

Retaining Beginner Math Teachers by Empowering Them With Leadership Projects

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Supporting Teacher Retention for Imperial Valley Educators (STRIVE) is a professional development project funded by the Supporting Teachers to Increase Retention (STIR) master grant of the California Mathematics Project (CMP). STRIVE's goals are to improve mathematics content and pedagogical knowledge, leadership skills, and the rate of retention of participating secondary math teachers by providing training and support. We report on the approach taken to increase leadership skills by supporting teacher based projects and their impact on the participating teachers' retention in mathematics teaching.

Introduction

The problem of retention of science and mathematics teachers has received some attention in the education literature, most recently by Ingersoll & May (2010), and Ingersoll & Perda (2010). Qualified mathematics teachers are in short supply throughout the United States. The shortage is particularly severe in areas of high poverty, which have a more difficult time attracting and retaining teachers. This is so despite the fact that the supply of new mathematics teachers is more than enough to make up for those who retire. The problem is that a large number of teachers leave the profession well before their retirement. In fact, the attrition is highest among beginning teachers within the first few years of their teaching careers. Ingersoll & Perda (2010) found that the rate of attrition varies widely from school to school, and that low pay, student discipline problems, lack of individual classroom autonomy, and lack of useful professional development support are some of the biggest factors that increase attrition.

In 2007, the California Mathematics Project (CMP) started the Supporting Teachers to Increase Retention (STIR) initiative to increase the retention of beginning secondary mathematics teachers by providing professional development and support during those critical first years. The master grant funds 10 sites throughout the state. The sites share the common goals of increasing participating teachers' math content and pedagogical knowledge, improving their leadership skills, and ultimately increasing their rate of retention in mathematics teaching; however, the sites take different approaches to serving these goals.

Supporting Teacher Retention for Imperial Valley Educators (STRIVE) is one of these sites. It is based at San Diego State University–Imperial Valley Campus (SDSU-IV), and serves Imperial County, which lies in California's southeastern corner. Year after year, Imperial County ranks at the bottom among California's 58 counties in mathematics achievement on the California Standards Test. One of the poorest areas in the state, the county

stands out with its unemployment rate of 28% and functional illiteracy rate of 42%. Only 15% of adults have four-year college degrees compared to a national average of about 30%. Almost all of the schools are classified as high needs. With little influx of outside talent, there is a perennial shortage of qualified mathematics teachers. Few math teachers hold degrees in mathematics. The majority earn degrees in something else, typically liberal studies, then move into math teaching via alternate pathways, such as passing the California Subject Examinations for Teachers (CSET). The attrition rate among new hires is high, comparable to the national average.

STRIVE provides professional development workshops, summer institutes, and academic year support to participating teachers. In addition to training in math content and related teaching strategies, one of the major components of STRIVE has been the support of teacher-designed leadership projects. These projects grew partly out of our mission to advance participants' leadership skills, and partly out of some of the difficulties faced by the STRIVE project.

STRIVE started operating in the summer of 2007. A little more than a year later, the project was suspended, along with all other grants at SDSU-IV, pending the outcome of an investigation into suspected violations of regulations. The project was finally resurrected approximately seven months later under new leadership. Needless to say, this kind of discontinuity did not help with our primary mission of increasing retention by providing sustained support. By 2010, STRIVE was supposed to start transitioning from grant funding to funding by the local school districts. As California's financial crisis deepened, it became clear that no school district was in a position to step forward with a large sum of money to support the project. STRIVE had lofty but somewhat distant goals, a troubled past, and a difficult time building relationships with school and district administrators, who also seemed to experience major retention problems.

This is how the idea of teacher-based leadership projects was conceived. Starting in the third year of the project (2009), participants were asked to design projects, either individually or in small teams, to advance math education in their communities while improving their leadership skills. STRIVE supported these with modest funding. In year 4, the teachers were asked to approach their administrators for matching funds. The aim was to build motivation and skills to survive in the profession and do meaningful things in lean economic times. Our expectations were as follows:

- teachers would take their own initiatives and engage in doing something they thought would make a difference for themselves and their students;
- teachers would construct new roles for themselves that they saw as valuable and develop a sense of ownership for their positions;
- the projects would make these beginning teachers—and in turn STRIVE—visible and valuable to their administrators; and
- teachers would build improved leadership and grant writing skills.

The Teacher-Driven Projects

To demonstrate the kinds of projects teachers pursued, we will describe three of them in some detail. Other projects not described here included organizing a math competition, engaging in lesson study, assuming the chairmanship of the mathematics department, and building a collaborative website where STRIVE participants could share ideas and teaching materials.

An Online Tool to Prepare Spanish Speaking Students for the High School Exit Exam

Victor Velazquez-Victorica is one of the teachers participating in STRIVE. He used to run a web design business in Mexico before going into teaching. Victor wanted to do something that would allow him to apply his unique experience to the service of mathematics education in the Imperial Valley. He did some research and found that in 2010–2011 in Imperial County:

- 20,924 or 57.44% of Imperial County's K–12 student population of 36,427 spoke Spanish as their native language.⁴
- 13,004 or 62.15% of these students were classified as English learner (EL) students.
- EL students have a passing rate of 62% on the math section of the California High School Exit Exam (CAHSEE) compared to a 95% passing rate for non-EL students.⁵

The mathematics tested on the CAHSEE is not particularly advanced, but the word problems and academic terminology seem to pose a challenge to EL students. While there are many online tools to help students develop math skills, Victor was not aware of any that specifically serve EL students whose native language is Spanish. So he proposed creating CAHSEWeb, an online training site for such students.

CAHSEWeb, which now exists as a bilingual, small-scale demonstration at www.cahseweb.com, presents released items from the CAHSEE in both languages. Users can request help with solving the problem in several steps according to their needs. The goal is to help students increase their scores on the CAHSEE by practicing problem solving and academic language in both English and Spanish. The program guides students in both languages to identify key phrases, organize the information given, and set up solution strategies.

Victor continues to develop the website. Working on the project has benefitted him by allowing him to develop necessary skills for constructing this kind of education technology. He expects that as his software matures, it will help a rapidly growing number of Spanish speaking students throughout the United States. He also hopes that CAHSEWeb will contribute to the retention of other beginning math teachers in demographically similar areas by giving them a tool to be more successful at teaching such educationally disadvantaged students.

⁴<http://dq.cde.ca.gov/dataquest/lc/CountyLC.aspx?Level=County&TheCounty=13+IMPERIAL&cYear=2010-11>

⁵<http://cahsee.cde.ca.gov/ExitProg2.asp?cSelect=13%2CIMPERIAL&cLevel=County&cYear=2010-11&cChoice=ExitProg2&cAdmin=C&tDate=000000&TestType=M&cGrade=10&Pageno=1>

Math Teams at Kennedy Middle School

Marco Arellano is a math teacher at Kennedy Middle School (KMS). This school is in a high-poverty, crime-ridden neighborhood of El Centro, California, which is depressed even by Imperial Valley standards. When Marco started teaching there a few years ago, after-school programs—other than detention—were essentially non-existent.

The Imperial County Office of Education runs an annual math competition each May for the secondary schools in the county. It is a team competition and offers several levels for students enrolled in different math classes. KMS had never had a team; Marco made it his project to start one. He recruited 7th and 8th grade students, who would come to training sessions in the afternoons throughout the spring semester, initially once a week, and then as the competition got closer, more frequently, and eventually every day. The students learned the competition protocol, practiced problems similar to those they could expect at the competition, and developed strategies. Since teams were limited in size, Marco announced the team members shortly before the competition. Indeed, Marco's charisma attracted many more students to the training sessions than could qualify for the team. He established an atmosphere in which students, even ones who were not competitive in math, wanted to participate and aspired to be on the team. Participation in the training no doubt benefitted all of the students.

Marco has now been organizing the math teams for three years. During the first two of those years, he was supported by STRIVE funds. He now runs two teams, in Algebra 1 and 2. This past year, his Algebra 2 team placed second out of 16 teams. Seeing the value of his work, his own school this past year provided funding for a set of graphing calculators, which are used at the competition. These calculators have been integrated into the training.

Financial Math Course at Southwest High School

Monique Garcia and Jose de Jesus Lopez are high school teachers. Monique often teaches math support classes for students who are behind in the curriculum. Her high school district requires that students who have repeatedly failed Algebra 1 take Applied Geometry in the 12th grade to satisfy the district's two-year math requirement for graduation. In Monique's experience, students who failed Algebra 1 did not do better in Applied Geometry; they were not college-bound students. Monique and Jose wanted to offer them a course that would relate the mathematics they have learned over the years to their prospective lives past high school and impress on them the practicality of understanding and using basic mathematics.

Since many of these students come from low-income families, they often lack basic financial management skills. So Monique and Jose chose to design a financial literacy course. They surveyed such courses offered at other California schools and selected a textbook from the standard offerings for such courses. They picked the topics they wanted to cover and developed some teaching materials, such as a curriculum, a pacing guide, and materials related to student projects. Their course covers the basic math skills used in a variety of trades and math that is involved in making responsible decisions about such things as budgeting, retirement savings, property taxes, health insurance, and borrowing. Monique has convinced her

administrators to allow her to teach the financial math course at Southwest High School for the first time in the 2012–2013 academic year. In the meantime, she has submitted a proposal for the course to be offered at Central High School, the other high school in her district, during the following year. It will take time before the impact of this course on the students can be assessed. By pursuing this project, Monique and Jose learned about curriculum design and the process involved in adding new courses to the offerings in their school district.

Research Methods and Results

We collected our research data by asking participants to respond to online surveys. Throughout the project, a number of such surveys were administered. One in particular was devoted to leadership development. It was given a month and a half before the end of the third year of the STRIVE project (April 2010). By this time, all teacher participants were working on leadership projects, and the projects were well underway, although not yet completed. Fifteen of the 16 teachers active in STRIVE at the time responded. Respondents were asked:

1. if they intended to continue teaching mathematics,
2. if they intended to stay at their current schools/districts,
3. what they hoped to be doing in five years,
4. what professional activities/roles/additional education they planned to be involved in, and
5. to provide any comment they wished to share with CMP STIR researchers.

Responses to questions 3 through 5 were in an open format. We analyzed the data collected this way for evidence that STRIVE had achieved the goals as described.

First, we looked at retention. All of the 15 respondents said they wanted to continue teaching math, while 14 (93%) said they planned to stay at their current schools. The open format answers reinforced these answers. Seven of the 15 teachers (47%) linked their intention to stay in their jobs to a positive influence of participating in STRIVE. This is not a large number, but notice that none of the questions on the survey led them to making such a connection. For example, here are two typical responses from two different teachers:

I am very thankful for STRIVE and that there was a vision to help us new math teachers become experienced teachers within 3 years. I know the first year I started I was very confused but eager to learn. I feel very confident stepping in into [sic] any classroom and knowing what to do in order to engage and motivate students. I honestly do not know what kind of math teacher I would be without the program or if I would still be teaching without the support from the presenters from STRIVE. THANK YOU! (in response to question 5).

Strive helps teachers to improve their content knowledge and at the same time provides the tool to survive the first three years of teaching and stay at the school site (in response to question 5).

Next we examined responses for any evidence that teachers took their own initiatives and engaged in doing something they thought made a difference for them and their students.

We found such evidence in the responses of 8 of the 15 of the teachers (53%). Two examples are as follows:

This program has given me tools to continue on my quest for self improvement in mathematics. I am planning to implement some of the strategies acquired to further develop Lesson Study within my math department. If Lesson Study works within our school we will encourage te [sic] our feeder elementary schools to adopt it and we will most likely train them on how to do it (in response to question 5).

I hope to be an integral part of increasing the awarenes [sic] about mathematics and the need to see it as an integral part of the education of all children as a basis to further their abilities in all areas while also improving the learning process of children (in response to question 3).

Then we examined responses for evidence that teachers constructed new roles for themselves that they saw as valuable and developed a sense of ownership for their positions. We found that 12 out of 15 teachers (80%) had such evidence in their responses. Two examples are as follows:

I hope to become an influential teacher to my colleagues and influence the way math in [sic] been taught. [I want to] Continue serving as math department chair or school math coach and spread the word that STRIVE is the best program/training I have attended. I hope every teacher had the chance to experience the program (in response to question 3).

[I will be] having math teams and a math club in any school I am at (in response to question 4).

Even though none of the questions on the survey specifically addressed this subject, 5 of the 15 respondents (33%) hinted that the projects were making these beginning teachers—and in turn STRIVE—visible and valuable to their administrators. None of the teachers wrote explicitly about visibility, but we deduced such visibility from the types of activities they were involved in. Here is one such example:

I'd like to be a Resource Teacher for the math department, or maybe teach at the high school. For sure, I want to be more involved in my school to develop a stronger leadership role and work with the administrators (in response to question 3).

We inferred that being a resource teacher and working with administrators in the future would lead to some visibility.

Finally, we looked for evidence that teachers were building improved leadership and grant writing skills. Twelve of the 15 teachers (80%) showed evidence of improved leadership skills in their responses. We found no evidence for improved grant writing skills, however, none of the questions on the survey asked about grant writing. Thus the lack of responses about grant writing is not surprising and not in itself a negative result. Two examples of comments that display improvement in leadership skills are as follows:

I hope to someday be a math department head. I also would like to continue going to the yearly NCTM conference. I would also like to hold math trainings for other teachers like we had in STRIVE the past few years (in response to question 3).

I plan to use my master's in curriculum together with the [sic] my math background and experience and become either a trainer or a school district curriculum leader (in response to question 3).

Our quantitative results are summarized in the table below.

Table 1: Impact of STRIVE on Participating Teachers

Participants who intend to continue teaching mathematics	15/15 (100%)
Participants who intend to stay at their current schools/districts	14/15 (93%)
Participants who linked retention with STRIVE's positive influence	7/15 (47%)
Participants who took their own initiatives and engaged in doing something they thought made a difference for them and their students	8/15 (53%)
Participants who constructed new roles for themselves that they saw as valuable and developed a sense of ownership for their positions	12/15 (80%)
Participants who became/would likely become more visible and valuable to their administrators	5/15 (30%)
Participants who built improved leadership and grant writing skills	12/15 (80%)

Conclusions

These results suggest that participation in STRIVE had a strong impact on participants' intentions to stay in mathematics teaching. In fact, preliminary results of actual retention (Burt & Tuba, 2012) are consistent with these results. While we certainly hoped for this outcome, the extent of the apparent impact exceeds our expectations. That nearly half of the teachers linked their participation in STRIVE with staying in their jobs without being asked about such a connection is encouraging. The data also show that the leadership projects greatly improved the participating teachers' leadership skills even before the end of the year in which they were introduced. The teachers reported increased involvement in leadership at their schools and engaged in new roles that suggested they were developing a stronger sense of ownership in their jobs. About half of them reported—without specifically being asked about it—that their self-designed projects made a difference for them or their students. We came up short in our expectation that the projects would make these beginning teachers and STRIVE more visible and valuable to schools and district administrators and that they would develop teachers' grant writing skills. However, our analysis here only included the impact of leadership projects in year 3 of the STRIVE grant. In year 4, the projects required submission of a mini-grant proposal, and the review criteria included buy-in from school and district administrators, which may have served as an incentive for teachers to better communicate more closely with their administrators about their projects.

References

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IMRE TUBA was introduced earlier in this monograph.

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VICTOR VELAZQUEZ-VICTORICA is a teacher leader for STRIVE-SDSU (San Diego State University–Imperial Valley Campus) and a substitute teacher and parent liaison at the Calexico Unified School District. He is also developing a bilingual web-based prep test support tool for English learner (EL) students in support of the mathematics CAHSEE test (cahseeweb.com). Victor earned his B.A. in business from the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), in Monterrey, Mexico. He was a marketing professor for the Universidad Autónoma de Baja California, in Mexicali, Mexico, and a researcher for the Ethic's Value Center at ITESM.