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A Model for Community Partnerships in Mathematics

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This article describes a partnership involving a college and its surrounding public high schools in order to offer a model for transforming professional development initiatives into collaborative, reciprocal community engagement opportunities. This ongoing partnership addresses the shared goal of improving the mathematical college readiness of high school students through a three-part program focused on teacher content knowledge. The partnership is based on sustained, open dialogue in which the expertise of all participants, collegiate mathematics professors and high school mathematics teachers, are equally valued and imperative to achieving program outcomes.

The Need for Community Partnerships in Mathematics Education

In 2003, the Department of Education's National Assessment of Adult Literacy found that one third of adult Americans could not compute the difference between two numbers read from a bar graph or calculate the cost of three tickets to an Orioles game. Additionally, only 32% percent were able to correctly calculate the total price a customer should pay when given an order (Greenberg & Jin, 2007). These statistics illuminate persistent deficiencies in mathematics education as American elementary and secondary school students consistently fall below their peers in other first-world nations on standardized examinations (Gonzales et al., 2008; Organisation for Economic Co-operation and Development [OECD], 2010). Shortcomings in mathematics high school education have dramatically amplified the lack of student preparedness for collegiate mathematics. In 2010, only 43% of all ACT-tested high school graduates met the Mathematics Readiness Benchmark (American College Testing Program, 2010). The objective of a high school education must be the preparation of its students for the next stage of life, whether they are enrolling in college or entering the workforce. In this technologically advanced climate, students cannot be successful in either endeavor without strong math skills. In college, this lack of preparation translates into an increased need for remedial mathematics. At our institution, The Richard Stockton College of New Jersey, 28.2% of the incoming freshman class in 2010 required remedial placement for math skills. This percentage is up from 17.6% in 2009 (see Appendix A). These numbers are representative of a continued upward trend in remedially placed mathematics students at our institution.

Learning mathematics does not take place in a vacuum. Topics are cumulative and interrelated. Subjects build significantly on each other, and a strong foundation of knowledge is necessary for achieving success at the next level of study. For too long, colleges and universities have bemoaned the lack of student preparedness, without addressing the need for consistency between high school and college curricula. Lamenting the inadequacies of student preparedness is of no value unless we are able to address the reasons behind why students are not successful learners. This is a question that cannot be answered without the insight and feedback of the teaching professionals who are faced with these issues on a daily basis.

In this article, we describe an ongoing cooperative program between our institution and local high schools that addresses the needs of the students by addressing the needs of the teachers. Our model reflects the value placed in public scholarship on creating new disciplinary and pedagogical knowledge from community interactions, in this case knowledge focused on improving the learning outcomes of high school mathematics students. The main participants in this conversation are the mathematics faculty of Richard Stockton College and the high school teachers of the Greater Egg Harbor Regional School District, but the lessons learned from that conversation have long reaching implications for the students, the institutions involved, and the discipline of mathematics. In order to correctly identify reasons for the lack of student mathematical aptitude and to generate change, this conversation must be ongoing and responsive to the input provided by all educators within the partnership.

Unlike some models wherein collegiate educators bestow knowledge upon school teachers, the model we highlight here serves to establish a collaborative link between the college and community schools, which can better serve the whole by facilitating a discussion that clearly identifies and addresses the needs of the various stakeholders (Booker, Montgomery-Block, Scott, Reyes & Onyewuenyi, 2011; Fitzgerald, Allen, & Roberts, 2010; Rosaen, Foster-Fishman, & Fear, 2002). The intent of the mathematics education program is to create a shared experience in which a mutually beneficial relationship of shared knowledge existed (Fitzgerald et al., 2010; Sandmann 2008; Tett, Crowther, & O'Hara, 2003). We accomplished this by designing a model that integrates the three dimensions of academic life: teaching, research, and service (Kellogg Commission on the Future of State and Land-Grant Universities, 2000; Sandmann, 2008). We set forth to broaden our concept of the faculty role and to merge these often disparate responsibilities into an intentionally cohesive whole, recognizing that the artificial boundaries that compartmentalize this academic triumvirate suppress the natural union that exists between them (Colbeck & Wharton-Michael, 2006). This is particularly true when the research involves

teaching-oriented scholarship. As we sought to both provide a service to the teachers in our community and gain from them knowledge to improve our own teaching practices, we satisfied our service responsibility as educators and gained valuable insights as researchers.

The traditional one-shot workshop model of professional development has been widely criticized by researchers, primarily because such programs lack sufficient contact hours to effect lasting change in participants and are not sustained in the school year with any follow up (Fullan, 1991; Garet et al., 1999; Little, 1993; Yoon et al., 2007). Importantly, another shortcoming in the standard professional development model is the reliance on a one-way dissemination of knowledge (Community Partner Summit Group, 2010; Weerts & Sandmann, 2008). This approach ignores the expertise and experience of the participating teaching professionals (Fear et al., 2001; Williams 1997). Our goal was to change this norm by deepening the mathematical content knowledge of high school teachers through an active exchange of ideas, where all of the stakeholders brought expertise relevant to the discussion of increasing student proficiency. Our program strives to integrate a minimum of 40 instructionally based contact hours throughout the school year, which allows for sustained contact among the educators in the partnership. A partnership that embodies the ideals of public scholarship must provide ample opportunity for conversation among its participants (Foster-Fishman et al., 2006). Therefore, a strong support system and continual instructional conversations are hallmarks of our design. From the early planning stages of our program, we utilized a dialogue between all stakeholders to build a model that fit the needs of the high school teacher participants while addressing the theories espoused by the college mathematics faculty. In direct conversations with the teachers of Greater Egg Harbor Regional School District and as documented in our survey results (Appendix C), our local high school mathematics teachers expressed the need for content support. We responded to this need with a summer workshoFp focused exclusively on content knowledge development.

Partnership Background and Design

Not surprisingly, many researchers have established a positive correlation between teachers' mathematical content knowledge and the mathematical achievement of their students (Ball, 1990; Goldhaber & Brewer, 1997a; Goldhaber & Brewer, 1997b; Monk, 1994; Rowan, Fang-Shen, & Miller, 1997; Wenglinsky, 2000). Given that American students regularly underperform on standardized tests when compared to their international peers, it is fair to question the mathematical background of teachers in the United States (Gonzales et al., 2008; OECD, 2010). Indeed, there is a significant body of research supporting the conclusion that the mathematics teachers in the United States are lacking in mathematical

content knowledge (Ball, 1990; Bryan, 1999; Ma, 1999; Wilburne & Long, 2010), which thereby reveals questions about the instruction those teachers received in college. Against this national backdrop, recent mathematical achievement of local public secondary school students in New Jersey has been at or below state standards (Appendix B; New Jersey Department of Education, n.d.). The documented link between the mathematical knowledge of instructors and the achievement of their students in mathematics courses indicates that combating the mathematical illiteracy of our students must begin by improving the content knowledge of our high school teachers and the pedagogical approaches of the collegiate faculty who work with pre-service mathematics teachers.

An inherent difficulty in addressing the need for improved content knowledge involves defining "mathematical content knowledge" as it applies to teachers. Many reasonable definitions exist for this term. Proficiency in traditional undergraduate mathematics, which we refer to as *discipline content knowledge*, is the form of mathematical knowledge supported by the No Child Left Behind Act. An alternate definition relates content knowledge to the specific mathematics that the instructor teaches (Ball, 1990; Ball, Hill, & Bass, 2005; Bryan, 1999; Ma, 1999; Shulman, 1986). This knowledge base includes the instructor's ability to correctly perform a computation that he or she is presenting, a thorough understanding of why the process is correct, and a repository of alternate representations and mathematical methodologies for the problem. We will refer to this latter form of mathematical content knowledge as *classroom content knowledge*. Finally, content knowledge is often defined in terms of *pedagogical content knowledge* (Ball, Thames, & Phelps, 2008; Hill, Ball, & Schilling, 2008), which is based on understanding how students interact with the material being taught. Pedagogical content knowledge includes understanding of common student conceptions and misconceptions, proficiency in the design of course and lesson plans, and the use of instructional technology. For each of these three types of mathematical knowledge, research supports the conclusion that improving the content knowledge of instructors has a significant positive effect on student learning (Cobb et al., 1991; Darling-Hammond, 2000; Franke, Carpenter, & Levi, 2001; Goldhaber & Brewer, 1997a; Hill, Rowan, & Ball, 2005; Monk, 1994; Rowan et al., 1997; Wenglinsky, 2000). Moreover, programs which blend discipline, classroom and pedagogical content have shown the most success in aiding student achievement (Blank, de las Alas, & Smith, 2007; Cohen & Hill, 1998; Garet et al., 2001; Kennedy, 1998; Loucks-Horsley et al., 2003; Marra et al., 2011;Wei et al., 2009; Weiss & Pasley, 2006). This holistic approach to content knowledge fits well with our collaborative design.

The stakeholders in our partnership possess specific strengths relevant to the various forms of content knowledge, but our expertise is

also limited. As college mathematics faculty, we cannot pretend to know the challenges of the high school classroom, just as the high school mathematics teachers cannot ignore potential gaps within their own knowledge base. We must rely on the joint expertise of the partnership community to progress toward our goal of increased student achievement. Thus, instead of directing a one-way conversation that provides only minimal benefit, we strive to create a partnership environment utilizing the unique strengths of everyone involved. The strength of the college mathematics faculty was most evident in the dissemination of *discipline content knowledge*. Providing teachers with the opportunity to increase their skills relevant to the discipline of mathematics is an important part of our program's philosophy. The implementation of our summer workshops made use of this strength. The high school teachers were experts in the area of *pedagogical content knowledge* as it pertained to their students. The teachers' pedagogical insights provided a better understanding of their daily challenges and had a significant impact on pedagogy and curriculum at both the high school and collegiate level. Working as true partners, the college mathematics faculty and high school teachers together contributed to the definition and discussion of *classroom content knowledge*, which is an important emergent conversation in the scholarship of mathematical pedagogy. Locally, the contributions of all the educators in this partnership helped to make significant progress toward the goal of increased student achievement.

Program Components and Outcomes

Our collaborative program explores mathematical knowledge through three venues: an annual summer workshop, a mini-workshop series throughout the school year, and a Precalculus for College Credit course taught at the local high schools. This program is part of a broader community partnership between the Stockton College mathematics program and the surrounding school districts. The larger partnership includes an annual high school mathematics competition at Stockton College, Stockton Math Club presentations at area schools, and numerous volunteer programs in which Stockton math students work in the capacity of classroom aides and student tutors. This growing relationship reflects the density of the network base that supports our program (Fitzgerald et al., 2010). The strong personal ties created and studied by many stakeholders over the life of the partnership (Stoecker et al., 2003) strengthened the professional ties of our academic interaction in this particular project.

Summer Workshops

Funded by a grant from Stockton College, a successful pilot of the workshop component of our program was instituted in Summer 2011. Three mathematics faculty from Stockton College and 25 high school

teachers from Greater Egg Harbor Regional School District contributed to the six day pilot. Based on the philosophies of the college mathematics faculty and the input of the high school teachers, the pilot focused on the dissemination of discipline content knowledge. Workshop participants were immersed in topics from undergraduate curricula. The college mathematics faculty presented courses on advanced mathematics topics: non-Euclidean Geometry, Abstract Algebra, and Advanced Calculus. The pilot was successful, as demonstrated by the fact that all but two of the participating high school teachers improved their scores on a pre-post content assessment, and all of the educators in the partnership reported benefits from the scholarly interaction. The college mathematics faculty gained a deeper appreciation for the need to place their discipline within the context of classroom content knowledge, and the high school teacher participants indicated that they learned a significant amount of disciplinary content (for the survey results, see Appendix C).

Our community took many lessons from the pilot workshop. In direct conversations and through the post workshop survey, the high school teachers indicated that they would like to see a closer connection between discipline knowledge and the mathematics of their classrooms. Meeting this need is ostensibly a small matter of tweaking the presented content. However, the issue is much deeper than it appears, as it is a fundamental shift in the workshop's mathematical knowledge base from discipline content knowledge to a combination of discipline and high school classroom content. Direct incorporation of classroom content knowledge into the collegiate mathematics curriculum is a vital focus of contemporary research. College faculty alone are not equipped to examine this question. Together with participating high school teachers, we began a thorough investigation of the connections between these two types of mathematical content. As a result of this investigation, the college mathematics faculty have gained insight into the questions and concepts that typically arise in high school classrooms, learning how to view the collegiate curriculum with a more critical eye. The high school teachers learned to place discipline content within the context of their classroom instruction and how their teaching is influenced by their academic background.

The benefits of our collaboration were directly reflected in the content developed for the Summer 2012 workshop. The 2012 workshop consisted of four sessions melding discipline and classroom content.

- "Why is ...?" led by Bradley Forrest. This discussion-oriented session explored group problem solving methods and mathematical facts from Precalculus and Calculus I. The session repeatedly posed the question: "Why is it true?"
- "Student Misconceptions in Precalculus and Calculus" led by

Pamela Kosick. Standard student errors and misconceptions were presented together with a discussion of why these errors are prevalent.

- "Vertical Integration of Mathematics: Elementary through Collegiate Level" led by Judith Vogel. Mathematical themes were explored, building from basic concepts learned in grade-school to advanced topics in college mathematics.
- "Why does Precalculus Exist?" led by Chia-Lin Wu. The role of Precalculus as preparation for Calculus was examined. Common gaps in students' precalculus knowledge were identified by teacher participants, and the effects of those gaps in learning calculus were collaboratively investigated.

This collaboration influenced change in the perception of the college mathematics faculty regarding discipline and classroom mathematics. Previously, our consensus was that discipline and classroom content are separate and distinct topics – with discipline content in the domain of collegiate instruction and classroom content in the domain of high school instruction. This is no longer our consensus, as we now recognize that these sub-fields are inextricably linked. This deeper understanding has allowed us to recognize gaps within the traditional collegiate mathematics curriculum. Our first step in addressing these gaps has been to conduct program-wide assessment in individual core courses and comprehensive assessment using a senior year field exam. Our goal is to determine what subject matter our students are learning in order to improve the connection between discipline and classroom content in our curriculum. Improving our curriculum in this manner will enhance the content knowledge of the next generation of local high school mathematics teachers, which will lead to better prepared students.

The collaborative development of the Summer 2012 workshop also affected the pedagogy of the high school teachers. Mathematics instruction at the college level is firmly grounded in mathematical inquiry, and understanding the rationale that supports the content is of primary importance. This is not the norm for high school courses, which are often focused on presenting procedural skills in formula-based lectures. Through our collaborative exploration of classroom content, the high school teachers learned the importance of the supporting rationale that intertwines discipline and classroom content and were able to utilize the tool of mathematical inquiry within the classroom. This is a fundamental step in raising the level of high school teaching, one that is further emphasized in our Precalculus for College Credit program.

Looking to future years, we propose the implementation of an eight-day summer workshop. The workshop will be organized around

a theme that allows participants to engage in mathematical inquiry. For example, Summer 2012's theme was "Asking Why." Other themes we may use for future workshops include "Prove It!," "Scientific Applications," "Computing," "Math of Today," "Economics," and "Mathematical Modeling." Our aim is to explore the connections between discipline and classroom content in engaging, discussion-driven sessions.

Workshop activities will connect to the state's Core Curriculum Content Standards in mathematics and to the newly adopted Common Core Standards. As per our model, planning each session will involve input from all the stakeholders and careful consideration of the subject matter to be addressed. Together we will determine which points to focus on and how to illustrate their importance within the high school curriculum. Indeed, we cannot succeed in connecting concepts to classrooms without college mathematics faculty providing mathematical expertise and high school teachers sharing their expertise as classroom instructors. To be sure, the dialogue that conceived the program will also sustain the program. In addition to the impromptu discussions that arise in the topic focused sessions, two discussion sessions will be planned. In the first session, the college mathematics faculty will serve as the panel. Discussion will focus on student preparedness and the direction of the current workshop. The dynamic nature of the workshop will be evident as the remainder of the workshop will be based on this discussion.

For the second discussion session, the high school teachers will select representatives to serve on a panel. The panelists will discuss their needs as educators and the needs of their students. The high school teachers will field questions related to content knowledge and teaching practices, providing their expertise to address these topics in a scholarly way. While the focus of these discussions will be on classroom content knowledge, the high school teachers will also field questions related to the teaching environment that they experience on a daily basis. What strategies have succeeded and failed? What limitations are placed on them by administration? What is the aptitude of the students and how does that affect the teachers' abilities to elevate their course content? We are wholly focused on the transference of knowledge between all the stakeholders, whether it is based on content, standards, or best practices. The expertise of all stakeholders is relevant and necessary to the success of the program's design (Fear et al., 2001; Williams, 1997).

To determine if the partnership is achieving its goals, the discipline and classroom content knowledge of the high school teachers will be assessed on the first and last day of the workshop. Whenever possible, we will rely on existing assessment tools which provide measurable data. For example, to assess the discipline content knowledge we will utilize

the Praxis II Mathematics: Content Knowledge exams (a requirement for a teaching certificate in mathematics in New Jersey). The partnership will use data collected from these assessments to direct our focus for future workshops and to guide our discussions throughout the year.

Mini-Workshop Series

As a follow up to the summer workshop, we are pursuing grant funding to plan and implement regularly scheduled mini-workshops to be held throughout the school year. The mini-workshops, which will take place two times per semester at participating high schools, consist of group discussions that are driven by content questions from the high school teachers' classrooms. The mini-workshops will give the educators in the partnership a shared responsibility to develop answers to these classroom content questions through discussion and debate. This open dialogue produces a collegial atmosphere and promotes a mutually beneficial sharing of ideas, a key feature of successful community collaboration (Sandmann, 2008).

The basis for the structure of the mini-workshops is not just about imparting knowledge to the participating high school teachers. Reciprocity of learning and teaching roles is inherent in this model. The college mathematics faculty gain valuable experience relating discipline content knowledge to classroom content, thereby helping to elucidate the underlying relationship between the two. The high school teachers not only learn the specific answers to their content questions but also gain experience engaging in mathematical inquiry within a scholarly community. The expertise of both parties will help advance the scholarly discussion of the proper context for classroom content knowledge within mathematical pedagogy. The mini-workshops provide a forum for adding to this discussion by answering fundamental questions concerning classroom content knowledge. What content knowledge is most useful for the teachers? What kind of support do they require to implement change in the classroom? How can the partnership meet the needs of the teachers and their students? The input and analysis of all the educators in the partnership will provide significant information as an assessment tool. In addition to feedback collected informally throughout the collaborative experience, a survey will be administered to provide the opportunity for a formal response focusing on the usefulness of the mini-workshops.

Precalculus for College Credit

One of the basic tenets of our program is to sustain a support structure for participating college and high school teachers to implement change. This is the focus of the third component of the program. It is of

chief importance to the partnership that the high school teachers have the opportunity and encouragement to execute their skills in a notable way within the classroom. If participating teachers are making investments to elevate their teaching and advance their students' learning, they should be acknowledged and incentivized for the measurable difference in both their teaching and the outcomes of their teaching on student knowledge. As such, Stockton College and the Greater Egg Harbor Regional School District have implemented an initiative among a subset of the participating high school teachers in which students receive college credit for Precalculus taught under their direction. The strong institutional support for this initiative is shared by the Stockton College Provost who, as a member of the statewide College Readiness Taskforce, has a vested interest in the success of the program.

Based on logistical necessity, this component of the program has started small. Of the 25 teachers who took part in the summer workshop, three are currently participating in the course for college credit component of the program. This number is based primarily on the student demand at each high school and the need to pilot this program in a manageable way between several institutions with many levels of administrative oversight. Also, in this endeavor, we have focused on Precalculus. There are several reasons for this choice. Historically, Precalculus is not a college-level math course. However, due to the lack of student preparation for Calculus and beyond, Precalculus has become a part of the college curriculum. For our goal of increased college readiness, Precalculus was the natural choice. It is an entry level course in preparation for college mathematics, and it is housed in both the high school and college curricula. This provides the unique opportunity to learn from each other in the implementation of this course. Our goal was to provide the high school teachers with the tools to elevate their existing course to be comparable to college-level Precalculus, but we have found that the significant exchange of ideas has affected the pedagogy and curriculum of the educators in the partnership. This includes content of the course, style of address, and form of assessment. The teachers in this initiative work closely with college faculty who teach this course on a regular basis. In addition, the department supervisors at the high schools play a vital role in the implementation of this program by overseeing the teachers and facilitating discussion among all participants.

We are currently in the second semester of the implementation of this pilot program, and the exchange of knowledge has been multi-faceted. College math faculty meet with high school supervisors once a month and communicate with them by phone and email as often as necessary. Individual evaluations of teaching are performed on each of the participating teachers to help guarantee conformity in presentation, and the teachers are also invited to observe the classrooms of the college mathematics faculty.

This uniformity of approach has propelled change at both the high school and collegiate level. In creating a program that requires consistency of Precalculus topics, the Stockton Math Program has addressed the need for greater consistency in the college Precalculus curriculum. The reciprocity of ideas has also affected the assessment strategies of the partnership community. Within the Precalculus for College Credit component of our program, tests are now created by the Stockton College math faculty with input from the supervisors and teachers. A rubric for each exam is devised with the input of all the stakeholders to insure a uniform assessment of student skills. Recognizing the importance of uniform assessment tools, the Mathematics Program has devised common examination questions across all sections within our Precalculus, Calculus I, and Calculus II courses. This call for greater consistency in evaluation of skills has also organically increased the consistency of rigor in teaching specific topics.

The partnership conversation includes a continual assessment of the students' needs. Student maturity is a topic revisited often in our discussions. Although it is a straightforward endeavor to elevate the material presented in the course, it is not as easy to elevate the expectations placed on the student. For example, the pool of students participating in this program are accustomed to multiple choice tests and have been taught to rely on a calculator as a learning tool. Learning in a collegiate setting is focused on the process, not the answer; therefore, neither of these tools are appropriate for a college-level course. The concrete learning outcomes for this dialogue have dually affected the high school and collegiate view of calculator use. College mathematics faculty members have re-evaluated the hard-fast rule of "no calculators" in the classroom. We have discovered that there needs to be a weaning process to the removal of the calculator as a safety net. Three of the four of us are now allowing a four-function calculator in our Precalculus and Calculus I courses. In addition, the high school teachers have accepted that their students rely too heavily on calculators, and they now compose exams with separate "no calculator" sections.

Dialogue about student maturity has also broadened the discussion of student preparedness. Collegiate math faculty and high school teachers share the common concern that students do not have the necessary preparation for their respective coursework. Math faculty are responding to the concerns raised by this dialogue with the introduction of two courses which address this deficiency. Intermediate Algebra is a course designed as a prerequisite to the Precalculus course for students lacking the necessary skills to succeed in a college level course, and Middle School Mathematics is a course designed to prepare future middle school teachers for the classroom content they will be teaching.

Conversations and observations among partnership members have

revealed that the formality of language that one uses at the college level for lecture and exams is not the same as at the high school level. For example, several discussions have focused on the mathematical sophistication of various exam questions, and the concern that high school students would not be able to understand the statement of the problem. This led to conversations about whether the students were not capable of understanding the formality of the language, or whether they just had not been taught the mathematical terminology. The specificity of word choice may seem like a small matter to the casual observer, but in a field of precise terminology it is a significant issue. Addressing these concerns and creating a program which illuminates these issues has been a rich outcome of the partnership as we are learning from each other how to better serve the needs of the students.

Students taking Precalculus within the context of this program receive four college credits from Stockton College for the completion of a year-long course. The credits are transferable to any college or university of their choice. As a further incentive, the students receive these credits at a much reduced rate without any fees associated with their non-matriculated status. With the continued support of the administration from all participating institutions, we envision growth of this component of the program in years to come. At the end of this pilot year, we will evaluate the implementation of this program and assess student achievement. We will look at factors like distribution of grades, as well as student and teacher feedback, to determine if we are achieving the goals set out by the program. Our focus will be on growing the program without sacrificing the integrity and reciprocal mission of the program.

Community Partnerships as Scholarship

The planning and implementation of this cooperative experience has united the best parts of scholarship and service within the Stockton Math Program. This project has allowed the mathematics faculty to reflect on the defining characteristics of scholarship within the existing literature and as set by the college's institutional guidelines (New England Resource Center for Higher Education, n.d.; The Richard Stockton College of New Jersey, 2007). The educators in the partnership are a team of professionals engaged in an active exchange of knowledge in which the expertise of all the stakeholders is a relevant and necessary component of the experience. We seek to advance our practice as teachers and researchers as we provide an environment of inquiry related to the design of the program and the expected outcomes. In addition, our work has positioned us to participate in the scholarly discussion of teacher and student preparedness as we relate our experiences through vetted articles and presentations.

With the intent of advancing knowledge, our program is positioned to address the following questions:

- Can a program based in collaborative community partnership improve the general mathematical content knowledge of high school teachers?
- Can a program based in collaborative community partnership improve the mathematical achievement of high school students?
- What new disciplinary and pedagogical knowledge results from collaborative community partnerships as a form of scholarly inquiry?

Our methodology for addressing these questions is framed in the scholarly interaction of high school teachers and college faculty. The shared expertise of the given stakeholders provide the foundation to answer these questions successfully (Fear et al., 2001; Williams, 1997).

This partnership is positioned to add to the scholarly foundations of pedagogical research. Classroom content knowledge as a scholarly endeavor is a concept oft discussed within the current literature (Bryan, 1999; Usiskin, 2001). Many of the pervading views on this topic consider classroom content knowledge as a branch of applied mathematics, emerging from the topics based in the classroom and addressing the needs of the various stakeholders (Usiskin, 2001). The applied nature of this discipline advances a breadth of interdisciplinary topics utilizing the joint expertise of both academics and field-based professionals. Classroom content knowledge has been formally investigated and documented for elementary education (Ball, 1990; Ball et al., 2005; Ball et al., 2008; Hill et al., 2005; Hill et al., 2008; Ma, 1999). However, there is limited comparable documentation of this kind within the literature on secondary education. As such, our work will provide a framework for developing these ideas as they pertain to the high school experience.

The interaction of the teaching professionals in this program has promoted an environment of reciprocity of learning for both the college mathematics faculty and the high school teachers, but the effects of this relationship go beyond the key players. The institutional bases supporting the partnership have also benefited by the association of its members. The work that we are doing contributes to the mission of the college and the school district. It strengthens ties between these two complementary institutions and promotes a positive image of the institutions in the community (Sandmann, 2010). In addition, the students of both institutions have been positively affected both directly and indirectly from the learning outcomes of this association. Change has been observed in the quality of instruction and in the redevelopment of pedagogy. Curriculum has been

modified to align itself with the lessons learned through the partners' active exchange of ideas. These modifications will have an ongoing effect on students at both the high school and college level. The effects of our partnership have also been felt beyond the scope of the original participating institutions as additional school districts have indicated an interest in adding to the conversation. The collaborative base of our partnership is growing due to the strong personal networks that have been established (Stoecker et al., 2003). Through continual community outreach – volunteer programs, math competitions, etc. – other area school districts are joining the discussion and are adding to the resources that will influence positive change (Fitzgerald et al., 2010).

The outcomes of our collaboration hold much potential for scholarly products that add to the current educational literature. The partnership adds to the knowledge of the discipline through investigating classroom content knowledge in the context of discipline content knowledge. The work we are doing enhances educational initiatives directed at teacher and student preparedness and fills a void by addressing these educational trends at the secondary level. One of the authors has contributed a scholarly presentation which highlighted our model of collaboration (Kosick, 2012), and we envision a follow up presentation which will display outcome results from future assessment of the program. In addition, we have recently applied for a grant to provide funding for the full implementation of the partnership model. Generating scholarship is a core vision of our partnership (Fitzgerald, 2000), and we have several forums for accomplishing this mission as the program matures.

Our college's support for the program and the praise that has been attributed to the faculty involved has been a telling affirmation of the value that the institution places on this partnership. The summer pilot program was highlighted in an address given by the Provost to the faculty body at an orientation breakfast. Recognizing the work we are doing within the context of a scholarly initiative has given us a new take on how to serve the needs of the community with a focus on scholarship (Boyer, 1990; Fitzgerald, 2000). Mathematicians often do not recognize their work towards community engagement as scholarship. However, within the context of this successful collaboration, we have gained a deep appreciation for the integration of teaching, research, and service. Indeed, the whole is greater than the sum of its parts (Colbeck & Wharton-Michael, 2006). Our institution's acknowledgment of this work as a scholarly endeavor has provided us with a level of confidence in the value of this professional discovery. Our program has positioned itself to advance the academic discussion of public scholarship at the same time as it exemplifies the benefits of integrating teaching, scholarship, and service in the context of a reciprocal community partnership.

Notes

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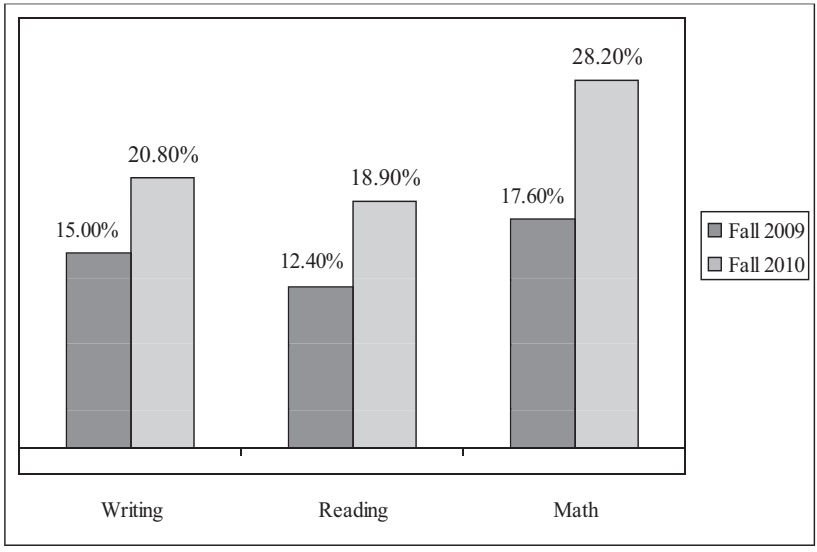
Appendix A: Enrollment Comparison in Basic Skills (BASK) for Fall 2009 and Fall 2010 Incoming Classes

The chart below gives the percentage of students in the incoming classes of Fall 2009 and Fall 2010 enrolled in remedial BASK courses in writing, reading, and mathematics in their first semester at the Richard Stockton College of New Jersey.



The table below shows the number of incoming Fall 2009 and Fall 2010 students that enrolled in BASK courses in their first semester at Stockton College.

	Fall 2009	Fall 2010
Total Students	898	927
Writing	135	193
Reading	111	175
Math	158	261

Appendix B: New Jersey High School Proficiency Assessment Data (HSPA) 2009-2010 Results

The chart below gives the percentage of students who scored in the ranges of Partially Proficient, Proficient, and Advanced on the mathematics portion of the New Jersey HSPA in the 2009-2010 school year for each high school in Atlantic County New Jersey and for the entire state of New Jersey.

	Partial	Proficient	Advanced
State of NJ	18.4	57.9	23.7
Atlantic City	43.6	50.9	5.5
Buena	25.4	66.7	7.9
Egg Harbor Township	14.7	69.0	16.3
Absegami	13.4	65.6	21.1
Oakcrest	24.6	60.7	14.7
Hammonton	15.8	59.8	24.4
Mainland	15.9	60.6	23.5
Pleasantville	58.3	40.8	0.9

Appendix C: Summer 2011 Workshop Survey Results

The table below presents selected results from a survey completed by 22 high school teachers in the 2011 summer pilot workshop. For each statement given in the table, teachers were asked to answer on a scale from 1 to 5 where 5 indicates "agree" and 1 indicates "disagree." The survey was given on the final day of the workshop, July 12, 2011.

Scale	1	2	3	4	5	Average
I learned a great deal in this workshop	0	1	4	11	6	4.00
After completing this workshop I feel more confident about my mathematical knowledge	2	3	5	9	3	3.36
Participating in this workshop will benefit my teaching	0	3	9	8	2	3.41
I am interested in participating in this workshop again covering the same topics	3	2	5	5	7	3.5
I am interested in participating in this workshop again covering different topics	0	0	3	5	14	4.5
I am interested in participating in other programs focusing on college level mathematics	0	1	3	6	12	4.32

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