In April and May 2007, we brought together a group of local mathematics teachers, ten teachers from Brooklyn high schools and four from the New York City College of Technology. Our goal was to engage in a conversation about teaching and assessing mathematics, with a special eye towards the experience of students making the high school / college transition. Among the challenges faced by new college students, perhaps one of the greatest deterrents to success is mathematics. It is our hope that by examining the culture, philosophies and practices in place on both side of ‘the great divide’ between secondary and postsecondary mathematics education, we can better understand the roadblocks and begin to implement change to help our students overcome them.

Our program has its roots in an existing program, Looking Both Ways, which examines the high school / college transition in the area of literacy. Looking Both Ways has provided a successful model of collaborative exploration between high school and college teachers, and the tools and insights developed across eight years of experience have been a great resource in developing our project. Many aspects of our project, including the use of two facilitators from different institutions, the incorporation of classroom visits, and a number of the activities and protocols used in our seminars have been borrowed or adapted from Looking Both Ways.

In the following sections I will discuss the structure of our program, the activities we included, and the questions and conclusions that developed out of our work. What is suggested about our activities in the classroom and our institutional policies? What can we learn about developing future collaborative projects of this nature?

Structure

Our project consisted of three seminar meetings, each three hours, on consecutive Saturdays in April and May 2007. In keeping with the spirit of collaboration between high school and college, the seminars were lead by a team of two facilitators, one from each institution. Our facilitators were Jonas Reitz, a faculty member in the Mathematics Department of the New York City College of Technology, and Kaia Mashariki, Regional Instructional Specialist for Region 10, DOE.

In the seminars themselves, we used a number of activities to structure our conversations. These included reflective writing, readings, and discussion in groups of various sizes. In addition to the seminars, we asked each participant to visit the classroom of one of their fellows. In these ‘intervisitations’ college teachers visited high school classrooms and
vice-versa, recording their observations and reporting back to the group in the following seminar.

**What we did**

We began our first seminar meeting by playing a name game (we borrowed the game ‘Bumpitty Bump Bump’ from Looking Both Ways, but retitled the game ‘a^2 + b^2 = c^2’). This led naturally into a (unplanned) group discussion about learning student names. This was the first of many times that, as facilitators, we were presented with an opportunity to deviate from our agenda by following a thread suggested by the group. While we were aware of the danger of pursuing tangents at the expense of our overall goals, I think that allowing (and at times encouraging) this kind of self-direction helped to give the participants a sense of ownership towards the program, its content and its goals. We then asked our participants to write about their own experiences as math learners, with high school teachers writing about their college experiences and vice versa. In addition to kicking off our investigation of teachers and learners of mathematics, this self-reflection and the subsequent sharing with the group brought a personal aspect to the discussion. Relating our own experiences as students to our current experiences as teachers pushed us to examine our classrooms from a broader perspective, and listening to the stories of our fellow participants helped to build the common trust and understanding that is so important to collaborative work. The ensuing discussion covered many themes that would resurface throughout the program, including high school and college culture, student and teacher expectations, student engagement, and pedagogical methods. Near the end of the session the discussion turned to assessment. Our high school teachers were surprised (shocked) to learn that the CUNY placement exam, the COMPASS ACT test, does not allow calculators. Indeed, this seemed to be such an important discussion point that we once again adapted our plans to allow us to devote the second seminar to examination of assessment and alignment issues (we had intended to spend the second seminar examining student work samples and related pedagogical issues).

In our second session we talked about content alignment through four stages of the high school / college transition, from the high school classroom through the high school exit assessment (Regents exam), to the CUNY entrance assessment (COMPASS ACT) and into the college classroom. We began by taking an in-depth look at the assessment portions, in particular the Regents Math A exam and the PreAlgebra and Algebra sections of the COMPASS ACT test, as these are the minimum assessments that a typical student will undergo. We asked each participant to look at a few sample problems from each exam, identifying and comparing the skills being assessed. For this portion we employed the structured discussion protocol ‘Think/Pair/Square/Share,’ which begins with individual analysis and proceeds through successively larger group work. After sharing the results with the full group, we brainstormed changes that could be made both on the personal and institutional levels to help students make the transition to postsecondary education.
In the third seminar, we spent a great deal of time sharing the results of intervisitations. While we used this as an opportunity to chart observed similarities and differences between college and high school classrooms, this discussion was lively and ranged over a large number of topics. Feedback from the group indicated that the intervisitations were one of the highlights of the program, eye-opening and thought-provoking. Our final activity was an analysis of a short article by Travis Reindl, *Getting Serious About Student Success: High School-College Alignment*, (College and University, Fall 2006). For this discussion we used The Final Word, another protocol borrowed from Looking Both Ways. In this small-group discussion format participants take turns summarizing, commenting, and responding to a piece of text according to strict format of timed rounds. While the formal nature of the discussion took some adjustment and discipline, participants were impressed with the results. The limited speaking time forced you to be clear in your mind about the points you wanted to make, and the turn-based format ensured that the less assertive participants were given equal opportunity for expression. The article provoked strong reactions from participants, who agreed with the basic premise (alignment is an issue that needs to be addressed) but disagreed with many of the proposed solutions. The resulting discussion was heated but productive, and demonstrated the level of comfort and openness that the group had achieved in a short time.

**What we found out**

Here are some of the collected observations and recommendations that have resulted from this program. I will consider two different domains, observations about the process (what did we learn about doing collaborative projects of this type?) and recommendations about the content (high school and college mathematics instruction).

**Observations about the process**

- Many of the lessons learned in the Looking Both Ways program apply to the mathematics setting as well. Of particular note are:
  - the use of co-facilitators
  - the use of intervisitations
  - employing protocols to structure conversations
- The ‘seminar culture’ is of utmost importance, developing a safe space in which these investigations can occur. We were hampered by the short time-frame (recommend more meetings spread out across the semester), but we were helped by the fact that our high school teachers had previous experience in working together as a group (through the TLQP program).
- The use of co-facilitators was key in establishing a sense of egalitarian collaboration. However, our second facilitator was not involved in the early planning, joining the project a few weeks before the first seminar. In addition, personal circumstances prevented our second facilitator from attending the second and third seminars. If possible, the two facilitators should work together from project’s inception and guide the program through design and implementation.
• A more equal proportion of high school and college teachers could have made the discussions more balanced. How can we encourage more college teachers to participate?
• Many students in high school and college are struggling with mathematical concepts first introduced before the high school level. It could be beneficial to include junior high school mathematics teachers in future collaborations.
• Feedback from participants suggested a number of different topics that could be explored in future collaborations. The most common question was “How can I bring the work we do here into my classroom?” Other suggestions include:
  o Compare teaching techniques in high school and college (for the same course level).
  o More intervisitations and active intervisitations, in which the visiting teacher participates in a class rather than simply observing.
  o Discussion of classroom management and discipline issues.
  o Use of technology in the classroom.
  o More in-depth comparison of high school and college math curriculum.

Recommendations to teachers
• In high schools, including some work without the calculator could help students prepare for the college entrance exam. For example, high school classroom work and tests could include a separate section to be completed without the calculator.
• In high schools, include sample questions from the COMPASS ACT exam in lessons and classwork.
• In college students are often expected to be more independent learners. This challenge could be addressed by teachers in both institutions. For example, in high school classrooms teachers could gradually decrease control while problem solving. In colleges, teachers could emphasize the resources available to students and model their use, including textbooks, learning centers, etc.
• In colleges, increasing differentiation of instruction to reach more students.

Recommendations to institutions
• Allow more high school students to experience a college classroom setting before reaching college, for example through participation in College Now.
• More bridge programs between high school and college.
• High school teachers report that many students, especially weaker students, are advised by high school counselors to stop taking mathematics once graduation requirements are complete. Encourage students to keep taking some kind of mathematics beyond Math A and increase elective mathematics offerings. Include more college math content in elective mathematics courses.
• Even students strong in mathematics opt out of taking math in their senior year of high school. One suggestion is to encourage students to take AP courses, by emphasizing the monetary (‘free college credit’) and educational (‘head start on college’) benefits.
Our comparison of Math A vs COMPASS ACT yielded mixed results. While many key skills were present on both exams, participants disagreed about which exams emphasized which skills more (e.g. some thought the Regents exam put greater emphasis on interpreting word problems, others thought the COMPASS exam did). At the very least, a serious investigation of alignment between these assessments is warranted. Special attention should be paid to the role of the calculator.

Quotes

Some selected quotes from our participants.

“We share a problem of student disengagement and apathy. I believe the only way we can overcome this is through course enrichment with manipulatives and historical modules and vignettes and a careful planning of each lesson.”

“A high school lesson lasts 45 minutes and meets five times a week, while the college course meets only twice a week but lasts for an hour and 40 minutes. This requires the college students to digest much more information in one lesson. To absorb the larger quantity of new material, a college student has to be focused and concentrate for a longer period of time. Also, a lot more emphasis is placed on individual study.”

“I got the impression that we are trying to lower the college academic level in mathematics to make every single student succeed with college curriculum. I don’t think it is a good strategy.”

“One of the things I got out of today’s seminar was to see some articulate high school teachers, with all their wisdom gleaned from their years of teaching.”

“I find the sharing out, focusing on similarities and differences between high school and college classrooms very valuable. Knowing other ways of addressing classroom issues gave me ideas about how I could improve student engagement in my classroom.”

“Participation in the program made me more conscious of the kind of activities I use in my class and how these activities could prepare students for college.”

Did participation in the program affect your perception of high school and college mathematics education? “Very much. I learned about gaps between high school and college in math education. I still do not know how to close them.”

“I got a sense of the spectrum of opinion regarding problems we all agree upon, but whose solutions we disagree on.”
“One of the things I got out of today’s seminar was to be reminded that we are still learners, it doesn’t matter if we work in high schools or colleges. We can and should learn from our students, colleagues and friends how to teach more effectively.”

Jonas Reitz
New York City College of Technology
The City University of New York
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