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Academic Peer Instruction (API) Program for Remedial Algebra at LaGuardia Community College

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Abstract

In 2011 and 2012, LaGuardia Community College, City University of New York, conducted a large-scale study by deploying highly selective Academic Peer Instruction (API) tutors in about 20 remedial algebra sections to promote collaborative learning and effective use of technology. The research hypothesis was that API tutors would motivate students to spend more time on studying, utilizing the online learning system called "EDUCO," which in turn would improve their academic performance. We present evidence that the students in the API group consistently show better outcomes in course pass rates and mean exam scores with lower standard deviations, compared to the students in the control group. We also share results of faculty and student surveys, reflecting the promise and challenge of peer instruction.

Introduction

Remedial education in mathematics has long posed a barrier that many students have been unable to surmount. At LaGuardia Community College, about 60% of incoming students are placed into non-credit math remedial courses. From fall 2006 to spring 2008, MAT 096 Elementary Algebra (the second of the two basic skills math courses) enrolled 4,134 students. All sections of MAT 096 use a system called "EDUCO" which has a textbook with online support consisting of three major components: (1) tutorials; (2) homework, and (3) quizzes. The EDUCO online system is also used for administering departmental midterm and final exams. While it is intuitively plausible that students' time-on-task for online material is associated with positive changes in learning outcome, it remains unclear how students actually utilize online materials outside the classroom. In our research, we incorporated the highly effective Academic Peer Instruction (API) program, previously employed for credit-bearing courses, into our MAT 096 course.

API is a peer tutoring program based on Supplemental Instruction, a nationally and internationally recognized program (Martin and Blanc 1981). API provides regularly-scheduled group study sessions for all students in the targeted courses. By encouraging all students to participate, even those already doing well, API removes the psychological stigma students feel when they are told to go for tutoring because they are failing. Since 1993, API has demonstrated at LaGuardia that students who participate in API have earned grades that are, on average, one half to one letter-grade higher than those who did not participate. The quality of peer tutors is assured through (a) a careful recruitment process, (b) a well-designed training regimen, and (c) the support and reinforcement provided by weekly meetings between Professor Joyce Zaritsky, the faculty director of API, Andi Toce, the assistant director, and all the peer tutors.

Our hypothesis is that highly qualified API tutors will motivate students to spend more time studying for MAT 096 and use EDUCO online material more effectively, which in turn will improve their

academic performance. In 2011, under the auspices of the CUNY Improving Mathematics Learning program, 24 out of 49 sections of MAT 096 were assigned an API tutor. The modest but promising outcomes of this study were reported in Wang et al. 2012. In the spring semester of 2012, under an internal funding opportunity, we repeated the study with some modifications. We placed API tutors in 20 out of 55 sections of MAT 096; this paper is primarily concerned with the 2012 study.

Method and Assessment

The key to API program success is careful planning of recruitment and training. Starting the end of October 2010, fliers, posters, memos, and college-wide emails were sent out to encourage qualified students to apply for the position. The principal investigators have been proactive in recruiting potential candidates from the college's Honors Society, and from higher-level math classrooms. We looked for students with a minimum GPA of 3.3 in math-related courses, and preferably those who are familiar with the EDUCO system. As of the end of January 2011, we had prescreened over one hundred students. We selected about 34 for interview, and 15 were hired. For the 2012 cohort, we had a similar but abbreviated process, because there were many returning API tutors.

Before the beginning of the semester, the API tutors must participate in a two-day API Training Workshop. The API tutors were introduced to the API model, covering topics in collaboration, active learning, coaching and facilitating, and the principles of successful learning. During the semester, API tutors attended three out of five class lectures (during the spring 2011 experiment tutors had attended all five class lectures) and helped students. They also attended the computer lab hour to assist the professor and facilitated the session. Furthermore, API tutors led the weekly scheduled tutoring hour in the new computer lab. They also scheduled at least three tutoring sessions to help students further practice and discuss class material. (During the 2011 experiment tutors provided two hours a week of additional tutoring.) During both semesters, API tutors met every week with the director and assistant director to share their progress and continue training. Principal investigators met with full-time and adjunct faculty at least once per month, to discuss effective ways to work with API tutors.

We relied on several sources of data to evaluate the effectiveness of our program. The EDUCO Company provided us with data for time-on-task for online tutorials. We also examined mean scores on three departmental exams and the raw final grade distribution in the course. LaGuardia's Institutional Research Office (IR) performed an analysis of pass rates and grade distribution. Routine data gathered as part of the API program included weekly student attendance at API tutoring sessions, end-of-semester faculty survey, and end-of-semester student evaluation of the API. We also designed a special questionnaire for the API-EDUCO group.

Intended Outcomes and Results

As detailed in Wang et al. 2012, we had a modest gain when we first attempted this approach. The overall pass rate for the API group was 2.3% greater than the control group in 2011. In 2012, we programed the EDUCO software to mandate a 30-minute online tutorial session before students could open each of the lab assignments. Our intervention was to compel students to learn, not simply to complete tasks. We intended to achieve a more substantial gain in learning outcome, as measured by pass rate and other assessment scores, than the previous year. To further strengthen support for students, we also added an additional tutorial hour (from 2 hours in 2011 to 3 hours in 2012, instead requiring our tutors to attend only 3 hours a week of lecture instead of all five hours).

According to the analysis performed by the IR, the pass rate for the API group was 66.9%, and that for the control group was 60.2%. With a total of about 1,400 students, it is a statistically significant gain (with a *p*-value of 0.01). Many studies suggest that grades C- or above represent a better indicator for students' long-term success. In terms of grades C- or above, the API group outperformed the control group by 8% (46.2% vs. 38.2%). A chi-square test of association between grade (C- or better, lower than C-) and treatment type (API or Control) reveals a statistically significant *p*-value of 0.004.

Table 1. Comparison of API group vs. Control group

	API	Control
Sample size	472	916
Tutorial Time Mean	**15 h 20 m**	**4 h 49 m**
Tutorial Time Median	**8 h 12 m**	**0 h 2 m**
Exam 1 Mean	58.19	57.42
Exam 1 Median	64.09	60.00
Exam 2 Mean	62.25	61.76
Exam 2 Median	73.33	73.33
Final Mean	55.97	51.77
Final Median	63.34	60.00
Final Standard Deviation	30.06	31.76
Final Standard Error	1.34	1.05
Pass Rate	**66.93%**	**60.18%**
C- or Better	**46.18%**	**38.23%**

Table 1 also shows that the API group consistently did better in all the departmental exams. The difference in the final exam mean between the API and control groups is statistically significant, with a *p*-value of 0.008. There is a drastic difference in tutorial time between the API group and the control group: the mean time for the API group is 15 h 20 m, and that for the control group is 4 h 49 m. In terms of the tutorial time median, it is 8 h 12 m for the API group, and merely 2 minutes for the control group. The API tutors definitely made a difference. It is highly suggestive that effective use of online tutorial contributes to math learning.

Consistent with the historical API records, the grade difference (using the GPA formula) between students who attended 3 or more sessions (modeled after the nationally recognized Supplemental Instruction program) and students who attended 2 or fewer sessions is +1.02, though this gain is uneven among sections as indicated by the rather large standard deviation, 0.90.

Participating instructors were overwhelmingly enthusiastic about the idea of using API tutors to promote EDUCO usage, and were greatly impressed by the quality of the API tutors. One professor wrote:

> *I wanted to tell you that I am very happy with the results of the program. My API this term was extremely helpful and he did an excellent job with the students. I can honestly tell you that I was able to see the improvement in the performance of many of my students, who after doing very poorly at the beginning of the semester, kept improving and did very well in the class in the end.*

This is a typical response from our faculty survey.

On the other hand, a persistent faculty sentiment was that student indifference, along with external factors such as students' family and work responsibilities, remain the greatest obstacles to students' success. Some students viewed the mandatory 30-minute tutorial as burdensome, and some gave up the lab credit entirely. Fortunately, they represented a small minority. With the above result, hopefully future students will understand the benefit of the tutorial and become more cooperative.

Student feedback was overall, very positive. Some representative comments include: "It was great to have a tutor in the class together with the teacher," "If I had a problem I could call [Mr. X] or send him an email and get a speedy response. His sessions were very helpful and important to me." "Attending API sessions has helped me to pass MAT 096." The most common issue that students raised was scheduling, as some students indicated that their family and job responsibilities prevented them from attending the API sessions. However, most students acknowledged that API tutors did their best to accommodate students' various needs.

Conclusions

In our 2012 study, we have convincingly demonstrated that API tutors are highly effective in promoting studying mathematics utilizing the EDUCO online tutorial. As a result, students in the API group consistently outperformed those in the control group. As shown in Table 1, there is a large discrepancy between the mean and median in tutorial time for both API and control groups, meaning that a few students spent a tremendous amount of time on tutorials while most students spent little time on it. Nevertheless, the API group is far less skewed than the control group.

Comparing with the 2011 results, we attribute the more significant gain in 2012 to the mandatory use of online tutorial. It is natural that students tend to focus on the imminent task of completing homework assignments, and they often do so before they fully comprehend the underlying principles. By forcing students to use a tutorial before graded tasks such as homework and quizzes in the API group, we proposed that their learning would be more robust and sustainable. The outcomes summarized in Table 1, particularly the statistically significant difference in the departmental final exam between the API and control groups, support our conjecture.

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References

EDUCO Learning System, https://www.educosoft.com.

Martin, D. C., & Blanc, R. A. (1981). The learning center's role in retention: Integrating student support services with departmental instruction. *Journal of Developmental and Remedial Education*, *4*, 3, 2-4, 21-23.

Wang, F., Betne, P., Dedlovskaya, M., & Zaritsky, J. (2012). Improving mathematics learning at LaGuardia. In A. W. Logue & M. Watanabe-Rose (Eds.), *Improving Undergraduate Mathematics Learning: Nine Research Reports by Faculty at The City University of New York* (pp. 61-67). New York: CUNY Office of Academic Affairs.

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