Effects of Elementary- and Middle School-Based GK-12 Programs On Graduate Student Teaching and Communication Skills

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Abstract

The NSF Graduate Teaching Fellows in K-12 Education program at the University of South Carolina supports engineering graduate students and advanced undergraduates to serve as content resources in local schools. A primary objective is to develop the teaching and communication skills of the fellows, who can become the faculty of the future. This GK-12 program includes three main elements: a service learning component where the fellows work ten hours each week with teachers and students; an education course developed specifically for the fellows; and a GK-12 Summer Institute for Teachers designed and taught by the fellows.

During the 2001-2002 academic school year, eleven fellows were partnered with teachers in elementary schools. During the 2002-2003 school year, a second cohort of ten fellows was partnered with middle school teachers. This paper compares and contrasts the elementary school-based and the middle school-based programs in terms of their effects on the fellows' teaching and communication skills. Qualitative and quantitative assessment data collected from the fellows, the teachers, and the fellow's advisors is evaluated. Results indicate that both approaches are effective in improving the fellows' teaching abilities. There is also some indication that the elementary school-based program may have been slightly more effective.

Introduction

The College of Engineering and Information Technology received an award from the National Science Foundation's Graduate Teaching Fellows in K-12 Education (GK-12) Program to support fellowships and associated training that will enable graduate students in engineering to serve as resources in K-12 schools[1]. The University of South Carolina is one of over 100 institutions funded by NSF through this program. Some of these awards have been described [2-6] and have provided guidance for the development, implementation and assessment of our efforts. This three-year program seeks to improve the teaching and communication skills of 30 engineering students, to enhance the ability of 120 elementary school teachers to use engineering applications to teach science, and to inspire thousands of elementary children.

A major objective of this and other GK-12 projects is to improve science learning of students and assist in the professional development of teachers in grades 3-8. These groups are targeted because this is the time when most young people are either turned-on, or turned-off, to science. Too often, science and mathematics are viewed by the students as facts and figures to memorize,

with little significance to the world around them. Engineering (the art of applying scientific and mathematical principles, experience and judgment to make things that benefit people) can provide the applications that make science real to the novice learner.

The USC program is different from other K-12 outreach programs in that the primary objective is to help prepare today's engineering graduate students to be the engineering faculty of tomorrow. To succeed, this future faculty must be prepared to teach a generation of students that has grown up in a global, high-tech society. To teach such students they will need better communication and teaching skills and greater knowledge of cognitive processes that enhance student learning, than today's faculty possess.

This paper focuses on a comparison of the effects of the program on the first two cohorts of graduate student participants. It includes descriptions of an education course developed specifically for the GK-12 fellows, their in-school activities with different populations of students, and their development and implementation of the GK-12 Summer Institute for Teachers. Data from a comprehensive assessment process implemented by the College of Education's Office of Program Evaluation has been used for both formative and summative assessment of the program.

Program Description

The GK-12 fellows at this university include graduate and advanced undergraduate students from the disciplines of chemical, civil, computer, electrical, environmental and mechanical engineering. A four-part educational plan was used to develop their teaching skills and knowledge.

Formal coursework. During the fellow's first semester of project involvement, they participated in a field-based university-credit course developed by a coPI of the GK-12 grant. The course, "EDTE 701-Special Topics in Teaching Science," consisted of two facets: formal instruction and practicum. Throughout the semester, the fellows met each week for two hours of formal in-class instruction followed by a two hour practicum. The in-class portion was taught by faculty in the College of Education, while the weekly practicum was supervised by teachers in K-12 schools. These teachers helped to design appropriate field-based experiences for the practicum portion of the course, supervised the fellows in the elementary and middle schools, and provided feedback to the fellows as they adjusted to the K-12 setting.

The course focused on pedagogy, teaching principles, communication skills, cognitive processes, and learning styles. The primary objective of the course was to provide the fellows with an overview of current, applicable educational theory that could be immediately implemented in the K-12 classrooms. This global objective was divided into five course goals:

1. Develop an understanding of the various forms of investigations appropriate for students.
2. Understand and apply the basic science process skills.
3. Design and implement lessons that incorporate math and science concepts to solve problems.
4. Apply current educational research to the teaching of science programs.
5. Identify and incorporate the educational standards into the fellows' lesson plans.

Of substantial importance to the fellows, the methodologies for educating the K-12 population were consistently expanded to include the similarities and differences for teaching at the university level. Many of the same techniques were found to be applicable at all levels of education. As an example, the learning cycle, taught as a means of introducing young students to new science lessons, was successfully applied to a freshman engineering class[7].

Fall teacher partnering. As part of the fall Special Topics course practicum and the conditions of their fellowship, the first cohort of GK-12 fellows spent 10 hours per week working directly with elementary school teachers and students. The second cohort of GK-12 fellows spent 10 hours per week working directly with middle school teachers and students. During the Fall 2001 semester, the participating schools belonged to the University's PDS network and the Teacher Partners had previous experience working with student teachers and interns. The fellows learned from their Teacher Partner role model while they implemented hands-on activities and design challenges that are aligned with state science standards.

Spring teacher partnering. For the spring 2002 semester, each trained and experienced Cohort 1 fellow moved to a different elementary school. These schools were not part of the PDS network and had not historically benefited from a close relationship with the University. In most cases, the teachers had only a few years of experience and/or had not mentored pre-service teachers before. The move to the new schools enabled fellows to share their expertise with teachers who were more likely to need help with science and mathematics content knowledge. It also gave the fellows an opportunity to better understand and appreciate the issues facing K-12 education in the state. Furthermore and most importantly, by changing teachers, the fellows were given another role model to help with the development of their own teaching and communication skills. For the spring 2003 semester, each trained and experienced Cohort 2 fellow remained in the same middle school. However, they were assigned to different teachers within the school.

Summer teacher institute. After a full year of in-school service learning with students, both cohorts of fellows designed and implemented a GK-12 Summer Institute for Teachers. These were 3-day workshops for in-service teachers on the college campus. Each fellow selected 2 or 3 of the activities they had developed and implemented during the school year, and taught the participating in-service teachers how to implement the activity during the workshop. The Institutes were the fellows' projects from planning through implementation. The PI and Co-PI approved or disapproved funding for supplies and helped with some of the logistics only when requested. The fellows designed the workshop syllabi, schedules and activities, prepared the instructional materials, acquired the supplies and instrumentation needed, and taught the teachers. The intended benefits to the fellows included developing their abilities to execute professional meetings and proactively organize teams, as well as enhancing their professional skills, such as leadership, communication, and professional responsibility.

Assessment Procedures

Multiple assessment instruments were used to characterize the effect of the GK-12 program on the graduate students. These include: fellows surveys, fellow focus groups, research advisor interviews, teacher partner focus groups, and workshop teacher surveys. This section describes these instruments and protocols.

Fellow surveys. Prior to starting the GK-12 program in the fall semester, and again at the end of the spring semester, a Likert-scale survey was administered to the fellows in both cohorts. Each survey contained the same 15 items; these were designed to measure the fellows' perceptions of their ability to teach and of their level of knowledge for teaching and learning strategies. Fellows rated statements regarding their abilities with the subscale: 1 = Not competent, 2 = Some competence, 3 = Competent, 4 = More competent and 5 = Very competent. For questions regarding knowledge of teaching strategies the subscale was, 1 = Not knowledgeable, 2 = Some knowledge, 3 = Knowledgeable, 4 = More knowledgeable, and 5 = Very knowledgeable.

Fellow focus groups. Two focus groups were conducted with the graduate fellows in each cohort. The first focus group took place during the fall semester, about 3 months after the fellows began the program. The second focus group was conducted in the summer after the fellows had completed the GK-12 program year. Each focus group required about one and one-half hour to complete. Prior to the start of a focus group, the purpose was explained and each participant agreed to be audiotaped. The focus groups were facilitated by a trained moderator. The moderator asked slightly different questions to the focus group participants in the fall and in the summer. However, in both cases there were 11 open-ended questions concerning the fellows', teachers' and students' experiences. Each focus group audiotape was transcribed verbatim, then software coded to identify and define issues and themes[8]. All information collected in each focus group was kept confidential and summarized in such a way that individual responses could not be identified.

Research advisor interviews. Telephone interviews were conducted with the research advisors of 6 of the 11 fellows in Cohort 1 and 8 of 10 fellows in Cohort 2. The subset for Cohort 1 occurred because two of the fellows were undergraduates and did not have research advisors, one of the advisors was on sabbatical at the time of data collection, and two of the fellows were advised by the principal investigator.

The advisors for both cohorts were asked five questions: (1) what do you know about the GK-12 program? (2) how is the GK-12 fellowship of your advisee affecting the progress towards his/her degree? (3) how is participating in the GK-12 program affecting the communication and teaching skills of your fellow? (4) Would you, as an adviser, encourage other students to apply to the GK-12 program? Why? or why not? and (5) What other thoughts do you have about the GK-12 program? The advisors' answers, related directly to the fellows' teaching and communication skills and to how participating in the GK-12 program is integrated into the student's program of study, are included here.

Teacher partner focus groups. Focus groups were conducted with the participating teachers for both cohorts of fellows. The first set of focus groups was conducted with the fall semester cohort of teacher partners and occurred in October, approximately 2 months after the program began. The second set of focus groups was conducted with the spring semester cohort of teacher partners and occurred in March, approximately 3 months after these teachers were assigned fellows. The primary purpose of the focus groups was to determine how the GK-12 program was affecting the teachers' knowledge, attitudes, beliefs and behaviors with respect to teaching science and applying engineering problem solving strategies. However, information was also

obtained that relates to the effect of the program on the GK-12 fellows. Such information is included in the results section of this paper. Data collection and analysis procedures were similar to that used for the fellow focus groups.

Workshop teacher survey. At the end of the GK-12 Institutes for Teachers, the participants were administered a survey consisting of four sections. The first section asked participating teachers to provide demographic information about themselves. In the second section teachers were asked to indicate their level of agreement with nine statements concerning their experiences in the Institute. The third section asked teachers to indicate in which of the available activities they participated and whether or not an activity they participated in was appropriate for use in their classroom. The last section of the instrument asked teachers to provide suggestions for improving the workshop or any other comments they may have concerning the workshop. Several of the questions from the second section were indicators of the fellows' teaching effectiveness. The results of those questions are presented.

Assessment Results

The assessment procedures described above provide information that can be used to evaluate the effects of the GK-12 Program on the fellows, the K-12 teachers, or the K-12 students. This paper focuses only on the GK-12 fellows. The research questions addressed here are:

1. How does the GK-12 program affect the science related communication and teaching skills of the fellows?
2. Is there a difference between the elementary-based and middle-school based GK-12 programs with respect to the answer to question 1?

Fellow survey results. Seven items on the initial/final fellow survey instrument directly addressed development of science related communication and teaching skills of project fellows. Initial and final surveys could be paired for 10 Cohort 1 fellows and for 9 Cohort 2 fellows. It should be noted that the survey asked fellows to indicate their prior teaching experience. For Cohort 1, seven of the fellows listed experiences that could be considered teaching experience. Only two fellows in Cohort 2 indicated such experiences. The Initial Survey mean responses for both cohorts to the seven items appear in Table 1. The Cohort 2 means for all seven of the items where higher than those for Cohort 1, even though fewer Cohort 2 fellows had prior teaching experience. This may indicate that the initial Cohort 2 perceptions of their understanding and abilities related to teaching and communication skills were higher than those for Cohort 1.

The Cohort 2 means were again higher on the final survey than were those for Cohort 1 as can be seen in Table 2. However, the differences between the two cohorts on the final survey items were smaller than the differences seen for the initial survey. The variability associated with the responses to the items was smaller for Cohort 2 on items 2 through 7 as compared to Cohort 1. The difference in variability is an indication Cohort 2 responses were more consistent as a group. The differences in means and variability might be a reflection of the differences between the two cohorts in past teaching experience. However one cannot rule out the possibility of effects due to one cohort being in elementary school classrooms and the other in middle schools.

Table 1. GK-12 Fellow Initial Survey Means for Survey Questions Related to Teaching and Communication Skills

	Cohort 1			Cohort 2		
Survey Item	n	Mean	SD	n	Mean	SD
1. Ability to appropriately engage children in problem solving activities that incorporate math and science	10	2.00	1.09	9	3.11	0.78
2. Ability to identify various investigative forms appropriate for children	10	1.80	0.92	9	2.33	0.87
3. Ability to manage a class using hand-on/laboratory activities	10	2.10	0.99	9	2.67	1.00
4. Ability to design and implement appropriate investigations for children	10	2.30	1.25	9	2.78	1.09
5. Ability to conceptualize activities that use math and science concepts to solve problems	10	2.80	0.79	9	3.11	1.05
6. Ability to use computer technology and other instructional media as teaching tools	10	3.20	0.92	9	3.89	1.05
7. Ability to develop appropriate forms of assessment	10	2.20	0.92	9	3.00	0.87

Note: n = Number of fellows. SD = Standard Deviation.

The initial to final survey differences in mean responses for items related to teaching and communication skills for each cohort were tested using a paired, or correlated, samples t-test. A Bonferonni adjustment was applied to the seven tests for each cohort to control the type I error rate. The data associated with these tests appear in Table 3.

The initial to final survey differences in means were higher for Cohort 1 on all items as compared to Cohort 2. There were significant initial to final survey differences for Cohort 1 on item 1 through item 6. Initial to final survey differences for Cohort 2 were only significant for item 2 and item 3.

The highest significant mean differences for Cohort 1 were for 1) ability to appropriately engage children in problem solving activities that incorporate math and science, 2) ability to identify various investigative forms appropriate for children, and 3) ability to manage a class using hand-on/laboratory activities. For Cohort 2, the highest significant mean differences were for 1) ability to identify various investigative forms appropriate for children, and 2) ability to manage a class using hand-on/laboratory activities. Neither cohort had a significant initial to final survey difference for item 7, ability to develop appropriate forms of assessment.

Cohort 1 and Cohort 2 initial to final survey difference scores were calculated for each fellow on each of the seven items. The resulting independent samples difference scores were then

analyzed using a Student's independent samples t-test. No significant differences were found between the two cohorts on any of the seven items that relate to teaching and communication skills. Thus while the data in Table 3 appears to show a greater increase in Cohort 1's perception of teaching abilities, it is not statistically significant.

Table 2. GK-12 Fellow Final Survey Means for Survey Questions Related to Teaching and Communication Skills

	Cohort 1			Cohort 2		
Survey Item	n	Mean	SD	n	Mean	SD
1. Ability to appropriately engage children in problem solving activities that incorporate math and science	10	4.00	0.82	9	4.22	0.97
2. Ability to identify various investigative forms appropriate for children	10	3.80	0.79	9	4.00	0.00
3. Ability to manage a class using hand-on/laboratory activities	10	3.90	0.74	9	4.44	0.53
4. Ability to design and implement appropriate investigations for children	10	4.00	0.82	9	4.11	0.60
5. Ability to conceptualize activities that use math and science concepts to solve problems	10	4.10	0.74	9	4.22	0.44
6. Ability to use computer technology and other instructional media as teaching tools	10	4.30	0.67	9	4.56	0.53
7. Ability to develop appropriate forms of assessment	10	3.00	0.82	9	3.33	0.71

Note: n = Number of fellows. SD = Standard Deviation.

Fall fellow focus group results. At the 3-month focus group, fellows were asked how EDTE 701 and how being in a school classroom helped them develop their teaching and communication skills. All of the fellows in both cohorts agreed that transferring information learned in EDTE 701 to their assigned school was helpful. The participants that did not have prior teaching experience said the GK-12 program gave them an idea of whether they would want to be teachers or not. Cohort 1 fellows who had prior teaching experience claimed that the GK-12 program enhanced their teaching abilities. One Cohort 1 fellow indicated, "It's taught me to ask questions to see if they understand and what kind of phrasing I should use to explain concepts." For two of the Cohort 1 fellows, learning methods in EDTE 701 and then using those in their assigned school helped them teach undergraduates at the college level. "I had to teach an engineering lab, and I could tell a total difference. I was more comfortable and I just knew what to do, even though it was on a higher level. You're still teaching to people who don't know what

Table 3. GK-12 Fellow Pre/Post Differences for Survey Questions Related to Teaching and Communication Skills

	Cohort 1					Cohort 2				
Survey Item	n	Diff.	SE	t	Sig	n	Diff.	SE	t	Sig.
1. Ability to appropriately engage children in problem solving activities that incorporate math and science	10	2.00	.39	5.07	.001	9	1.11	.45	2.44	.040
2. Ability to identify various investigative forms appropriate for children	10	2.00	.42	4.74	.001	9	1.67	.29	5.77	.000
3. Ability to manage a class using hand-on/laboratory activities	10	1.80	.39	4.63	.001	9	1.78	.36	4.88	.001
4. Ability to design and implement appropriate investigations for children	10	1.70	.42	4.02	.003	9	1.33	.41	3.27	.011
5. Ability to conceptualize activities that use math and science concepts to solve problems	10	1.30	.37	3.55	.006	9	1.11	.42	2.63	.030
6. Ability to use computer technology and other instructional media as teaching tools	10	1.10	.31	3.50	.007	9	.67	.37	1.79	.111
7. Ability to develop appropriate forms of assessment	10	.80	.29	2.75	.022	9	.33	.24	1.41	.195

Note: n = Number of fellows. Diff = Final to initial difference in means. SE = Standard error. t = t statistic. Sig. = Significance level.

you're teaching them. I was surprised." Another fellow reported, "I've basically turned the table on them and instead of doing typical college spoon feeding about theory and procedures, I've taken what we've done in here and said, let's prepare a divergent exercise and give them just the theory and what I expected." I gave them a questionnaire later and found that an overwhelming majority agreed with the statement, 'I learned more.' Getting the students involved is a win-win." These Cohort 1 fellows were able to extend their learning experiences in EDTE 701 from the elementary school level to older students. However, some Cohort 2 fellows had difficulty extending what they had learned in EDTE 701 to teaching middle school students. One fellow stated "the stuff in there about elementary school science learning to me doesn't have anything to do with what we are doing." Three other fellows agreed with this statement and none of the other fellows indicated they disagreed with the statement. However, this contrast changed by the time of the summer fellows focus group.

Summer fellow focus group results. At the year-end focus group, each fellow was asked to discuss how the summer workshop helped them develop science-related teaching and communication skills. In general, the fellows in both Cohorts thought it was good because it was one of the first opportunities to actually teach adults.

Cohort 1 fellows felt it was an opportunity to speak to different audiences and different age groups. One fellow said, "It sounds kind of silly, but at least you got a chance see how your experiments work correctly because with the kids it gets a little bit confusing and you don't know if you're getting anything across. I felt fulfilled that at least somebody had learned something by the end." Another fellow said, "It was nice because you can teach 30 kids, but if you teach a teacher they may teach it for 15 more years, so you're getting more impact." A fellow did point out that it was more difficult than teaching children because the fellows "didn't have any power over the teachers, for example, being able to take away their recess."

In reference to the Summer Workshop, one Cohort 2 fellow indicated that the three day experience helped prepare them to teach adults. In reference to the difference between children and teachers, the fellow said, "The main difference is the confidence level and the ability level, but you are still presenting the material to people who may or may not understand it." In response to this statement another said, "The teachers really are just big kids, aren't they?" Another fellow said, "One of the nice things about teachers was that some of them asked some very pertinent questions. Questions that weren't asked by the students, so that made me think a little more, or at least in a different way about how to approach it."

Research advisor interviews. In their interviews, the research advisors for both cohorts were asked "Tell me how participating in the GK-12 program is affecting the communication and teaching skills of your fellow." A majority of advisors for both Cohorts felt their students' communication and teaching skills had improved.

Four of the six Cohort 1 advisors believed that the GK-12 program improved their student's communication and teaching skills. They provided comments like "It is improving skills – especially in taking the education communication course" and "He teaches and subs for me in class. He's able to communicate better with the students because of this program." One advisor

stated "I think she's getting a lot of strength in both areas. It is also helping her focus on her career choices." The two advisors who did not notice an improvement in their fellows' communication and teaching skills stated that they were "great to begin with anyway" and "already excellent in her case."

Six of the eight Cohort 2 advisors believed that their advisees' communication and teaching skills have been positively affected by their participation in the GK-12 fellowship. One of the advisors noted that the fellow's "self confidence" has improved and that this experience "has motivated him to push himself even harder." Another advisor stated, "Clearly it's been a very positive influence on him. He wants to continue to work with students. He wants to continue to improve his skills." One advisor stated that he was unable to answer this question because he has "had no real opportunity to observe [the fellow] teaching since he started the program." Another advisor said that it is still too early to say; however, this advisor believes that he "will have positive feedback in the future." The advisor explained, "When a student is so committed to something, I guess something positive will come out of it."

Teacher focus group results. Teachers in both the Cohort 1 and Cohort 2 focus groups spoke enthusiastically about their fellows' participation in their classrooms. For both cohorts, all teachers described hands-on activities brought to their classrooms by the fellows that initiated excitement and learning in their students. The teachers all reported that the fellows consistently mentioned problem solving and higher order thinking such as hypothesizing during the experiments. Some teachers said they could tell that their students could verbalize what was going on in an experiment better than they could before having the fellow in the classroom. A Cohort 1 teacher stated, "They may not be able to pass it on a test, but they have a better understanding of what's going on in the experiments now." A Cohort 2 teacher remarked, "The students are able to solve problems more." Cohort 1 teachers indicated fellows usually went above and beyond what was in the textbook in all subject areas, including language arts, by relating the lesson back to science and problem solving when appropriate. Cohort 2 teachers indicated the fellows used PowerPoint presentations in their lectures and demonstrations, and they used the internet as a source for research. One Cohort 2 teacher indicated a fellow developed an interactive web page for the students to work on in the computer lab. Another teacher indicated a fellow compiled a list of websites for the students to use over the course of the semester. Cohort 2 teachers said the fellows communicated well with the students. One teacher remarked, "When they talk to the kids, a lot of times they will stoop down and get eye-to-eye with them…and communication is better."

All of the foregoing can be seen as indicators of competency in science-related communication and teaching for both cohorts of fellows. From the teachers' perspectives, there appears to be little difference that could be attributed to one cohort being in elementary school classrooms and the other being in middle schools.

Workshop teacher survey results. Several questions on the survey given to participants after the GK-12 Institute for Teachers addressed development of science related communication and teaching skills of the fellows. The survey results are shown in Table 4, which shows the number and percent of teachers strongly agreeing or agreeing to the statements associated with the seven survey questions that addressed development of science related communication and teaching

skills of project fellows. The only scale categories used by Cohort 1 participating teachers for any of the survey items were "Agree" and "Strongly Agree." The same was true for Cohort 2 on most of the items. One teacher was undecided as to whether fellows were good teachers and whether their knowledge of engineering had increased. The percentage of teachers for Cohort 1 indicating "Strongly Agree" was consistently higher on all items as compared to the responses for Cohort 2.

Table 4. Teacher Workshop Participant Responses to Survey Questions Related to the Teaching and Communication Skills of the GK-12 Fellows

	Cohort 1					Cohort 2				
Survey Item	n	SA	%	A	%	n	SA	%	A	%
1. The engineering Graduate fellows were good teachers	29	19	66	10	34	28	14	50	14	50
2. My knowledge of engineering increased in the workshop	29	19	66	10	34	28	13	46	14	50
3. The engineering Graduate fellows were helpful resource experts	29	25	86	4	14	28	19	68	9	32
4. The activities I participated in were problem-based experiences applicable to science	29	27	93	2	7	28	21	75	7	25
5. The strategies presented in the lessons will promote inquiry and enhance creative and critical thinking	29	28	97	1	3	28	21	75	7	25
6. The workshop improved my ability to teach science	29	21	72	8	28	28	16	57	11	39
7. I would recommend this workshop to other teachers	29	28	97	1	3	28	22	79	6	21

For Cohort 1, about 86% strongly agreed that fellows were helpful resource experts, and a majority (66%) strongly agreed that fellows were good teachers. For Cohort 2 about 68% strongly agreed that fellows were helpful resource experts, and a 50% strongly agreed that fellows were good teachers. Most (72%) of Cohort 1 teachers strongly agreed the workshop improved his/her ability to teach science. For Cohort 2 teachers, 57% strongly agreed the workshop improved his/her ability to teach science.

These evaluation results were from professional educators, which is an indication that after completing the GK-12 program, the fellows from both cohorts had good science-related communication and teaching skills. However there is a hint in the descriptive evidence that perhaps Cohort 1 fellows may have gleaned more from the experience than did Cohort 2 fellows.

Conclusion

The various forms of assessment data collected and analyzed indicate the GK-12 program has had a positive impact on the graduate student participants' development of science related communication and teaching skills for fellows in both cohorts. There is agreement among

fellows, participating teachers, and research advisors that the program has improved the fellows' science related communication and teaching skills. However, there is some evidence in the fellow's survey data and in the teacher workshop data that suggests that perhaps the Cohort 1 experience in the elementary schools may have been more beneficial than the Cohort 2 experience in the middle schools. This finding, however, is not conclusive. One cannot rule out differences in the fellows or participating teachers for the two cohorts as being the reason. Further investigation is certainly warranted.

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