

# ***U-PACE* INSTRUCTION: IMPROVING STUDENT SUCCESS BY INTEGRATING CONTENT MASTERY AND AMPLIFIED ASSISTANCE**

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## **ABSTRACT**

*U-Pace*, an instructional intervention, has potential for widespread implementation because student behavior recorded in any learning management system is used by *U-Pace* instructors to tailor coaching of student learning based on students' strengths and motivations. *U-Pace* utilizes an online learning environment to integrate content mastery with Amplified Assistance (instructor-initiated, individually tailored feedback on concepts not yet mastered and constructive support that every student receives via email weekly or more often as needed). Evaluation findings for *U-Pace* instruction revealed that compared to conventional, face-to-face instruction, *U-Pace* instruction was associated with greater academic success for all students and reductions in the achievement gap for "disadvantaged" students. Additionally, "disadvantaged" *U-Pace* students showed improvements in the rate of content mastery and intrinsic motivation. Consistent with these indicators of improvement in self-regulated learning skills, *U-Pace* students reported greater improvements in their time management and study skills, greater control over their learning and a greater sense of achievement than conventionally-taught students. The convergence of findings from student reports, performance measures recorded within the learning management system, and objectively determined grades suggests *U-Pace* instruction holds promise for higher education.

## **KEY WORDS**

Online Learning, Distance Education, Self-paced Learning, *U-Pace* Instruction, Student Success, Amplified Assistance, Mastery, Control, Academic Success

## I. INTRODUCTION

The percentage of undergraduates in the U.S. who do not complete a degree or certificate program in college is a critical problem. Only 58.3% of full-time students, enrolling in four-year institutions for the first-time, graduate within 6 years [1]. The graduation rates are even lower for students from Hispanic, African American, and American Indian/Alaskan Native backgrounds [1]. Philanthropic organizations (e.g., the Bill and Melinda Gates and William and Flora Hewlett Foundations) are addressing this problem with important initiatives such as Next Generation Learning Challenges [2]. The U.S. government has also allocated significant funding to major initiatives such as the American Graduation Initiative and to granting agencies such as the Institute of Education Sciences, which invest in research that will result in effective interventions to increase graduation rates. *U-Pace*, one such instructional intervention, has potential for widespread implementation because student behavior recorded in the learning management systems is used by *U-Pace* instructors to tailor coaching of student learning based on students' strengths and motivations. The *U-Pace* method integrates content mastery in a self-paced format with Amplified Assistance (instructor-initiated, individually tailored feedback on concepts not yet mastered and constructive support that every student receives via email weekly or more often as needed). *U-Pace* instructors are able to provide personalized support (specific concept guidance, study strategies) based on student behavior such as number of quiz attempts and quiz scores recorded in their own learning management systems. This study reports evaluation findings for *U-Pace* instruction on five important outcomes:

- student academic success
- improvements in rate of content mastery (indicating improvements in self-regulated learning skills)
- perceived control over learning and sense of achievement
- perceived improvement in time management and study skills, and
- student motivation, a characteristic of self-regulated learners.

## II. U-PACE INSTRUCTION

The Mastery component of *U-Pace* instruction allows students to progress to new content *only* after they demonstrate mastery of current material by achieving at least a 90% on a quiz. Each quiz corresponds to one small module, equivalent to about half a chapter or lesson. A deep level of understanding of the material is required to earn the 90%, as the quiz questions were developed with Bloom's Revised Taxonomy as a framework [3]. As in most Mastery approaches, students can retake quizzes an unlimited number of times without penalty, but they do not get the same questions on retakes and must wait at least one hour (to study the material further) before attempting a retake.

The Amplified Assistance component of *U-Pace* instruction is unique because the instructor reaches out to each student personally without the student having to ask for help. Amplified Assistance is designed to maximize the quality of instructor-student interactions and, specifically, the rapport experienced by students. Considerable evidence indicates that the perceived quantity and quality of interaction in online courses are associated with student satisfaction and student achievement [4, 5, 6].

In addition to building rapport, Amplified Assistance communicates a powerful message that students can be successful even if they are unsuccessful at the moment. This unwavering belief in the students' ability to succeed is fundamental because students achieve consistent with the expectation of their instructor [7]. With Amplified Assistance, the students perceive that the instructor strongly believes they will succeed regardless of their performance thus far. Templates of high quality "intervention" messages facilitate the provision of Amplified Assistance.

*U-Pace* is designed to empower students by fostering a sense of control. The self-paced nature of *U-Pace* allows students to determine when, and at what rate (within a semester), they engage the material. The mastery requirement focuses students on learning small, manageable amounts of material at one time; and

consecutively mastering each content module strengthens the link between effort and positive outcome, building a sense of control over learning. The empowering messages communicating an unwavering belief in the student's ability to succeed and the support that is at the core of Amplified Assistance also foster a sense of control. Research has shown that individuals who perceive control achieve more and have better psychological outcomes and students who feel a deepened sense of control over their learning may show increased persistence in the face of academic challenges [8].

### III. METHOD

The research was conducted at the University of Wisconsin-Milwaukee, the urban doctoral university in the University of Wisconsin System with over 28,000 undergraduates. *U-Pace* instruction was evaluated in the context of Introduction to Psychology, one of the most popular general education courses. *U-Pace* instruction was compared with conventional instruction of students in sections using the same textbook, and of students in sections using a different textbook. Conventionally-taught students attended lectures in a classroom while *U-Pace* students worked through interactive online modules covering the same content. In both the *U-Pace* and conventionally-taught sections, grading was completely objective, based on students' performance on computer-scored multiple-choice assessments. Students' final course grades in the *U-Pace* course were based on the number of quizzes (out of 24) on which they achieved a score of 90% or higher in the semester, whereas conventionally-taught students' final course grades were based on the average of their exam scores.

*Student academic success* was evaluated in 1,734 *U-Pace* students and 2,874 conventionally-taught students. *Student academic success* was measured using objectively determined final course grades. *Academic success* was defined as final course grades of A or B and was examined by disadvantaged status. "Disadvantaged" students were defined as students from low income backgrounds (federal Pell grant eligible) or students from racial/ethnic minority backgrounds (African American, Hispanic, Native American, or Southeast Asian) at increased risk for college non-completion.

For the *U-Pace* students only, *improvement in the rate of content mastery* was indicated by significant declines during the course in the number of attempts per quiz necessary to achieve a 90% or better. The number of attempts per quiz was examined using the behavioral record in the learning management system (Desire2Learn). Increases in the rate of content mastery suggest improvements in self-regulated learning skills.

Randomly selected samples of students enrolled in *U-Pace*, conventionally-taught sections using the same textbook, and conventionally-taught sections using a different textbook completed an online survey at the end of the course assessing *perceived control over learning*, *sense of achievement*, and *perceived improvement in time management and study skills* as a result of their course experience.

For the *U-Pace* students only, *student motivation* was assessed through a behavioral indicator: an optional content module and quiz were available to students who had already earned an A in the course. Students understood that this module and quiz would have no bearing on their grade. Whether or not students chose to complete this optional, non-counting module was measured.

### IV. RESULTS

#### A. Student Academic Success

A significantly higher percentage of *U-Pace* students earned a final course grade of A or B compared to conventionally-taught students ( $\chi^2(1)=137.13, p<.001$ ). Chi square analysis was also conducted to examine how well "disadvantaged" students performed relative to "not disadvantaged" students in the *U-Pace* and conventionally-taught sections. While "disadvantaged" students earned fewer As and Bs relative to "not disadvantaged" students in both *U-Pace* instruction and conventional instruction, analysis revealed that the gap between "disadvantaged" students and "not disadvantaged" students was significantly smaller in *U-Pace* compared to conventional instruction (8.54 percentage points versus 14.08 percentage points), ( $\chi^2(1)=5.98, p<.05$ ). Furthermore, the "disadvantaged" *U-Pace* students earned

a significantly greater percentage of As and Bs than the conventionally-taught “not disadvantaged” students ( $\chi^2(1) = 5.73, p < .05$ ). These findings, depicted in Figure 1, were calculated based on all students (*U-Pace*  $n=1,734$ , conventional  $n=2,874$ ), regardless of whether they withdrew or dropped from the course. Although the *U-Pace* sections had a greater mean drop/withdrawal rate than the conventionally-taught sections ( $M=7.7\%$  versus  $M=4.7\%$ ), the drop/withdrawals rates were low in both sections [9]. Reanalysis of the data using a worst-case scenario (assuming that all students who dropped the *U-Pace* sections would have failed the course and that all students who dropped the conventionally-taught sections would have earned an A) demonstrated that the differential drop/withdrawal rate had no significant impact on the findings.

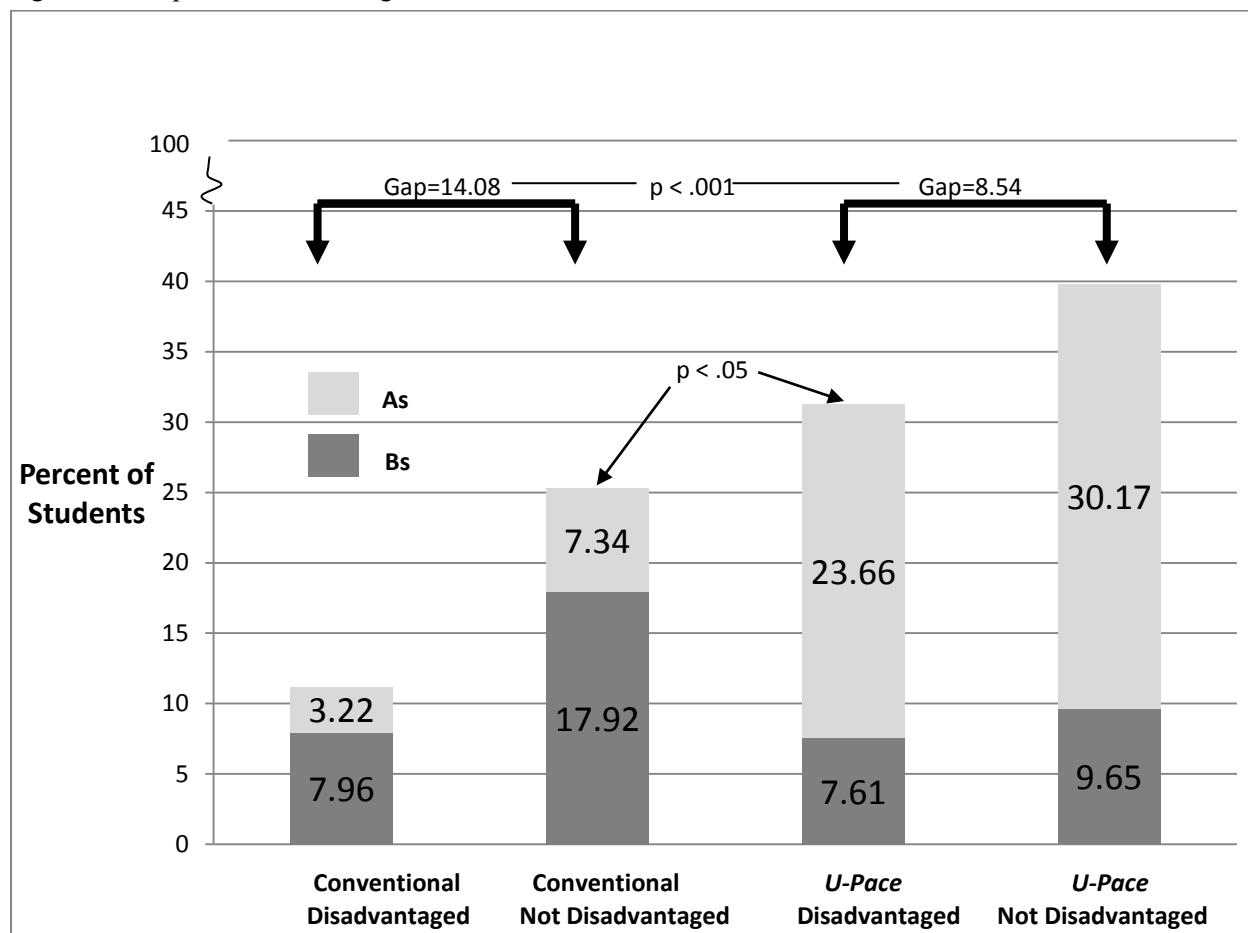


Figure 1. Percent of *U-Pace* and conventionally-taught undergraduates earning As and Bs by disadvantaged status.

## B. Improvements in the Rate of Content Mastery

The number of attempts per quiz needed to achieve mastery (i.e., score at least 90%) were examined for *U-Pace* students who completed the content modules. Figure 2 shows remarkably similar declines during the course for both “disadvantaged” students and “not disadvantaged” students in the number of quiz attempts needed to achieve mastery. This decline reached the level of statistical significance for the “disadvantaged” students. This finding is not a function of quizzes decreasing in difficulty over the semester; in other semesters, the quiz order was varied, and a significant decline in the number of attempts needed to achieve mastery still emerged.

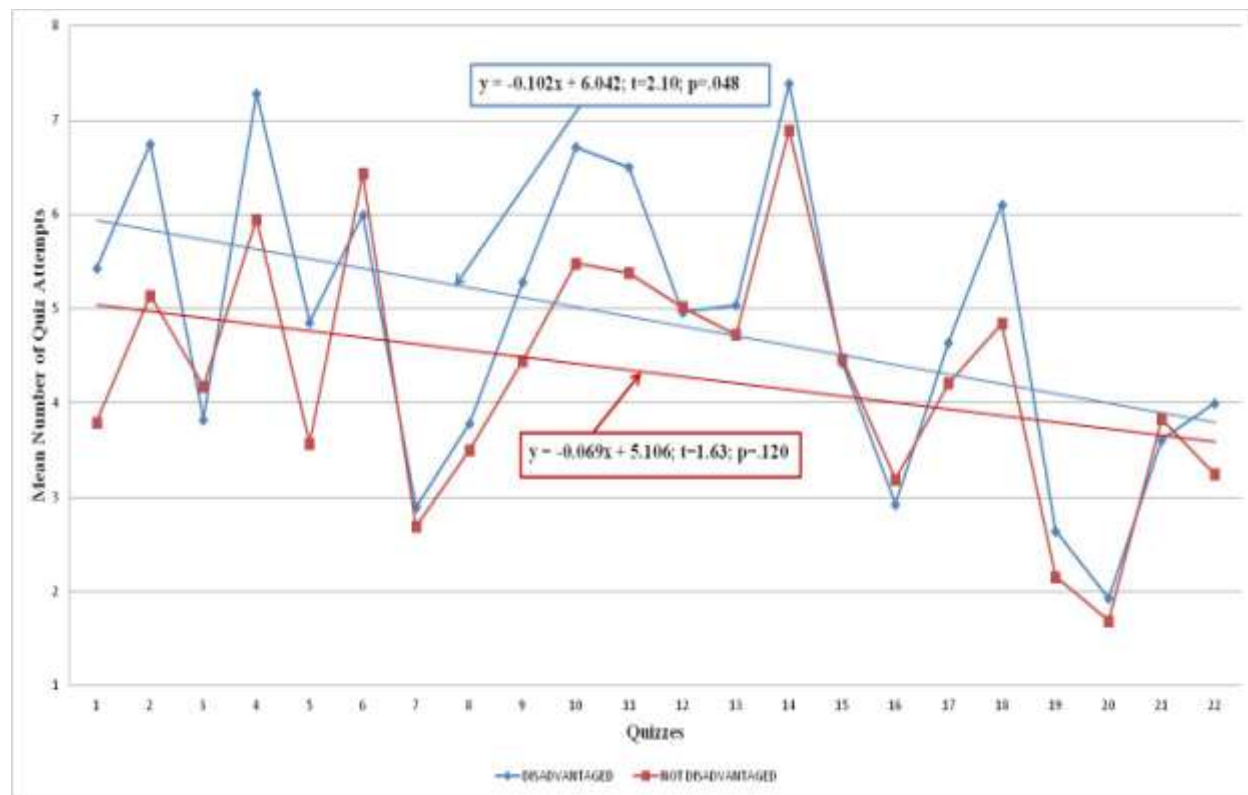


Figure 2. Improvement in the rate of content mastery for “disadvantaged” and “not disadvantaged” *U-Pace* students.

### C. Perceived Control over Learning and Sense of Achievement

*U-Pace* students ( $M=9.12$ ) reported a greater sense of control over their learning compared to conventionally-taught students in sections using the same textbook ( $M=6.72$ ) and conventionally-taught students in sections using a different textbook ( $M=7.54$ ); ( $F(2,163)=14.52, p<.001$ ). *U-Pace* students ( $M=8.08$ ) also reported a greater sense of achievement than conventionally-taught students in sections using the same textbook ( $M=7.03$ ) and conventionally-taught students in sections using a different textbook ( $M=7.18$ ); ( $F(2,163)=3.56, p<.05$ ). No differences in perceived control or sense of achievement were found between conventionally-taught students in sections using the same textbook and conventionally-taught students in sections using a different textbook.

### D. Perceived Improvement in Time Management and Study Skills

*U-Pace* students reported significantly greater improvement in their time-management skills ( $M=7.03$ ) compared to conventionally-taught students in sections using the same textbook ( $M=5.79$ ), and conventionally-taught students in sections using a different textbook ( $M=5.67$ ); ( $F(2,163)=5.60, p<.01$ ). The *U-Pace* students also reported significantly greater improvement in their study skills ( $M=7.60$ ) relative to the conventionally-taught students in sections using the same textbook ( $M=6.21$ ) and conventionally-taught students in sections using a different textbook ( $M=6.35$ ) ( $F(2,163)=7.24, p<.01$ ). No differences on these reported skill improvements were found between conventionally-taught students in sections using the same textbook and conventionally-taught students in sections using a different textbook.

### E. Student Motivation

Among *U-Pace* students who were aware that they had already earned an A in the course, 92% completed an optional content module and quiz that they understood would have no bearing on their final grade, suggesting that *U-Pace* engendered students’ intrinsic motivation. The majority (57%) scored at least

90% on the optional content module quiz.

#### **IV. SUMMARY**

The integration of content mastery and Amplified Assistance in U-Pace instruction was associated with greater academic success for all students and reductions in the achievement gap for “disadvantaged” students. In fact, “disadvantaged” students in U-Pace instruction performed significantly better than the “not disadvantaged” students in conventionally-taught sections. Research has shown that U-Pace instruction is also associated with greater learning relative to conventional instruction and other types of online instruction. Compared to conventionally-taught students, U-Pace students demonstrated greater retention of knowledge up to six months after the course on proctored cumulative exams measuring core concepts [10].

In addition to fostering greater academic success for all students, U-Pace may help students develop skills they need to succeed in future courses. U-Pace students showed an increased rate of content mastery during the course (i.e., took fewer attempts to earn a 90% or better on each quiz), and this increased rate of content mastery reached the level of significance among “disadvantaged” students. This indicates that U-Pace students were making important gains in self-regulated learning skills, a finding which is most apparent in “disadvantaged” students, who may have stood the most to gain initially. U-Pace students may have developed better study strategies to reach the deep level of learning necessary to earn an A on each quiz. These findings converge with the survey data, indicating that U-Pace students reported greater improvement in their time management and study skills compared to conventionally-taught students. The increased rate of content mastery may also demonstrate that U-Pace students gradually gained a better sense of self-knowledge regarding when they were “ready” to take a quiz, possibly reflecting improvements in meta-cognitive skills. Accumulating evidence suggests that the development of meta-cognitive skills in students improves learning [11, 12, 13].

Student motivation is also critical to learning [14], and it was found that among U-Pace students, who knew they had already earned a final course grade of A, nearly all (92%) chose to study an optional content module that would not count toward their grade. The majority of these students (57%) performed well on the optional content module quiz, earning a 90% or greater. This finding suggests that U-Pace engendered students’ intrinsic motivation, which has been linked to school retention [15], higher grades and achievement in school [16], and deeper understanding of concepts [17]. Much like increased time management, study, and meta-cognitive skills, increased motivation will support students in all of their academic pursuits moving forward. To succeed, students need both motivation to work toward graduation and self-regulated learning skills [11]. The findings suggest that U-Pace instruction cultivates both.

U-Pace students also reported a greater sense of control over their learning as a result of their experience in the course compared to conventionally-taught students. This finding supports U-Pace’s conceptual model [10], which posits that perception of control over learning is the mediator of student success and learning. That U-Pace students report a greater sense of control is significant because sense of control has been linked to physical and psychological well-being, as well as performance improvement [8]. Consistent with this greater sense of control, U-Pace students reported a greater sense of achievement. For students (especially those with a limited history of earning As), consecutively earning As on challenging quizzes that measure deep learning may instill a sense of control as students demonstrate to themselves that they can be successful and practice the time management and study skills needed for success. Students’ realization of the link between their effort and positive academic outcomes may be strengthened by U-Pace instruction. Strengthening this link may be particularly important for racial and ethnic minority students and low income students who often have a lower sense of mastery and personal control [18].

In interpreting the findings for U-Pace several limitations should be kept in mind. Students were not randomly assigned to U-Pace or conventional instruction. However, U-Pace students did not differ from conventionally-taught students on standardized college admission scores (composite ACT scores) or college cumulative grade point average. In addition, student perceptions were measured only at the conclusion of the courses. Baseline measures of these constructs are not available, so improvements in

time management and study skills are simply student perceptions of improvement. These perceived improvements are, however, supported by the measureable increase in rate of content mastery seen in “disadvantaged” U-Pace students over the course.

In conclusion, the convergence of findings from multiple outcomes—institutional records indicating greater academic success for all students, performance measures demonstrating improvements in the rate of content mastery and student motivation, and student reports of increases in time management skills, study skills, sense of control over learning, and sense of achievement—strongly suggests that U-Pace instruction holds promise for higher education.

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