Developing an Early-Alert System to Promote Student Visits to Tutor Center

Qijie Cai, Carrie L. Lewis, and Jude Higdon
Minnesota State University, Mankato

Abstract

An early-alert system (MavCLASS) was developed and piloted in a large gateway math class with 611 freshman students to identify academically at-risk students and provide alert messages. It was found that there was significant association between the alert messages students received and their visits to the university's tutor center. Further, the achievement of students who visited the tutor center was improving over the semester. Evidence from the study suggests that an early-alert system focused on personalized feedback from instructional staff correlates with the help-seeking behaviors of at-risk students in large gateway classes.

Keywords: early alert; tutor center; large gateway course; math

Large classes of between 100 and 1000 have become common in higher education (Smith et al., 2005). Literature shows that large classes present many challenges to teaching and learning, including poor student engagement and low satisfaction (Gibbs, 1992). To address these challenges, much of the literature focuses on adapting the instruction mode from content-centered lectures to learner-centered activities. While effective classroom activities are critical, it seems self-evident that learning is optimized when students are also engaged in positive learning behaviors outside of the classroom, such as seeking help from the tutor centers. It is especially important for students from large courses to use the tutor centers, because the opportunities they get help directly from the instructor are so limited due to the

Qijie Cai | Minnesota State University, Mankato | qijie.cai@mnsu.edu

large class size.

However, at our university, there was no formal mechanism to motivate students to seek help from the tutor center, Center for Academic Success (CAS). Additionally, there was no systematic process to track and assess the effects of CAS on student performance.

To address the above challenges, we developed an early-alert system, called Maverick Comprehensive Learning Analytics Support System (MavCLASS), to encourage students to visit CAS. The MavCLASS project was just piloted in a large-cohort gateway class: Math 098 Intermediate Algebra. The purpose of this study is to explore the patterns of student visits to CAS under the MavCLASS intervention and assess the relationship between the tutoring services provided by CAS and student performance in Math 098.

Interventions to Increase Tutor Center Use

Academic Tutor Centers are one method of improving student achievement and retention rates (Thompson, 2007). These centers often operate on an as-requested basis, where the onus is on the student to initiate contact. There are many factors associated with students' willingness to seek help from the tutor center, including students' motivation, self-esteem, and self-efficacy (Karabenick & Knapp, 1991), as well as many environmental factors (Lee, 2007).

Bosco (2012) suggests that interventions designed to increase the frequency with which students seek help should begin early, follow up with students at several points in the semester, and dialog about specific challenges and strategies relevant to the students. Bosco's argument echoes with the perspective that personalized help could be effective ways to increase graduation and retention rates among college students (Capaldi, Lombardi, & Yellen, 2006).

The emerging "big data" and analytics technologies in higher education have provided new tools for developing personalized advising interventions. Student data can potentially inform university staff and faculty on students' performance and provide students a mechanism by which they could involve themselves in developing more positive learning behaviors, such as seeking help from the tutor center (Hrabowski III, Suess, & Fritz, 2011). Dringus (2012) suggests that student data must be "measurable, visible and transparent" if it is to be valuable in informing academic interventions (p. 98). This

maps to broader theories of feedback and feedback interventions, which emphasize, among other things, that feedback must be seen by the recipient to be "legitimate, trustworthy, knowledgeable, and likeable" (Pintrich & Schunk, 2002, p. 168).

Given this background, we felt that a successful early-alert system would have to include components that provide ongoing, personalized feedback about student performance. Additionally, it would need to suggest clear actionable items so that students understand what to do to improve their performance.

The Maverick Comprehensive Learning Analytics System (MavCLASS)

The MavCLASS project was piloted in the course Math 098 Intermediate Algebra in Fall 2013. The goal was to create a system to allow faculty and graduate assistants (GAs) to view students' performance in greater detail and develop personalized feedback to encourage learners to seek help from CAS for course improvement. The project had three components: standard-based formative assessments, data dashboards, and personalized alert messages.

When designing the course, the instructor worked with an instructional designer to create weekly standards students were expected to achieve, and then organize the course content and assessments around these standards. With this approach, each assessment (e.g., homework, quiz, test) was associated with a few specific course standards so that faculty and GAs could quickly identify the specific standards students needed to work on.

The data dashboard worked across two assessment systems, including the university's Learning Management System (LMS) that provided exam and class participation scores and a publisher system that managed assignments and quizzes (Cengage's WebAssign). These data were cleaned, analyzed and displayed in colors of green, yellow, or red for the instructor and GAs to review. The colors were determined based on algorithms defined by the instructor to reflect student assessment achievement levels. Students who got the yellow and red colors were identified as in the cautionary and danger of failing and would receive alert messages from the GAs of the course.

The alert messages were sent out to students within 1 week after the assessment scores were published on their dashboards.

The message began from a standardized script: It told students their current status on the assessments and encouraged them to seek help from CAS. The GAs were then instructed to manually customize the alert messages and send them out to students. Since each assessment was associated with a few specific standards, by looking at the dashboard, the GAs could quickly identify the course standards the student was struggling with, and therefore, they could explicitly point out to students the associated learning materials they should work on, including the lecture notes, textbook chapters and exercises. In the alert message, the students were instructed to bring these suggested learning materials to CAS so that there was a clear focus during the tutoring sessions.

Research questions

This study aims to answer the following questions:

1. Under the MavCLASS intervention, is there any pattern of student visits to CAS?
2. Is there any relationship between the alerts and students' visits to CAS?
3. Is there any relationship between the student visits to CAS and their achievement?

Methods

Data Collection

Three types of data were collected from the 611 students who took Math 098 in Fall 2013: the alert message data, the student achievement data, and the CAS visit data. The alert message data were collected through MavCLASS. In Math 098, students who performed below the standards on any assignment, quiz or exam would be considered as at-risk students. Their scores on these assessments would be displayed in yellow or red and the alert messages were sent out to these students. We reviewed the scores for all types of assessments in MavCLASS to identify the recipients of the alert messages, as well as the dates when the alerts were sent out.

The student achievement was mainly measured by the four high-stake exams in this course. Students took these exams at Week 5, Week 9, Week 13, and Week 16 of the semester. Student performance data on the four exams were retrieved from MavCLASS.

The CAS visit data were collected at the end of the semester.

The data identified the students who visited CAS for Math 098 in Fall 2013 and the time and date of their visits.

Data Analysis

The data analysis process included the following steps. First, relationships were established among the three sets of raw data based on the student identification information. Data was subsequently anonymized and rescaled by converting the student assessment scores to the accuracy rate (i.e., the total of points earned divided by the total of points possible). Microsoft Excel Version 14.4.1 and IBM SPSS Statistics 20 were used to conduct various descriptive analyses and t test.

Results

Research Question 1: Patterns of CAS Visits

Figure 1 shows that 478 students (78.2%) from Math 098 received alert messages. This means that these students did not meet the standards on at least one assessment of the course and were encouraged to visit CAS to seek help. Among these students, 81 visited CAS, but 397 did not. 133 students (21.8%) received no alert messages throughout the semester, suggesting that they performed above the standards on every assessment. Twelve of these higher-performing students still visited CAS, even if they were never prompted to do so by MavCLASS.

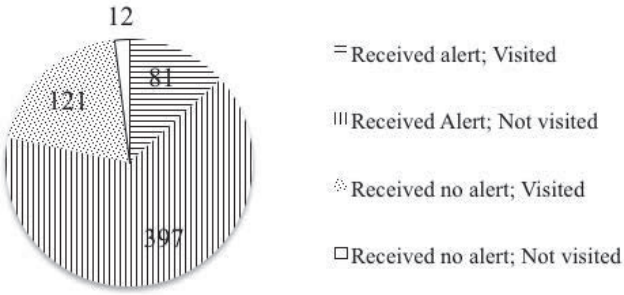

Figure 1. MavCLASS students divided into four groups.

Figure 2 shows the distribution of the students' CAS visits in Fall 2013. From Week 6 to Week 9, when the students took the first

and second high-stake exams, 581 alert messages were sent out and there were 145 visits to CAS, representing 45% of the total visits throughout the semester. Between Week 10 and Week 13, 598 alert messages were sent. In contrast, only 38 CAS visits occurred during that time, representing 11.7% of the total visits.

This pattern indicates that the students were much more engaged in help-seeking in the second quarter of the semester (i.e., between Week 6 and Week 9). Despite the increase in the number of alert messages in next four weeks, the students did not visit CAS as much as they did prior to Week 9. This finding is consistent with previous research (Bevitt, Baldwin, & Calvert, 2010), which has confirmed that early assessments and interventions (e.g., alert messages) are effective methods of engaging students in positive learning behaviors, such as seeking help from the tutor centers.

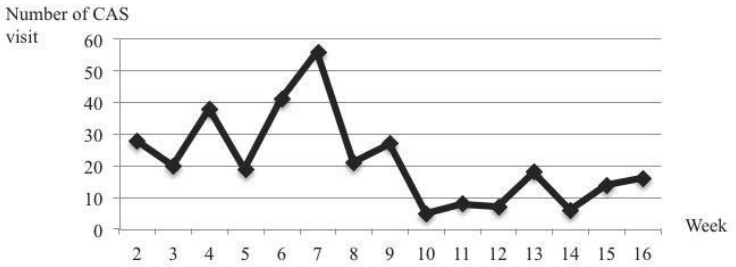

Figure 2. Number of CAS visits by week.

Research Question 2: Relationship between MavCLASS and CAS Visits

A t-test was conducted between students who received alert messages and students who did not receive any alert to determine whether there is any difference in their visits to CAS. Table 1 indicates that the difference between the two groups is significant ($p<.01$). Because the students received the alerts when they failed to meet the standards on at least one assessment, the t test results could be interpreted in at least two ways. First, the students with lower assessment outcomes tend to visit CAS more often. Second, the students receiving the alerts are more likely to visit CAS. Admittedly, based on the current data, it is premature to determine any causal relationship between the alerts and the students' visits to CAS. But these findings are consistent with the notion that even the simple

notification interventions (e.g., letting students know their assessment grades) may lead to positive changes in student learning behaviors (Jayaprakash, Moddy, Lauria, Regan, & Baron, 2014).

Table 1

t Test between Students Who Received Alerts and Students Who Did Not

		F	Sig.	t	df	Sig. (2-tailed)
Number of CAS Visits	Equal Variances assumed	15.106	.000	2.169	609	.031*
	Equal Variances not assumed			3.101	436.991	.002**

Note. *p<.05, two-tailed. **p<.01, two-tailed

Research Question 3: Relationship between CAS Visits and Achievement

In Math 098, the students took four high-stake exams throughout the semester. Student achievement on these exams was compared between two groups. Group 1 consists of 518 students who did not visit CAS. Group 2 includes 93 students who visited the tutor center.

Figure 3 shows that, the Group 1 students achieved nearly 70% of accuracy rate on Exam 1, but their performance was continuously declining on the subsequent exams. For the Group 2 students, their average accuracy rate was about 63% on Exam 1, but slightly increased to nearly 65% on Exam 2. After that, their accuracy rate decreased to 64% on Exam 3 and to 57% on the final exam.

Generally, Group 1 had better performance than Group 2 on these exams. However, the achievement gap, as reflected by the difference in the average accuracy rate between the two groups, was nearly 8% on Exam 1, but was getting closer and closer. Eventually, the two groups had about the same performance on the final exam. The t test shows that the difference between the two groups was significant ($p < .005$) on Exam 1 but no significant between-group difference was detected on the other exams. The diminishing trend

of the achievement gap is more clearly reflected in Figure 4, which presents the students' z scores. On the first exam, the gap between the two groups was about .33 standard deviation (SD). But the gap was getting much closer on the following exams and got to less than .03SD on the final exam.

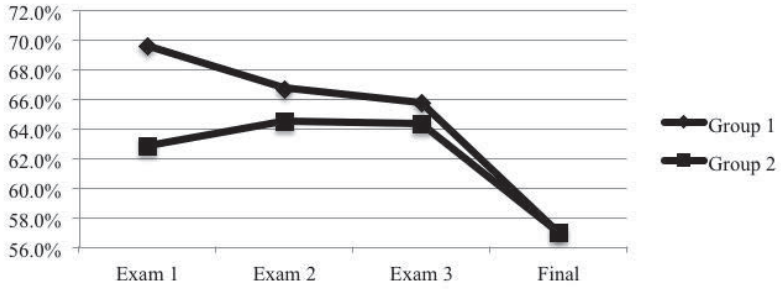

Figure 3. Average accuracy rates of Group 1 and Group 2 students.

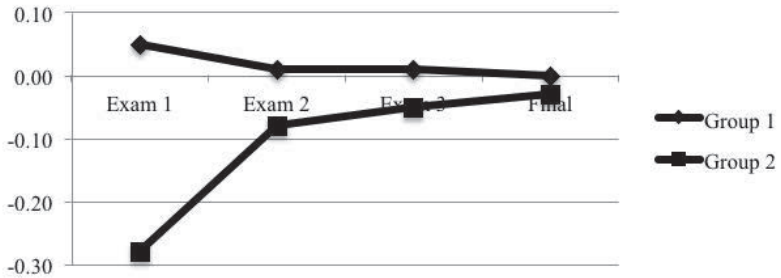

Figure 4. z scores of Group 1 and Group 2 students.

The two groups of students were further divided into four subgroups based on whether they received any alert messages. As mentioned earlier, students who never received any alert passed all the course assessments, and therefore, were considered higher-performing students. Students who received the alert messages failed at least one assessment, and were identified as lower-performing students. As the Figure 5 suggests, among the higher-performing groups, students who visited CAS generally had higher achievement than those who did not and their final exam scores were increased from the earlier exams. In contrast, the performance of higher-performing students who did not visit CAS was decreasing across the four exams.

A similar pattern was found for the lower-performing groups. Students who visited CAS were more than .4SD below the class's average level on the first exam, but they were making improvements and increased their achievement by over .2SD at the end of the semester. However, the other subgroup, the lower-performing students who did not visit the center, did not make any progress. Their performance was around .2SD below the average level for each of the exams over the semester.

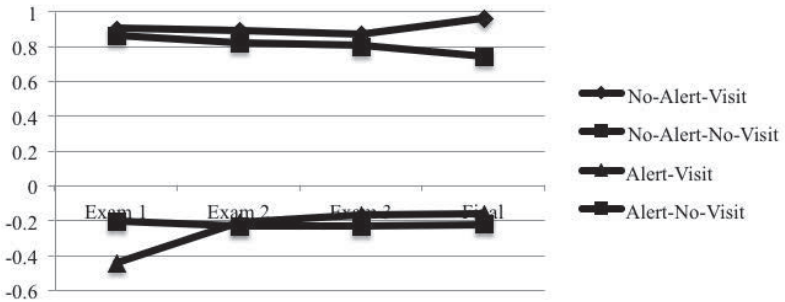

Figure 5. z scores of four subgroups of students.

Discussion

Results from this study, along with the previous studies (Bevitt, Baldwin, & Calvert, 2010; Colby, 2004), indicate that it is important to provide students with meaningful assessments and feedback early in the semester in order to encourage their use of tutor center for academic improvement. As Pistilli and Arnold (2010) point out, often students do not understand how well they are performing in a class until it is too late to make any positive changes.

This study also suggests that early interventions have the potential to positively impact student academic performance through increasing help-seeking behaviors. In this study, the early-alert system seems positively associated with the student visits to CAS. This finding is consistent with the work at Purdue University, which shows that the use of relatively simple notification can have a significant impact on student behaviors which can lead to improved achievement (Jayaprakash, Moddy, Lauria, Regan, & Baron, 2014).

Another contribution of the study is that it has built connections between the students and the tutor center at the university.

Many institutions provide services tailored to their student needs, such as various tutoring sessions. Unfortunately, these services are often underused by students who could benefit from them the most (Tinto, 2012). The intervention piloted in this study has the potential to address this issue by identifying the academically at-risk students and sending alert messages on an ongoing basis to connect the tutor center with those students.

Additionally, the personalized alert messages received by students could potentially drive the content of these tutoring sessions, making them more productive and manageable, particularly for those students in large gateway classes. The rise in achievement for those students who sought help from CAS would seem to indicate that, in general, students who seek help from CAS are able to improve their academic achievement.

Limitations

As with any study, limitations existed with this study. Due to the unavailability of the CAS visit data from the previous years, the causal effects of MavCLASS were unable to be determined. Since CAS does not have any records before Fall 2013, it is not yet possible to track the students' CAS visits over time to see whether there is any difference before and after the MavCLASS implementation.

Another limitation of the study is that only 15.2% of students sought help from CAS for their math course, but the current data cannot help us understand why the majority of students did not visit CAS. Researchers find that, students' psychological constructs, such as self-efficacy (Ryan & Pintrich, 1997) and goal orientations (Newman, 1998) may play a role in their help-seeking behaviors. These factors will need to be considered in the next phase of the project so as to design effective interventions. For example, we could send customized feedback messages that match students' goal orientations to better motivate the students to use the tutor center.

Conclusion

In this study, we piloted the MavCLASS intervention in a large gateway course. MavCLASS functioned as a systematic mechanism that established direct connections between the students and the tutor center (i.e., CAS) at the university. Additionally, the study generated empirical evidence regarding the pattern of the student visits

to CAS across the semester and the relationship between the student achievement and their CAS visits. As discussed above, the findings echoed with previous studies and provided implications for the design and implementation of feedback interventions that increase the visits to the tutor center.

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