THE EFFECTS OF CONDITIONAL RELEASE OF COURSE MATERIALS ON STUDENT PERFORMANCE

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Abstract

Learning management systems have a variety of options to control the release of course content based on specific criteria. Following best practice recommendations, we evaluated the effects of conditional release (CR) on underprepared student performance in essentials and college algebra mathematics courses. Results indicated that students in courses with CR and without CR were similar in their course grades. However, students who completed the essentials course online earned higher semester average grades with CR than without CR, whereas students who completed the course face-to-face earned higher semester average grades without CR than with CR. We discuss the implications of these results for future research on CR and its implementation.

Keywords: Conditional release, scaffolding, underprepared students, online pedagogy, content mastery

For years, educators have seen value in students mastering material before moving on to new material. As early as 1912, the psychologist E. L. Thorndike (1973) described this

concept as a book in which pages could not be turned until previous work had been completed. Another way to consider this concept is through developing a scaffold, or framework, to mediate students' navigation through layers of course content (Hammonds & Gibbons, 2001). Today, technology provides a means of facilitating this level of control by using conditional release of course material through a learning management system.

Conditional release refers to the process by which course content is made available to students in a controlled manner. Many learning management systems provide conditional (also called "selective" or "adaptive") release as an option in the development of a course. As this option has become more available, educators find themselves attempting to implement this feature with little guidance. In an effort to provide needed direction for the use of this tool, Gardner, Fisher, Brinthaupt, and Raffo (2011) proposed six best practice recommendations for using conditional release:

- *Conditions for release should be reasonable and realistic*. They recommended setting achievement-based release at the minimum level for passing.
- *Conditional release is best used with activities or assignments that lead to the mastery of course content.* Teachers may need to allow students to repeat assignments until the release condition is met.
- *Conditional release is best used when course content progresses linearly or builds on itself.* If there is a specific sequence that is required for students to progress through the course, then teachers and students can benefit from the effective use of conditional release.
- *Reasons for using conditional release and for using specific release criteria must be transparent and clearly communicated to students.* Teachers should explain to students that mastery of content will be necessary for success later in the course.
- *Teachers who use conditional release need to be flexible.* Teachers may need to alter or adjust both the conditions and the deadlines as the course progresses to avoid creating impenetrable barriers for students.

- *Conditional release is best used with caution*. It is recommended that conditional release be targeted toward critical tasks for ensuring mastery of course content.

In an initial assessment of these conditional release (CR) best practice recommendations, those same authors (Fisher, Gardner, Brinthaupt, & Raffo, 2014) examined the relationship of CR usage to students' perceptions. They found good support for the recommendations, with students reporting favorable evaluations of and positive experiences with CR. In addition, students with lower overall grades reported being more engaged in courses with CR compared to those with higher overall grades. However, Fisher et al. (2014) did not examine how CR related to actual performance in the course, nor did they compare the presence or absence of CR in a controlled experimental study. Thus, while at least some students report finding it to be helpful, we do not know whether their objective performance in the course is positively affected by the implementation of CR. This is an important question to address so that some of the parameters (and potential limitations) of CR use can be identified.

Guided by the Gardner et al. (2011) best practice recommendations and the Fisher et al. (2014) findings, the purpose of the present study was to evaluate the results of using CR in undergraduate entry-level mathematics courses, using a controlled experimental design. Low success rates in entry-level mathematics courses can be a major stumbling block because they are both a gateway to many majors or are necessary to meet a general education requirement. In mathematics, providing structure, or scaffolding, is particularly important to support student success (Thiel, Peterman, & Brown, 2008). Yet much of the research on scaffolding (Gupta, Harris, Carrier, & Caron, 2006) has come from disciplines other than mathematics. Means, Toyoma, Murphy, Bakia, and Jones (2009) make the case for a systematic examination of the differential effects of scaffolds for diverse groups of learners.

In the present study, we collected data from students enrolled in twelve sections of online and face-to-face (F2F) mathematics courses for elective and general education credit over a two-year period. Half of the courses were designed without the use of CR, while the

other half were designed using CR. Because of CR's scaffolding features and its emphasis on ensuring mastery of course content before progressing to later material (Gardner et al. 2011; Hammond & Gibbons, 2001), we predicted that courses with CR would be associated with superior student success (e.g., higher exam scores and final course averages) compared to courses without CR.

We also expected that CR would be more effective for online compared to F2F courses, given that many features of CR are easier to implement and control in an online than in a F2F format (Gardner et al., 2011; Hall & Williams, 2012). Finally, we predicted that CR would be more effective for the more underprepared students, since there is some evidence that CR is more successful for students with lower grades or more difficulty with the course content than those with higher grades or less difficulty (Fisher et al., 2014; Tuckman, 2007).

Method

Participants. Participants were 215 undergraduate students (134 women, 81 men) who enrolled in either an essentials of mathematics course for elective credit or a college algebra course for general education credit with one of the authors as the instructor. Both courses were designed for underprepared students. We obtained IRB approval for the study prior to data collection.

Courses Used in the Study. Both courses were mathematics courses for underprepared students and all of the courses and sections used in this study were developed and taught by the same instructor. The courses used Pearson Education's MyMathLab educational software program, which includes online interactive homework and assessments. Each course also included approximately 100 instructional videos created by the developer. One class was an essentials of mathematics course taken by students who had ACT mathematics subscores of 14 or below. This course was offered in both the online and F2F delivery modes. Each class included 41 homework assignments and five exams. Both the online and F2F students also completed a standardized,

comprehensive departmental final exam. Online students were required to take this exam in a proctored environment approved by the instructor.

The college algebra course for general education credit was taken by students with ACT mathematics subscores of 17 or 18. All of the sections of this course were offered in an online delivery mode. This course included 29 homework assignments, five online exams, and two proctored exams. One of the proctored exams was a comprehensive departmental final exam taken by all college algebra students.

A total of 148 students (91 women, 57 men) enrolled in sections of the essentials course taught in the F2F format. The online sections of this course included 78 students (57 women, 21 men). There were 67 students (43 women, 24 men) enrolled in the online college algebra course.

Design. The study included eight sections (four online, four F2F) of the essentials mathematics course. Of the four F2F courses, we randomly assigned two to use CR and two to be taught without CR. For the online sections, two used CR and two did not use CR (randomly assigned). With the online college algebra course, we randomly assigned two sections to be taught using CR and two to be taught without CR.

The design therefore consisted of three factors. There were two levels of the CR variable (present/absent), two course delivery formats (online/F2F), and two kinds of courses (essentials math/college algebra). The major dependent variables included the percentage of students who completed the course requirements, the average score for the homework assignments, the final exam score, and the overall semester average (the combination of the homework, exams, and final exam scores). Semester averages were computed only for those students who completed the course (i.e., who completed all of the course requirements).

Conditional Release Procedure. Both courses progress linearly and build on previous material throughout the academic term and were therefore considered good candidate courses to test CR effects. In both courses, homework was designed to be an activity that

led to mastery of material and included a release condition. Using the best practice recommendations outlined by Gardner et al. (2011), the release conditions were set in MyMathLab at the minimum passing level for both courses. In the essentials course, the minimum passing level was 70%. In the college algebra course, the minimum passing level was 60%. At the start of the courses with CR, the instructor described to students the conditions for release and the reasons and rationale for these conditions.

The instructor was flexible with the CR implementation throughout both courses. For example, if an online student missed an assignment, the deadline was always extended and the student was encouraged to complete the work and continue through the rest of the course. This required that the student cover the material (and meet the condition for release) before moving forward. In the F2F courses the instructor also extended deadlines on homework, if necessary. This approach worked well as long as students completed all homework before the test. However, if students in F2F classes did not complete the homework prior to the test, they were allowed to take the test with the rest of the class. They could also continue with the course into the next unit of material with the release conditions for that unit intact. Not implementing this exception to CR would mean that a student in a F2F class could hit an impenetrable barrier and be left behind as the F2F class continued to move on to new material. Thus, the F2F sections implemented a more lax version of CR than the online sections.

Results

Descriptive Statistics

Table 1 presents descriptive statistics for the major measures. These statistics indicate that student performance tended to decline slightly as the academic term progressed, as did the number of students who completed assignments. As noted earlier, a greater percentage of students participated in the courses online (67%) than in the F2F format (33%). Compared to the F2F students (M = 71.54, SD = 16.17), the online students scored significantly higher (M = 77.52, SD = 11.52) on their semester average course grade,

$t(155) = 2.70$, $p = .008$. In contrast, the F2F students scored significantly higher than the online students on Exams 1, 2, and 6. The online students ($M = 83.69$, $SD = 19.54$) did not differ from the F2F students ($M = 82.72$, $SD = 17.00$) on their course homework averages, $t(213) = .35$, $p = .72$.

Table 1. *Descriptive Statistics for the Major Measures*

Variable	*M*	*SD*	*n*	*Range*
Homework Average	83.37	18.72	215	20-100
Exam 1	82.79	12.43	215	20-102
Exam 2	73.34	19.22	211	11-102
Exam 3	71.90	20.81	191	0-101
Midterm Exam	74.78	18.69	120	0-100
Exam 5	72.36	20.50	178	0-100
Exam 6	72.64	25.37	160	0-100
Final Exam	64.83	18.11	168	18-98
Semester Average	75.20	13.78	157	20-98

Note. All measures are based on a 100-point grading scale. Exams also included a 5-point bonus question. Students who failed to complete an assignment received a grade of 0.

Seventy-three percent ($n = 157$) of the students completed all the course assignments, not necessarily passing the course. Analysis of course completers (yes/no) by the two courses (essentials/algebra) indicated that a greater percentage of students (81%) completed the algebra course than the essentials course (70%), although this difference did not reach statistical significance, $X^2(1) = 2.83$, $p = .09$. The percentage of students who earned a passing grade differed significantly between the essentials course (46%) and the college algebra course (79%), $X^2(1) = 20.61$, $p < .000$. The percentage of students who

passed did not differ significantly for courses with CR (54%) and without CR (58%), $X^2(1) = .33$, $p = .56$. The percentage of students passing also did not differ significantly for courses delivered online (57%) and F2F (54%), $X^2(1) = .17$, $p = .68$. There were no significant differences between female and male students on any of the major measures.

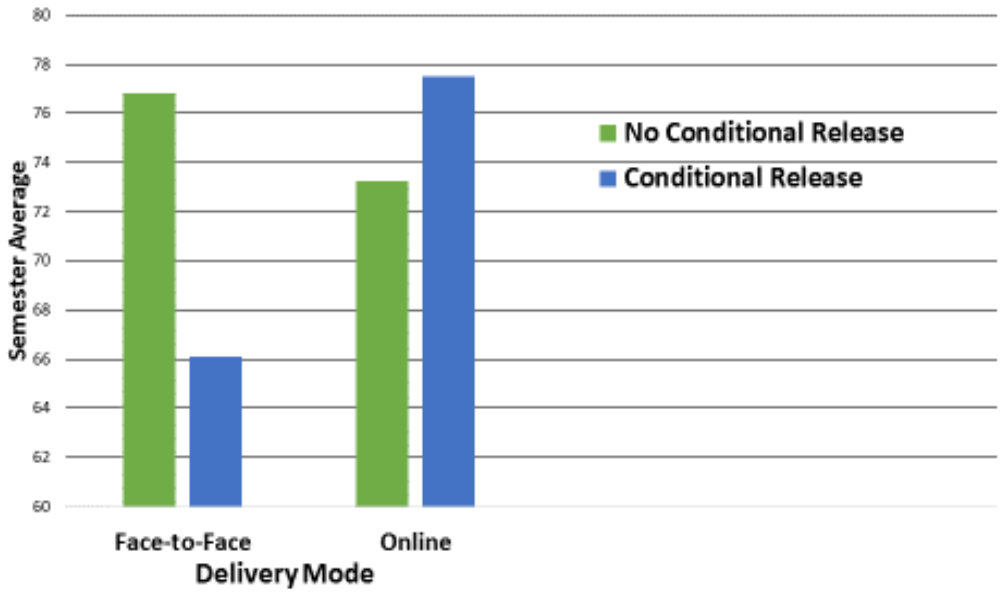
Tests of Hypotheses

According to the first hypothesis, we expected that students who participated in courses with CR would be more likely to complete all course assignments compared to students without CR. Analysis of the percentages of completers and non-completers by the presence and absence of CR found no significant difference, $X^2(1) = .04$, $p = .84$. The percentage of completers was similar for the CR courses (72%) and the non-CR courses (74%). We also conducted independent-samples *t*-tests on the homework average, final exam, and semester average measures. There were no significant differences between student scores in courses with CR and without CR. Thus, there was no support for Hypothesis 1.

For the second hypothesis, we predicted greater effectiveness of CR for online compared to F2F courses. To test this prediction, we examined the students who had completed the essentials course, since the college algebra course was only offered online. We conducted a series of 2 (CR: present/absent) X 2 (delivery: online/F2F) between-subjects ANOVAs, with the homework average, final exam, and semester average measures as the dependent variables. These analyses revealed no significant effects for the final exam scores. For the homework average measure, there was a main effect of delivery mode. In this case, students in the online sections ($M = 95.73$, $SD = 4.84$) scored significantly higher than those in the F2F sections ($M = 86.77$, $SD = 13.04$), $F(1, 102) = 17.65$, $p < .000$. Finally, for the semester average measure, we found a significant CR/delivery mode interaction. In particular, students without CR performed better in the F2F compared to the online sections, whereas students with CR performed better in the online compared to the F2F sections, $F(1,102) = 6.47$, $p = .013$. Figure 1 depicts this interaction. In a separate independent samples *t*-test analysis, we examined the differences between the CR/non-CR

sections of the online college algebra course. We conducted the same analyses for the CR/non-CR sections of the online essentials course. For those sections, there were no significant differences on the major measures. Thus, we found partial support for Hypothesis 2.

Figure 1. *Interaction of CR and Delivery Mode for Essentials of Mathematics Semester Course Average*



According to our final hypothesis, we expected that CR would be more effective for the more underprepared students. To test this hypothesis, we examined students who completed the course in the online format for the essentials and college algebra courses (because the algebra course was only offered online). We conducted a series of 2 (CR: present/absent) X 2 (course: essentials/college algebra) between-subjects ANOVAs, with the homework average, final exam, and semester average measures as the dependent variables. There were course main effects for scores on the final exam ($F(1, 156) = 6.25$, $p = .013$) and the semester average ($F(1, 156) = 6.88$, $p = .010$). In both cases, students in the college algebra course earned higher final exam scores ($M = 70.89$, $SD = 11.82$) than

students in the essentials course (M = 63.36, SD = 20.00) and higher semester averages (M = 79.12, SD = 9.48) than students in the essentials course (M = 73.14, SD = 15.21). There were no significant CR or interaction effects. Thus, there was no support for Hypothesis 3.

Discussion

The purpose of this study was to examine whether the use of conditional release (CR) was associated with differences in student performance in math courses for underprepared students. According to the results, CR did not provide substantial benefits compared to courses that did not use it; nor did courses with CR show any decrements in student performance compared to courses that did not use it. Students were likely to complete the courses at similar rates and earned similar grades in them, regardless of whether they experienced CR. We also found no support for the prediction that CR would be more effective with students in the essentials course than the college algebra course.

Although there was no support for two of our hypotheses, there was partial support for one of our hypotheses. The effects of CR on semester average did depend on mode of delivery for the essentials course. In particular, students who completed this course online earned higher semester average grades with CR than without CR, whereas students who completed the course F2F earned higher semester average grades without CR than with CR.

This is the first controlled experimental study to systematically examine the effects of CR on student performance. Previous researchers (Fisher et al., 2014) have shown that students who experience CR in their courses view it favorably, particularly students who are underprepared. However, in the present study of underprepared students, we found no differences in course completion rates and objective course performance between courses with and without CR. There are several possible reasons for this outcome. First, the same things that contribute to students being underprepared (e.g., life events, organizational and time management problems, family and financial issues, cultural factors) do not disappear once they enroll in college classes. Secondly, the very nature of CR (i.e., being organized,

working in a timely manner, completing assignments successfully) includes many of the same things that are frequent struggles for underprepared students. Whereas CR offers the scaffolding and support for these students to be successful, many of them are unable to fulfill the CR requirements. In an economic sense, underprepared students may have limited time and effort resources (e.g., with job and family responsibilities) that need to be allocated among a large number of competing activities. This line of reasoning suggests that CR will work best for underprepared students who have the time, motivation, and support to invest in a course so that they can adequately benefit from the scaffolding that CR provides.

Implications for Future Research

Our findings suggest that CR might be more effective for online than F2F courses, at least for the highly underprepared (essentials of mathematics) students we used in this study. As Figure 1 shows, for F2F sections of the essentials course, using CR was associated with poorer performance than not using it. This pattern was reversed for the online sections, with CR sections showing better performance than non-CR sections. Interestingly, with the college algebra students (who are somewhat better prepared than the students in the essentials course), CR was not differentially effective depending on mode of delivery.

There is less flexibility with exam scheduling and extensions in the F2F compared to the online sections. Because of this lack of flexibility, if F2F students fall behind, they can quickly become overwhelmed and be unable to complete all of the homework requirements before the next exam. In the online format, the pressures on students of falling behind can be alleviated more easily by the teacher through extending homework and exam deadlines compared to F2F delivery. Future research might examine the extent that students appreciate, take advantage of, or benefit from the opportunity to gain homework and exam extensions. Since CR did not provide the flexibility needed for F2F students, other pedagogies such as the “flipped” classroom or classrooms using

supplemental instruction could also be examined to see if the flexibility they provide might better serve underprepared students.

Fisher et al. (2014) found that students with lower overall GPA reported being more engaged in courses with CR compared to higher performing students. It is possible that, in the online version of the essentials course, CR helped students to stay on task and to be more consistently engaged in the course material, compared to the F2F version of the course. However, we did not collect student evaluation data about the use of CR and their experiences with it. Having these data might provide additional insights into how CR operated and how it affected students.

We did not have any F2F college algebra sections. So, we were unable to examine whether CR effects differed between online and F2F versions of this course, as we did for the essentials course. Future research might examine whether CR is differentially effective across delivery modes for the college algebra course.

In conclusion, even though the results did not demonstrate strong effects of CR with the underprepared students in this study, there is still potential for some students to benefit from the tool. In particular, we found evidence that CR may be helpful for online students. There are also several interesting questions about the boundaries of CR effectiveness that future research can examine. The present results suggest that a variety of other student factors (both academic and non-academic) need to be addressed when implementing best practice CR recommendations. In other words, the use of any pedagogical tool must always take into account how the characteristics of one's student population will impact student success.

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