scope; while at master's institutions less than three-fourths of departments train teaching assistants (Belnap & Allred, 2006). Little is known at this time about what sorts of models are most effective for developing instructors at the college level.

To address these challenges, Jones and Johnston designed a lesson template that would assist instructors in engaging their students, and provided a professional development workshop to a group of adjunct instructors (Jones & Johnston, in press). This study reports on the effects of professional development on participating instructors' classroom practices.

BACKGROUND AND THEORETICAL FRAMEWORK

A limited but growing body of literature addresses the preparation and professional development (PD) of college instructors (Speer, Gutmann, & Murphy, 2005). Among these works are those

who have investigated the skills needed by instructors to implement reform-based teaching in the classroom (Bartlo, Larsen, & Lockwood, 2008; Wagner, Speer, & Rossa, 2007), or sought to understand teaching assistants' cognitive growth or affective experiences in becoming classroom instructors (Belnap & Giullian, 2008; Mendoza-Spencer & Hauk, 2008).

Far fewer studies have investigated the effects of training on instructors' classroom practices or the effects on student learning. Childs (2008) investigated the effects of a teaching assistant development program on student grades and withdrawals, and found that instructors with more experience and more training had significantly fewer students withdraw from their courses. Speer (2001) found that written instructions, including pre-scripted lessons and intensive short-term training, was insufficient to change instructional practice. McGivney-Burelle, DeFranco, Vinsonhaler, and Santucci (2001) examined how a course for graduate teaching assistants (TAs) in mathematics changed their beliefs from traditional lecture-centered instruction, toward cooperative, learner-centered teaching. However, factors including traditional curricula and the rapid pace of the syllabus, a lack of planning time, and foreign TAs' difficulty in reconciling their own university teaching culture with that of their new American university, impeded the TAs' ability to align their teaching to their belief in promoting student learning. This paper adds to the literature by examining the effects of a particular kind of PD with adjunct mathematics faculty, namely structured lesson planning.

The theoretical framework for this research is based on prior work on student engagement through cooperative learning, and the development of deep conceptual understanding in mathematics. Increased student engagement is correlated with improved student performance on

both cognitive and non-cognitive outcomes in college mathematics courses (e.g., Miller, Santana-Vega, & Terrell, 2006; Weston & McAlpine, 1998; see also reviews by Herzig & Kung, 2000; Springer, Stanne, & Donovan, 1999). In mathematics, Dees (1991) found that cooperative learning increased problem-solving performance of students in remedial college mathematics, while Moore (2005) found that collaborative learning increased success rates of minority students in calculus. The Good Questions calculus project is an example of positive outcomes resulting from concept development and the use of questions to engage students in that development (Miller, Santana-Vega, & Terrell, 2006). As in prior literature, we explore the joint effects of instructors' use of cooperative learning along with their use of other tactics, such as multiple representations and use of questions, to foster deeper learning.

In addition to cooperative learning, research has documented the need to focus on conceptual understanding. Thompson and Thompson (1994; Thompson, Philipp, Thompson, & Boyd, 1994) found that students had difficulty following explanations that focused only on sequences of computations instead of concepts. Additional investigations have shown that conceptual understanding and procedural understanding support each other (Rittle-Johnson, Siegler, & Alibali, 2001) and that comparing solution methods boosts procedural knowledge, flexibility and conceptual understanding (Rittle-Johnson & Star, 2007; Star & Seifert, 2006). At the college level, a number of studies have found positive effects for students in collaborative settings and in courses emphasizing conceptual knowledge development (Bonsangue, 1991; Chappell, 2006; Miller, Santana-Vega, & Terrell, 2006). In projects that emphasized conceptual development, the curricula often relied on the use of multiple representations in addition to the traditional symbolic representation (see Herzig & Kung, 2000, for a review). This study sought to find out whether

and how participating instructors implemented concept-based teaching as advocated in the workshop.

This study seeks to understand college instructors and their development by exploring the impact of a professional development program on teaching practices, including student perception of those practices. This work extends prior exploration of the effects of the workshop (Jones & Brockman, 2008; Jones & Johnston, March, 2008). In particular, less-experienced instructors struggled to plan according to the workshop principles, while more-experienced instructors were more successful (Jones & Johnston, March, 2008). Moreover, observations from the semester in which follow-up occurred indicated that instructors were able to utilize cooperative learning, but only three of five instructors observed during that semester were able to focus on developing deep understanding (Jones & Brockman, 2008).

RESEARCH QUESTIONS

In this study, we posed the research questions: 1) Are instructors implementing classroom practices advocated by the professional development workshop? 2) Comparing the first and second semesters following the initial workshop, do instructors' use of practices increase over time? 3) Are students' perceptions of instructor practices correlated with their grades?

DATA AND METHOD

A professional development (PD) workshop was offered to instructors at a master's granting university in Southern California and its feeder community colleges. Participants were compensated for their time in the workshop and offered preferential consideration in future course assignments at the university. Ten adjunct instructors (five female) agreed to participate in the professional development workshop. They ranged in teaching experience from those in their first year as instructors to those with more than 15 years of teaching. Their educational backgrounds varied from those concurrently enrolled in an M.A. degree program in mathematics to those with an advanced degree in mathematics; one participant had completed an Ed.D. At a follow-up meeting, instructors from the workshop were informed of the opportunity to participate in the current study. Six of the ten participants (four female) gave consent and the classes assigned to them by the university during the two semesters of this study were the sources of the data collection reported here. Details of the professional development workshop are described in Jones and Johnston (in press).

Each of six instructors participating in the study was typically visited twice for each course assigned to him or her during those semesters. Over two semesters, two instructors had 1 course each, one instructor had 2 courses, one instructor had 3 courses, and two instructors each had 4 courses, for a total of 15 courses. There were three sources of data: observations, student surveys, and instructor surveys. The 15 courses were observed 26 times and surveyed 30 times. The design of each instrument is described below.

An observation instrument coded time spent in various modes of instruction as well as coding for the source and types of question-and-response exchanges. To ensure inter-rater reliability observers were calibrate on two separate occasions to within ± one question. The observation instrument documented the time spent on each task posed to the class. The observer also noted whether the instructor completed the task, or whether it was solved by the whole class, by an individual student at the board, or by students working alone or in groups. The observer also noted the questions posed during the class, classifying them as Recall/Evaluate, Comprehension, When, or Why. Recall/Evaluate was used to designate questions requiring recall of terms or short computations or simplifications; Comprehension was used to designate checks for student understanding, such as, "Does this make sense?" or "Are there any questions?" When was used to denote questions of when a procedure would be used or in what situations it could be applied; Why was used to denote questions of why a procedure worked, as an invitation to reason or justify solutions or methods. It was noted whether the instructor or a student posed the question, and whether a student or the instructor answered the question.

In addition, surveys for participating instructors and their students were developed using a number of existing survey instruments (H & H Publishing, Inc., 1996; Marsh, 1982; Op't Eynde & De Corte, 2003; Pintrich & De Groot, 1990; Ramsden, 1991; Trigwell & Prosser, 2004), adding a few qualitative response items. The Learning and Study Skills Inventory (LASSI) is a diagnostic and prescriptive Likert-type ten-part survey that was developed to measure students' awareness of learning and study skills in strategic learning (H & H Publishing, Inc., 1996). Cronbach's alpha score for this portion of the LASSI is reported as 0.83. The researchers also reworded some questions to measure students' perception of their instructors' ability to help

them learn conceptual knowledge, in an effort to capture the students' understanding of classroom instruction as well as their awareness of their own learning, for example, "My instructor helps me to see translate what we are learning into words and ideas that make sense," and "My instructor helps me to see translate what we are learning into words and ideas that make sense." Questions focused on student behaviors were coded into the variable student-centered information processing (SCIP), while questions focused on instructor behaviors were coded as instructor-centered information processing (ICIP). Other variables measured were Student Course Engagement (SCE, items developed by Handelsman, Briggs, Sullivan, & Towler, 2005), Student Evaluation of Educational Quality (SEEQ, items developed by Marsh, 1982; Coffey & Gibbs, 2001), Small Group Interaction (SGI, developed by the present authors), and instruction using Multiple Representations (MR, developed by the present authors). A more detailed of the development of the survey instruments used for this study is available in Jones and Brockman (2008). In the present study, the Cronbach alpha for the entire survey was .83.

RESULTS

Below, we present results from analysis of this yearlong project. The presence of three data sources allows for a broad perspective on the practices used by instructors. A preliminary report on this project (Jones & Brockman, 2008) found that all instructors were using or attempting to use cooperative learning, but only three of five used multiple representations and high-level questions as advocated in the PD. Initial data was collected in the fall while follow-up support was available to participants; formal follow-up support was not available to instructors in the

spring, the second semester of observation. Thus, analysis of this data explores the extent to which instructors are able to independently sustain practices advocated in the PD.

Across all data sources, cooperative learning appeared as a consistent element. In the fall, students rated instructors highly on using cooperative learning, with between 63 and 81 percent agreeing or strongly agreeing with the 4 items. In the spring, between 49 and 67 percent of students agreed or strongly agreed with the 4 items. Note that because sampled instructors and courses were not weighted equally across the semesters, the lower numbers do not necessarily represent a longitudinal trend. Observers noted the use of cooperative learning in at least one course for every one of the six instructors. There was a wide range in the duration of the group activities, from 5 minutes to an entire course meeting of 75 minutes (for an exam review session). At the individual level, students' self-reported participation levels correlated with their final grade at the $p = .01$ level, as measured by the variable SCE on the set of first visits in the spring. This variable was comprised of the prompts, "In this course, I volunteer to answer the instructor's questions," and, "In this course, I ask questions when I don't understand the instructor." In addition, fall final grades correlated with the SEEQ from the first set of visits at the $p = .01$ level, with questions including, "Students were encouraged to participate in class discussions" and "Students were invited to share their ideas and knowledge." These findings should be interpreted with caution, since the primary unit of analysis in this study is the instructor and not the student, and because a number of confounding variables exist that make comparing grade assignments between instructors, courses, or course sections invalid. However, this finding was used to gauge the extent to which a student's engagement with the instructor and perception of the instructor had a positive effect on the student's course grade.

No clear pattern emerged with regard to instructors' use of practices designed to promote conceptual understanding. Participants typically did not design the short concept questions or essential questions regarding strategic knowledge advocated by the workshop. However, multiple representations were used to some extent. The item, "This week, the instructor used graphs, diagrams, or tables to help us connect the ideas we are learning," generated strong support, with 76% and 69% agreeing or strongly agreeing with the prompt, the highest item agreement on the survey. Observations confirmed that instructors did attempt to connect different representations in their modeling of problems to students. The kinds of questions asked by instructors are shown in Table 1. Prompts to recall information or to perform simple computations and solicitations of questions or points of confusion continued to dominate the discourse, at 91% of all the questions asked. Questions regarding when to apply procedures were very infrequent, and questions about why procedures worked were only slightly more common. On their surveys, three instructors cited a lack of time in the syllabus or personal planning time as a difficulty in designing lesson questions like the ones advocated in the workshop.

Question type ↓	Avg. Q's per 75-min. meeting	Total Q's posed (as a % of all Q's)
Recall/ Evaluate	21	61
Comprehension	10	30
When	0.7	2
Why	2.4	7

Table 1. Instructors' use of questions by type.

Finally, it is worthwhile to provide a portrayal of the six instructors as individuals and to describe their practices over time. Instructors A and B, both veteran instructors, implemented the

workshop strategies consistently with regard to tasks and questions and use of engagement strategies. Instructor C, also a veteran instructor, made some effort to use the task strategies, and frequently but not always used groups in her courses, although she always made some effort to engage students. The remaining three instructors, D, E, and F were less-experienced and used groups to a moderate extent, but not in all courses they were teaching in a given semester. They also used multiple representations occasionally, but not questioning strategies or other tasks to foster understanding.

Among these instructors, four were visited in both semesters. Instructor A remained consistent and high in her implementation of workshop strategies. Instructors C and D showed a modest decrease in their use of groups as well as use of tasks designed to foster understanding, and instructor E showed an increase in his use of groups but no change in task design or questioning strategies.

CONCLUSION

This work has implications for all departments interested in providing assistance for faculty to develop teaching skills beyond traditional lecture. These findings support earlier studies (McGivney-Burelle, et al., 2001; Speer, 2001) documenting the difficulty of changing classroom practice, given time constraints, including typical course syllabi, but show that PD may enable certain change elements, particularly cooperative learning. It also suggests that PD may be valuable for experienced instructors. As described by Jones and Johnston (in press), the PD was designed specifically for mathematics courses in which the goal is to obtain fluency with a set of procedures and would not be appropriate to proof-based courses. For this specific population of

courses and for a similar group of instructors, the authors speculate that the PD participants would benefit from more opportunities to practice implementing specific elements into their practice before attempting a complete change in approach to a single lesson. Future research should examine the extent to which instructors' adaptation of elements advocated in PD is built on prior practices, and the extent to which elements vary systematically by the level and audience for the course.

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