# Student Performance at a Community College: Mode of Delivery, Employment, and Academic Skills as Predictors of Success

**Brian G. Wolff**
Instructor
Biology Department
Normandale Community College
Bloomington, MN 55431 USA
brian.wolff@normandale.edu

**A. Michelle Wood-Kustanowitz**
Environmental Sciences, Policy, and Management Program
University of Minnesota
St. Paul, MN 55108 USA
hartn003@umn.edu

**Jennifer M. Ashkenazi**
Librarian
National Library of Israel
Jerusalem ISRAEL
jennifer.ashkenazi@nli.org.il

**Abstract**

Numerous studies have been conducted to evaluate differences in online and face-to-face (F2F) student performance. However, relatively little work has been done to evaluate differences in online and F2F student performance at community colleges, which attract different students than 4-year institutions and professional programs. Using multiple and logistic regression models, the authors examined 11 predictors of performance in an environmental biology course taught both online and F2F at a community college in the Midwestern United States. Employment, math proficiency, and mode of delivery proved to be significant predictors of successful course completion. Employment and math proficiency were also found to be significant predictors of final exam performance, but mode of delivery was insignificant at an alpha level of .05. However, differential attrition rates appear likely to have masked a meaningful difference in online and F2F final exam scores. When quiz results were used to estimate the final exam scores for course dropouts, mode of delivery was found to be a significant predictor of final exam performance.

**Keywords:** online learning performance, working students, academic placement, student preparedness, math placement, community college

## Introduction

The demand for online courses at public and private institutions of higher education continues to grow. Thirty-one percent of all higher education students in the U.S. took at least one online course in 2011 (Allen & Seaman, 2011), and while overall student enrollment at community colleges remained flat in 2011, online enrollment at community colleges increased 8.2% (Crawford & Persaud, 2013).

Studies of online instruction have highlighted various advantages for instructors and students, but critics point to disconcertingly high course dropout rates, low college and program retention rates, low performance, and difficulties in providing adequate support as potential drawbacks to online education (Lei & Gupta, 2010). To address these concerns, numerous studies have been conducted to assess the efficacy of online instruction (e.g., Bello et al., 2005; Mentzer, Cryan, & Teclehaimanot, 2007; Steinweg, Davis, & Thomson, 2005). It is widely acknowledged, however, that many of these studies are difficult to

interpret due to a lack of experimental controls. A survey of studies published between 1996 and 2008 found, for example, that only 15.5% of the 1,132 studies evaluated used "experimental or quasi-experimental design and objectively measured student learning outcomes" (Means, Toyama, Murphy, Bakia, & Jones, 2010, p. xii). Variables that are likely to be important, including employment for pay and caregiver status, are also commonly ignored, even when other demographic factors are examined.

Muse (2003) and Smith, Lange, and Huston (2012) have evaluated multiple variables to identify at-risk students in online community college courses, but similar studies aimed at identifying key predictors of performance in particular courses, including science courses, are rare and potentially important predictors have gone largely unexamined.

Differences between student bodies have also received insufficient attention, and more studies at community colleges are needed. The majority of studies investigating differences in performance among online and face-to-face (F2F) undergraduate students have been conducted at 4-year institutions, although 31% of 18- to 24-year-old college students and more than half of all online students in the United States attend 2-year institutions (Fry, 2009; Johnson & Berge, 2012). These institutions attract students that differ in many respects from their 4-year counterparts. Students at 2-year institutions are more likely to attend part time, be employed full time, care for a child as a single parent, enter college courses without a high school diploma, and/or require remedial coursework (Aud et al., 2011; Bettinger & Long, 2005; Fry, 2009; Griffith & Hunt-White, 2005; Horn, Nevill, & Griffith, 2006; Johnson & Berge, 2012; Xu & Jaggars, 2011). Given these differences, the efficacy of online instruction may vary significantly between 2- and 4-year institutions, and conclusions drawn from studies conducted at the latter institutions may not be applicable to the former.

A widely cited meta-analysis conducted by the U.S. Department of Education found that students in purely online courses performed similarly to their peers receiving F2F instruction (Means et al., 2010). A survey by the authors revealed, however, that none of the purely online versus F2F studies included in the meta-analysis looked at the performance of community college students. Of the studies considered, 58% evaluated the performance of students in professional programs, and 27% evaluated the performance of undergraduate students at 4-year institutions. All but one of the remaining studies focused on graduate, pre-professional, or elementary students. The exception involved students in a corporate setting (Hairston, 2007).

Large studies investigating student performance in online and F2F community college courses have produced valuable results (Jaggars & Xu, 2010; Kaupp, 2012; Xu & Jaggars, 2011). However, these studies ignore important variables and outcomes. For example, a study of 51,017 students enrolled in Washington State community colleges from 2004 to 2009 compared the performance of all students taking all available online, hybrid, and F2F courses, but did not address potential differences in teaching experience or expectations. Nor did researchers analyze performance on standardized exams or similar standardized measures of learning (Xu & Jaggars, 2011).

Some smaller studies addressing performance in online and F2F community college courses have also generated valuable results by employing multivariate procedures to evaluate student performance (Carpenter, Brown, & Hickman, 2004; Zavarella, 2008). Unfortunately, the number of such studies is limited, and variables that are likely to be important are commonly omitted (e.g., employment). The potential impact of differential attrition rates on student performance is also rarely addressed. For example, almost all of the purely online versus F2F studies included in the Department of Education meta-analysis cited above neglect to report on student attrition rates. As a consequence, it is impossible to determine if differential attrition rates may have biased measures of student performance.

The purpose of this study was to investigate 11 factors likely to have a significant influence on student performance at a Midwestern community college: age; gender; course load; caregiver status; mode of delivery; grade point average (GPA); credits previously completed; employment (average hours employed per week for pay); and math, reading, and writing proficiency (as measured by ACCUPLACER and ACT tests). Variables (i.e., predictors) were identified for possible inclusion based on conversations with community college instructors and a literature search conducted by the authors. Once identified, those variables considered likely to have an impact on student performance were included in the analyses if reliable data could be obtained. In order to control as many variables as possible, all students included in the study were enrolled during the same semester in parallel environmental biology courses taught by the same instructor.

## Background

Although they have not been similarly analyzed, all of the predictors chosen for inclusion in the present study have received attention from published scholars. Numerous studies have, for example, examined the correlation typically observed between GPA and student performance in F2F and online courses (Baxter, Hungerford, & Helms, 2011; Harrell & Bower, 2011; Morris, Finnegan, & Wu, 2005; Muse, 2003). A number of studies have also been conducted to evaluate the efficacy of college placement and readiness examinations. Belfield and Crosta (2012), Jenkins, Jaggars, and Roksa (2009), and Michaelides (2005) found student achievement on placement exams to be only weakly correlated with various aspects of class performance. Studies by Gilmore (2008), Mattern and Packman (2009), and Peng, Le, and Milburn (2011) indicate, however, that college entrance and placement exams may be useful predictors of student performance. Several studies suggest math placement exams are more likely than reading and writing exams to accurately predict course outcomes (Hughes & Scott-Clayton, 2011; James, 2006; Jenkins et al., 2009), but reading skills have long been linked to student success (Fike & Fike, 2008; Fleischauer, 1996), and most community colleges administer reading and writing placement exams ("What are College Placement Tests?," 2014). Researchers consequently tend to have ready access to some math, reading, and writing proficiency data.

There is research indicating that age, gender, and prior course experience can predict course outcomes (Aragon & Johnson, 2008; Schofield & Dismore, 2010; Smith, Garton, Killingsworth, Maxwell, & Ball, 2010). There is also evidence that student success rates are correlated with course load and that online students are both older and inclined to attempt fewer credits per semester than their F2F peers (Allen & Seaman, 2006; Bormann, Moser, & Bates, 2013; Dutton, Dutton, & Perry, 2002).

It has been estimated that 57% of college students in the United States work at least on a part-time basis (Miller, Danner, & Staten, 2008), and numerous studies show that academic performance is impacted by employment (Callender, 2008; Carney, McNeish, & McColl, 2005; Furr & Elling, 2000; Miller et al., 2008; Torres, Gross, & Dadashova, 2010-2011). Online students are, additionally, more often employed than F2F students and work more hours (Allen & Seaman, 2006; Dutton et al., 2002; Stewart, Bachman, & Johnson, 2010).

A significant percentage of online students are primary caregivers to dependent children or adults (Capra, 2011; Halsne & Gatta, 2002). Few studies have looked at the impact of caregiving on student success, but some research indicates that the duties of parenting may negatively impact classroom performance. Lynn and Robinson-Backmon (2006) found, for instance, that students with children performed below their peers in accounting classes.

The authors' decision to collect data regarding student employment and caregiver status was driven, in part, by conversations with struggling students. Struggling students enrolled in prior offerings of the course commonly indicated that work and/or children interfered with their studies.

## Methods

### *Participants and Context*

The study included 105 community college students simultaneously enrolled in a 16-week environmental biology course. Students were free to choose the instructional mode of delivery that best suited their needs. There were 56 students enrolled in the online course and 49 students enrolled in the F2F course.

### *Data Collection*

An instructor with 12 years of experience teaching online and F2F environmental biology courses taught both classes using the same textbook. Online and F2F students were required to complete identical reading assignments. Both classes followed the same lesson schedule, addressed the same discussion topics, took the same seven quizzes, and were assigned the same fieldwork (i.e., a biological community study). Discussion assignments differed only due to the difference in venue: online students participated in asynchronous online discussions, while F2F students participated in small classroom discussions. All students were required to complete the same proctored final exam.

The instructor graded all final exams. Names were withheld from the instructor until grading was completed. The final exam took the following form:

- *Multiple choice questions:* 40 x 2 points each;

- *Written definitions:* 7 x 3 points each;
- *Short essay questions:* 5 x 5 points each;
- *Long essay questions:* 2 x 15 points each.

The final exam was worth a total of 156 points and accounted for 44.57% of the final grade, excluding a negligible amount of extra credit. Final exam score distribution was normal with a confidence of 25.29% (Anderson–Darling normality test). The combined online and F2F class mean was 103.00 with a standard deviation of 22.06.

Quizzes were administered to F2F students in class. Online students completed their quizzes online. All quizzes were timed. Students were allowed 28 minutes to complete their quizzes, but classroom timing was imprecise, and the timing of F2F quizzes may have varied by 2 to 3 minutes. To stay in keeping with the instructor's traditional methods, F2F students were denied access to notes and other materials. Because it would have been impossible to deny online students access to course materials, the quizzes were carefully written to make extensive use of notes or other instructional aids difficult within the imposed time constraints. The F2F students could have been required to complete their quizzes online, and the authors considered this possibility. It was decided, however, that the potential advantages associated with F2F learning could be compromised by forcing F2F students to adopt online practices, and by requiring the instructor to give up the control over student behavior that can be exercised in a conventional classroom setting.

Every other week, the instructor posed a topical discussion question on the website for the online section of the course. Online discussions were asynchronous and conducted via threaded discussion board. These ran for a period of one week. Each online student was required to make a minimum of four substantive posts.

The instructor considered a post "substantive" and worth full credit if it demonstrated an understanding of the subject and contained one or more of the following:

- A germane reference to a passage in the assigned reading or an outside source;
- An important insight (e.g., an insight concerning the relationship of the question posed to another topic in environmental biology);
- An appropriate correction to another participant's post;
- A thoughtful answer to a follow-up question;
- A related question of interest or concern.

Research indicating that timely and substantive instructor feedback enhances student participation in online discussions and learning was incorporated into the course (e.g., Dennen, 2005; Gallien & Oomen-Early, 2008; Wolff & Dosdall, 2010). The discussions were monitored by the instructor and a peer educator – a student who had previously taken the course and volunteered to assist in facilitating discussions. Both the instructor and peer educator attempted to enhance participation by asking for clarification, posting follow-up questions, and assuring that the majority of initial student posts received at least one reply. The instructor read all discussion posts, attempted to clarify inaccurate statements that went unchallenged, and answered all questions directed specifically to the instructor. Online students posted an average of 492.3 words per student per discussion (range: 43.5 to 1484.3). The instructor and peer educator posted a combined average of 9,580 words per discussion.

The same discussion question posed to the online students was assigned to the F2F students. Each student was required to submit one response online before the scheduled class meeting. During class, the students were asked to form discussion groups of six to 10 and given 40 to 50 minutes to consider the question. The instructor monitored the classroom discussions and made occasional contributions. F2F students were given full credit for participation in the discussion if they attended class.

The F2F class met for 50 minutes, three times per week. Attendance in class was mandatory**,** and points were deducted for each class missed after the fourth unexcused absence. On average, students attended 86% of the 45 scheduled class meetings and received approximately 29.33 total hours of classroom instruction, excluding class time devoted to quizzes. The instructor's online instructional hours were recorded and averaged 14.02 hours per week over the course of the semester (224.25 total

hours). Approximately 94% of the instructor's online instructional hours were devoted to participation in the asynchronous discussions. The remainder was spent answering questions posted for the instructor. The hours spent by the peer educator were not recorded.

All students were required to complete a biological community study. This entailed identifying 20 different species and examples of a variety of ecological terms (e.g., keystone species, mutualism, competitive exclusion). Students were allowed to work independently or to participate in one of several instructor-led field days. Of the students who completed the assignment, 71% of the F2F students and 28% of the online students participated in one of the instructor-led field days.

Two 3-hour final exam study sessions, open to all students, were conducted during the week preceding the final exam. Attendance was light, and not more than 15% of the students participated in a study session. A record of attendees was not kept. The study sessions were organized as question and answer periods. It is important to note that students in the F2F setting always had the opportunity to ask questions during class, and online students had the opportunity to ask questions throughout the semester via discussion board, telephone, e-mail, and Skype. Hence, all students were given the opportunity to ask questions afforded by the study sessions.

Data relating to age, gender, GPA, college credits earned, course load, and institutional placement levels derived from ACCUPLACER and ACT scores were obtained from the college's Division of Planning and Institutional Effectiveness. Students were surveyed at the close of the semester to determine if they had held a for-pay job and/or were primarily responsible for the care of a dependent child or elderly adult. Students who indicated they held a job during the semester were asked to estimate the average number of hours employed per week. Students who did not respond to e-mail requests for information were contacted by telephone. Of the 105 students included in the study, 97 responded and provided the information requested. Students who failed to respond to the survey did not differ statistically from their peers with respect to outcome or mean final exam score. A positive outcome was defined as both completing the course and passing the final exam; a negative outcome was defined as either withdrawing from the course or failing the final exam. Students that officially dropped the course during the first 5 days of the semester and were entitled to a tuition refund were not included in the study.

*Data Analysis*

Each predictor was independently evaluated to identify statistically significant differences between online and F2F students, between students with positive and negative outcomes, and in final exam scores. Distributional differences were evaluated via chi-squared analysis. Differences in means were evaluated using the *t*-test, or via rank sum when a normal distribution could not be assumed.

Regression analysis was used to evaluate the functional relationship between each predictor and final exam score. Residuals were examined to identify questionable model assumptions. Data were transformed, as necessary, to address apparent model violations.

Multiple regression analysis with backward elimination was used to identify the largest subset of significant exam score predictors (i.e., where $p < .05$). No grade point average was available for first semester students, and GPA was not included in the multiple regression analysis due to the number of missing values. Because the assumption of homoscedasticity did not appear to hold**,** and attempts to achieve linearity failed to produce satisfactory results, math placement was treated as a qualitative variable. Writing placement scores were dropped from the analysis to address similar problems and also because it was determined that reading and writing placement scores were moderately to strongly correlated (Pearson's $r = .515$). Removal had no meaningful impact on the model produced via backward elimination.

To assess the impact of differential online and F2F withdrawal rates, the analysis was repeated after using a simple regression model to estimate missing final exam scores from mean quiz scores. The mean quiz score was calculated using all completed quizzes. When used to estimate the exam scores produced by students completing the course, the model produced an $R^2$ of .685. The GPAs of students who withdrew from the course were also compared to retained students using the White modification of the Wilcoxon rank-sum test (Ambrose & Ambrose, 1987).

Multiple logistic regression analysis with backward elimination was employed to identify significant predictors of outcome. The same predictors of final exam performance were included in the analysis, but employment was treated as a qualitative variable. The critical value was set at 12 hours per week based

on indications that students employed 12 or fewer hours per week were as likely to successfully complete the course as unemployed students.

**Results**

No significant differences (α = .05) between online and F2F students were found to exist with respect to GPA, course load, gender, placement levels, or previously completed credits. Online students were significantly older and more likely to be employed than F2F students. Online students were also more likely to describe themselves as the primary caregiver to a dependent child or adult (Table 1).

Table 1. *Comparison of students in the online and F2F sections of environmental biology*

| Variable | Online | F2F | *p*[a] |
|---|---|---|---|
| Age (mean) | 23.42 | 20.08 | $6.32 \times 10^{-7}$ |
| Caregivers (%) | 18.30 | 4.10 | .035 |
| Course Load (mean credits) | 10.86 | 12.57 | |
| Credits Completed (mean) | 23.95 | 18.53 | |
| GPA (mean) | 2.75 | 2.75 | |
| Gender Ratio (male:female) | 53.6:46.4 | 44.9:55.1 | |
| Math Placement Level (mean) | 5.16[b] | 5.06[b] | |
| Reading Placement Level (mean) | 6.05[c] | 5.88[c] | |
| Writing Placement Level (mean) | 4.57[d] | 4.31[d] | |
| Employed Hours Per Week (mean) | 24.00 | 15.22 | .001 |
| Final Exam Score (mean) | 97.73 | 107.16 | .066 |
| Outcome (% positive[e]) | 39.29 | 65.31 | .007 |

[a]All significant differences at α = .10 are noted.
[b]The placement level is an institutional course readiness score based on ACT and/or ACCUPLACER test results. Math level 5.6 = ACT math score 19-20 or ACCUPLACER elementary algebra score 63-75.
[c]Reading level 5.7 = ACT (Read) > 23 or ACCUPLACER (CPT Read) 78-95.
[d]Writing level 5.7 = ACT (Write) > 23 or ACCUPLACER (CPT Write) 86-120.
[e]A positive outcome was defined as both completing the course and passing the final exam (i.e., score > 90/156). A negative outcome was defined as either withdrawing from the course or failing the final exam.

When evaluated individually, GPA, placement levels (math, reading, and writing), and employment were determined to be significant predictors of final exam score at an alpha level of .05 (Table 2). GPA, math placement, employment, and mode of delivery were determined to be significant predictors of outcome (Table 3). Sixty percent of students employed more than 12 hours per week and 60.7% of online students experienced a negative outcome, while only 25% of students employed 12 or fewer hours per week and 34.7% of F2F students experienced negative outcomes.

Table 2**.** *Summary of significant predictors of final exam score*

| Predictors | Bivariate Analysis | Multivariate (Regression) Analysis | | | |
|---|---|---|---|---|---|
| | | Without Estimated Exam Scores[a] | | With Estimated Exam Scores[b] | |
| | *p* | Coefficient (*SE*) | *p* | Coefficient (*SE*) | *p* |
| GPA | .0220 | | | | |
| Credit Load (credits) | * | -1.464 (0.720) | .04744 | -1.491 (0.743) | .04915 |
| Math Placement Level | .0001 | 21.783 (5.121) | .00009 | 20.216 (5.170) | .00023 |
| Reading Placement Level | .0001 | 9.759 (3.265) | .00430 | 9.194 (3.329) | .00759 |
| Writing Placement Level | .0055 | * | * | * | * |
| Employment (hours/week) | .0011 | -.624 (0.146) | .00009 | -.495 (0.155) | .00230 |
| Mode of Delivery | * | * | * | -11.801 (4.891) | .01883 |

[a]$R^2$ = .569, model significance = $7.28 \times 10^{-9}$, *N* = 56.
[b]$R^2$ = .490, model significance = $5.92 \times 10^{-8}$, *N* = 67.
*Insignificant at α = .05.

Course load, math placement, reading placement, and employment were found to be significant predictors of final exam performance when examined via multiple regression with backward elimination

(α = .05). The four-variable model produced explained 53.6% of the variance in final exam scores with very high significance (adj. $R^2$ = .536, $p$ = 7.28 x $10^{-9}$). Math placement and employment were found to be highly significant predictors of final exam performance (α = .0001). Further analysis demonstrated that a two-predictor model with math placement and employment could explain 45.0% of the variance in final exam scores with very high significance (adj. $R^2$ = .450, $p$ = 4.8 x $10^{-8}$).

Table 3**.** *Summary of significant predictors of outcome*

| Predictors | Bivariate Analysis | Multivariate (Logistic Regression) Analysis[a] | | |
|---|---|---|---|---|
| | *p* | Coefficient (*SE*) | *p* | Odds Ratio |
| GPA | .0002 | | | |
| Math Placement > 4 | .0037 | 1.8384 (0.6445) | .0043 | 6.2862 |
| Employment > 12 hours/week | .0088 | -1.3817 (0.6082) | .0231 | .2512 |
| Mode of Delivery (online) | .0086 | -1.2096 (0.5783) | .0365 | .2983 |

[a]Model significance = .0001, *N* = 71.

The predicted final exam score for students associated with a math placement level of 4 or less was 21.78 points lower (95% CI: -11.50 to -32.06) than the score predicted for students associated with a math placement level above 4. The predicted final exam score for students employed 40 hours per week was 24.95 points lower (95% CI: -13.22 to -36.69) than the predicted final exam score for unemployed students. An analysis of residuals produced no indication that the assumptions of the model were violated.

When estimated exam scores were included in the analysis, mode of delivery was found to be a significant predictor of final exam score at an alpha level of .05. The predicted score for online students was 11.8 points lower than the predicted score for F2F students (95% CI: -21.58 to -2.02). Despite the increased significance of mode of delivery, math placement level and employment remained the most significant predictors of final exam performance (Table 2).

Mode of delivery, math placement level (> 4), and employment (> 12 hours per week) were determined via logistic regression with backward elimination to be significant predictors of outcome at an alpha of .05. Online students, students placed at or below math level 4, and students employed more than 12 hours per week, were all significantly less likely than their peers to complete the course and to pass the final exam (Table 3). The *p*-value associated with the logistic model developed was highly significant (i.e., .0001).

**Discussion**

This study builds on a handful of studies that have compared student performance in online and F2F versions of the same course. It complements far larger studies that have looked at student performance in online and F2F courses across multiple disciplines and institutions.

Unlike a majority of similar studies published to date, the authors examined student performance at a 2-year institution with open enrollment using some predictors of student success that are commonly unavailable to investigators and often ignored (i.e., employment and caregiver status).

Students who enrolled in the online environmental biology course were older, worked more hours, and were more likely to describe themselves as primary caregivers than their F2F peers. In this respect, they were largely representative of online students at other institutions (Aud et al., 2011; Horn et al., 2006; Romero & Barberà, 2011; Xu & Jaggars, 2011).

A key finding is the importance of employment and academic preparedness as predictors of successful course completion. Of the students employed 12 or fewer hours per week, 75% completed the course and passed the final exam, whereas only 40% of the students employed more than 12 hours per week experienced the same positive outcome.

The four-predictor model produced by the authors indicates that nearly 55% of the variation in final exam scores can be explained by differences in course load, employment, and academic preparedness (i.e., math and reading placement levels). Students associated with math placement levels at or below 4 scored 21.78 points lower on the 156-point final exam than did their more proficient peers. Students employed full time lost 24.95 points relative to their unemployed peers. These figures are very high

relative to the standard deviation for final exam scores (i.e., 22.06 points) and equate to greater than a full letter grade drop in performance.

The significance of math placement as a predictor is interesting in that the course was not mathematically demanding. Algebra skills at the middle school level were sufficient to allow a student to perform very well on the final exam and the significance of math placement level warrants additional study.

The importance of employment as a predictor of final exam performance and successful course completion is noteworthy. Work is likely to reduce the number of hours available for study. It may also be impacting performance by diminishing opportunities for meaningful interaction with peers and instructors. Such interactions are clearly important (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006), and may already be restricted in online settings. Feelings of isolation appear to be common among online community college students (Bambara, Harbour, Davies, & Athey, 2009), and any sense of isolation is likely to be exacerbated by employment when work requirements limit opportunities to interact with other class members engaged in online activities. Studies have found that participation in online course discussions, in particular, can be a significant predictor of final exam performance (Schoenfeld-Tacher, McConnell, & Graham, 2001; Wolff & Dosdall, 2010). The latter study also found online course discussion participation to be a significant predictor of course completion.

A 2006 study of employed students at 4-year colleges found that those working 10 to 19 hours per week had higher GPAs than those working either less than 10 or more than 20 hours per week. The GPAs of students in the latter two categories were comparable (Dundes & Marx, 2006-2007). The authors found no evidence that a moderate number of hours employed per week was of benefit to the students in this study. Unemployed students performed significantly better on the final exam than their classmates working more than 12 hours per week.

The difference between the results obtained by Dundes and Marx (2006-2007) and the results reported here might be explained by the differences that exist between student populations in 2- and 4-year institutions (Armstrong, 2000; Fry, 2009; Horn et al., 2006). The difference in results might also be explained by the differences in variables measured. The authors studied the relationship between hours employed per week and final exam performance, and between employment and course outcome, in one course. Dundes and Marx studied the relationship between hours employed and GPA. Approximately 30% of the students in this study had not yet established a GPA, and it is possible that those who withdrew from or failed this course may never establish a GPA. One conclusion supported by both studies is clear: there is some point at which the number of hours employed per week has a significant and negative impact on student performance. This figure, furthermore, appears to be well below 40 hours per week.

The findings reported here are consistent with previous findings indicating that online students are significantly less likely than their F2F peers to successfully complete their courses (DeTure, 2004; Morris, Wu, & Finnegan, 2005; Urtel, 2008), even when other variables are taken into account (Carpenter et al., 2004; Xu & Jaggars, 2011).

The authors did not find mode of delivery to be a significant predictor of final exam performance when looking solely at the performance of students who completed the course, but the results obtained do not support claims that students enrolled in online courses perform as well as their peers in F2F courses (Driscoll, Jicha, Hunt, Tichavsky, & Thompson, 2012; Larson & Sung, 2009; Mentzer et al., 2007; Neuhauser, 2002). Mode of delivery was found via multiple regression to border on significance ($p$ = .066) and differences in attrition rates among online and F2F students appear likely to have masked a more significant finding. When quiz results were used to estimate the scores of students who withdrew from the course, mode of delivery was determined to be a significant predictor of final exam performance ($p$ = .019).

The results obtained by estimating final exam scores appear to highlight the importance of accounting for differential attrition rates when attempting to evaluate differences in online and F2F student performance. Students do not drop out of courses randomly. Carpenter et al. (2004) found, for example, that online attrition rates were highest among students associated with low developmental placement scores. In this study, students that withdrew from the class had significantly lower GPAs ($p$ = .001) than retained students. Consequently, differential attrition left the online course with students that were likely better prepared than their F2F counterparts when classes began.

The findings summarized above suggest that online student success rates could be enhanced by discouraging students with poor academic skills from enrolling in online courses and, perhaps, by providing working students with additional guidance during registration.

Students with poor academic skills face well-understood difficulties that may be exacerbated by enrollment in online courses. By requiring students to address their academic weaknesses before taking online courses, administrators may be able to reduce the number of risk factors associated with poor academic performance and improve online success rates.

Greater investments in mandatory counseling and online orientation programs targeting students with poor academic skills and encouraging F2F or hybrid enrollment, when possible, may be a practical alternative to policies outright prohibiting at-risk students from enrolling in online courses. Counseling and orientation programs for online students have been linked to success in online courses and have been credited with increasing online retention rates among community college students (Lorenzo, 2011; Wojciechowski & Palmer, 2005).

Mandatory counseling may well improve success rates simply by helping students develop more realistic expectations. Online students with accurate expectations are more successful than students with false expectations (Herbert, 2006; Nash, 2005). Mandatory counseling could be of particular benefit to working students, who may have trouble recognizing unmanageable course loads without help.

## Conclusion

The current cuts in funding for community colleges, reflecting a trend in higher education, force colleges to increase efficiency, provide quality education, and retain students. Online education may offer an avenue to achieve these goals with thoughtful implementation. To ensure that students taking online courses succeed and are retained, community colleges must aggressively seek to identify at-risk students and their needs. This effort will not be entirely successful unless a greater attempt is made to identify important predictors of student success previously overlooked or ignored due to a lack of readily accessible data. Because courses differ with respect to the prerequisite knowledge and demands they place on students, additional effort will also be needed to evaluate predictors of student success on a discipline-by-discipline and course-by-course basis. Similarly, differences in student bodies require that investigators perform more studies at 2-year colleges and avoid the assumption that findings at 4-year institutions can be readily applied to 2-year colleges.

## References

Allen, I. E., & Seaman, J. (2006). *Making the grade: Online education in the United States, 2006*. Needham, MA: The Sloan Consortium. Retrieved from http://www.sloanconsortium.org/sites/default/files/Making_the_Grade.pdf

Allen, I. E., & Seaman, J. (2011). *Going the distance: Online education in the United States, 2011*. Babson Park, MA: Babson Survey Research Group and Quahog Research Group. Retrieved from http://www.onlinelearningsurvey.com/reports/goingthedistance.pdf

Ambrose, H. W., & Ambrose, K. P. (1987). *A handbook of biological investigation* (4th ed.). Winston-Salem, NC: Hunter Textbooks.

Aragon, S. R., & Johnson, E. S. (2008). Factors influencing completion and noncompletion of community college online courses. *American Journal of Distance Education, 22*(3), 146-158. doi:10.1080/08923640802239962

Armstrong, W. B. (2000). The association among student success in courses, placement test scores, student background data, and instructor grading practices. *Community College Journal of Research and Practice*, *24*(8), 681-695. doi:10.1080/10668920050140837

Aud, S., Hussar, W., Kena, G., Bianco, K., Frohlich, L., Kemp, J., ... Tahan, G. (2011). *The condition of education 2011* (NCES 2011-033). Washington, DC: U.S. Department of Education, National Center for Educational Statistics. Retrieved from http://www.nces.ed.gov/pubs2011/2011033.pdf

Bambara, C. S., Harbour, C. P., Davies, T. G., & Athey, S. (2009). Delicate engagement: The lived experience of community college students enrolled in high-risk online courses. *Community College Review, 36*(3), 219-238. doi:10.1177/0091552108327187

Baxter, J. T., Hungerford, B., & Helms, M. M. (2011). Predicting success in the introduction to computers course: GPA vs. student's self-efficacy scores. *Information Systems Education Journal, 9*(2), 75-66. Retrieved from http://www.isedj.org/2011-9/N2/ISEDJv9n2p75.pdf

Belfield, C. R., & Crosta, P. M. (2012). *Predicting success in college: The importance of placement tests and high school transcripts* (CCRC Working Paper No. 42). New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/predicting-success-placement-tests-transcripts.pdf

Bello, G., Pennisi, M. A., Maviglia, R., Maggiore, S. M., Bocci, M. G., Montini, L., & Antonelli, M. (2005). Online vs. live methods for teaching difficult airway management to anesthesiology residents. *Intensive Care Medicine, 31*(4), 547-552. doi:10.1007/s00134-005-2561-0

Bettinger, E. P., & Long, B. T. (2005). Remediation at the community college: Student participation and outcomes. *New Directions for Community Colleges*, *129*, 17-26. doi:10.1002/cc.182

Bormann, J. M., Moser, D. W., & Bates, K. E. (2013). Factors effecting student performance in an undergraduate genetics course. *Journal of Animal Science, 91*(5), 2438-2443. doi:10.2527/jas.2012-5839

Callender, C. (2008). The impact of term-time employment on higher education students' academic attainment and achievement. *Journal of Education Policy, 23*(4), 359-377. doi:10.1080/02680930801924490

Capra, T. (2011). Online education: Promise and problems. *MERLOT Journal of Online Learning and Teaching, 7*(2), 288-293. Retrieved from http://jolt.merlot.org/vol7no2/capra_0611.htm

Carney, C., McNeish, S., & McColl, J. (2005). The impact of part time employment on students' health and academic performance: A Scottish perspective. *Journal of Further and Higher Education, 29*(4), 307-319. doi:10.1080/03098770500353300

Carpenter, T. G., Brown, W. L., & Hickman, R. C. (2004). Influences of online delivery on developmental writing outcomes. *Journal of Developmental Education*, *28*(1), 14-16, 18, 35. Available from ERIC database. (EJ718700)

Crawford, C., & Persaud, C. (2013). Community colleges online. *Journal of College Teaching & Learning, 10*(1), 75-82. Retrieved from http://www.cluteinstitute.com/ojs/index.php/TLC/article/download/7534/7600

Dennen, V. P. (2005). From message posting to learning dialogues: Factors affecting learner participation in asynchronous discussion. *Distance Education, 26*(1), 127-148. doi:10.1080/01587910500081376

DeTure, M. (2004). Cognitive style and self-efficacy: Predicting student success in online distance education. *American Journal of Distance Education*, *18*(1), 21-38. doi:10.1207/s15389286ajde1801_3

Driscoll, A., Jicha, K., Hunt, A. N., Tichavsky, L., & Thompson, G. (2012). Can online courses deliver in-class results? A comparison of student performance and satisfaction in an online versus a face-to-face introductory sociology course. *Teaching Sociology*, *40*(4), 312-331. doi:10.1177/0092055X12446624

Dundes, L., & Marx, J. (2006-2007). Balancing work and academics in college: Why do students working 10 to 19 hours per week excel? *Journal of College Student Retention: Research, Theory and Practice*, *8*(1), 107-120. doi:10.2190/7UCU-8F9M-94QG-5WWQ

Dutton, J., Dutton, M., & Perry, J. (2002). How do online students differ from lecture students? *Journal of Asynchronous Learning Networks, 6*(1), 1-20. Retrieved from http://www.sloanconsortium.org/sites/default/files/v6n1_dutton_1.pdf

Fike, D. S., & Fike, R. (2008). Predictors of first-year student retention in the community college. *Community College Review, 36*(2), 68-88. doi:10.1177/0091552108320222

Fleischauer, J. P. (1996). Assessing developmental reading courses: Do they have an impact? *Research and Teaching in Developmental Education, 12*(2), 17-24.

Fry, R. (2009). *College enrollment hits all-time high, fueled by community college surge*. Washington, DC: Pew Research Center. Retrieved from http://www.pewsocialtrends.org/2009/10/29/college-enrollment-hits-all-time-high-fueled-by-community-college-surge/

Furr, S. R., & Elling, T. W. (2000). The influence of work on college student development. *NASPA Journal, 37*(2), 454-470. doi:10.2202/1949-6605.1108

Gallien, T., & Oomen-Early, J. (2008). Personalized versus collective instructor feedback in the online courseroom: Does type of feedback affect student satisfaction, academic performance and perceived connectedness with the instructor? *International Journal on E-Learning, 7*(3), 463-476. Available from EdITLib Digital Library. (23582)

Gilmore, M. (2008). Predictors of success in associate degree nursing programs. *Teaching and Learning in Nursing, 3*(4), 121-124. doi:10.1016/j.teln.2008.04.004

Griffith, J., & Hunt-White, T. (2005*). 2003-04 National Postsecondary Student Aid Study (NPSAS:04): Undergraduate data analysis system* (NCES 2005164). Washington, DC: U.S. Department of Education, National Center for Educational Statistics. Retrieved from http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2005164

Hairston, N. R. (2007). *Employees' attitude toward e-learning: Implications for policy in industry environments* (Doctoral dissertation). Available from ProQuest Dissertations & Theses database. (UMI No. 3257874)

Halsne, A. M., & Gatta, L. A. (2002). Online versus traditionally-delivered instruction: A descriptive study of learner characteristics in a community college setting. *Online Journal of Distance Learning Administration, 5*(1). Retrieved from http://www.westga.edu/~distance/ojdla/spring51/halsne51.html

Harrell, I. L., II, & Bower, B. L. (2011). Student characteristics that predict persistence in community college online courses. *American Journal of Distance Education, 25*(3), 178-191. doi:10.1080/08923647.2011.590107

Herbert, M. (2006). Staying the course: A study in online student satisfaction and retention. *Online Journal of Distance Learning Administration, 9*(4). Retrieved from http://www.westga.edu/~distance/ojdla/winter94/herbert94.htm

Horn, L., Nevill, S., & Griffith, J. (2006). *Profile of undergraduates in U.S. postsecondary education institutions: 2003-04: With a special analysis of community college students* (NCES 2006-184). Washington, DC: U.S. Department of Education, National Center for Educational Statistics. Retrieved from http://www.nces.ed.gov/pubs2006/2006184_rev.pdf

Hughes, K. L., & Scott-Clayton, J. (2011). *Assessing developmental assessment in community colleges* (CCRC Brief No. 50). New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/assessing-developmental-assessment-brief.pdf

Jaggars, S. S., & Xu, D. (2010). *Online learning in the Virginia Community College System.* New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/online-learning-virginia.pdf

James, C. L. (2006). ACCUPLACER OnLine: Accurate placement tool for developmental programs? *Journal of Developmental Education, 30*(2), 2-8.

Jenkins, D., Jaggars, S. S., & Roksa, J. (2009). *Promoting gatekeeper course success among community college students needing remediation: Findings and recommendations from a Virginia study (summary report)*. New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/strategies-promoting-gatekeeper-success-summary.pdf

Johnson, S. G., & Berge, Z. L. (2012). Online education in the community college*. Community College Journal of Research and Practice*, *36*(11), 897-902. doi:10.1080/10668920903323948

Kaupp, R. (2012). Online penalty: The impact of online instruction on the Latino–White achievement gap. *Journal of Applied Research in the Community College, 19*(2), 8-16.

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2006). *What matters to student success: A review of the literature*. Washington, DC: U.S. Department of Education, National Center for Educational Statistics, National Postsecondary Education Cooperative. Retrieved from http://www.nces.ed.gov/npec/pdf/kuh_team_report.pdf

Larson, D. K., & Sung, C.-H. (2009). Comparing student performance: Online versus blended versus face-to-face. *Journal of Asynchronous Learning Networks, 13*(1), 31-42. Retrieved from http://www.sloanconsortium.org/sites/default/files/v13n1_4larson_0.pdf

Lei, S. A., & Gupta, R. K. (2010). College distance education courses: Evaluating benefits and costs from institutional, faculty and students' perspectives. *Education*, *130*(4), 616-631.

Lorenzo, G. (2011). *Online education learner engagement & academic success strategies at community colleges*. Williamsville, NY: Lorenzo Associates. Retrieved from http://www.edpath.com/images/OnlineLearningReportFinal2.pdf

Lynn, S. A., & Robinson-Backmon, I. (2006). Academic success of non-traditional students: Factors affecting performance in an upper-division undergraduate accounting course. *Journal of Teaching & Learning, 3*(12), 85-96. Retrieved from http://www.cluteinstitute.com/ojs/index.php/TLC/article/download/1653/1633

Mattern, K. D., & Packman, S. (2009). *Predictive validity of ACCUPLACER scores for course placement: A meta-analysis* (Report No. 2009-2). New York, NY: The College Board. Retrieved from http://research.collegeboard.org/sites/default/files/publications/2012/7/researchreport-2009-2-predictive-validity-accuplacer-scores-course-placement.pdf

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, DC: U.S. Department of Education, Office of Planning, Evaluation and Policy Development. Retrieved from http://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

Mentzer, G. A., Cryan, J., & Teclehaimanot, B. (2007). Two peas in a pod? A comparison of face-to-face and web-based classrooms. *Journal of Technology and Teacher Education, 15*(2), 233-246. Available from EdITLib Digital Library. (19863)

Michaelides, M. P. (2005). *North Carolina Community College System placement validity study*. New York, NY: The College Board.

Miller, K., Danner, F., & Staten, R. (2008). Relationship of work hours with selected health behaviors and academic progress among a college student cohort. *Journal of American College Health, 56*(6), 675-679. doi:10.3200/JACH.56.6.675-679

Morris, L. V., Finnegan, C. L., & Wu, S.-S. (2005). Tracking student behavior, persistence, and achievement in online courses. *The Internet and Higher Education, 8*(3), 221-231. doi:10.1016/j.iheduc.2005.06.009

Morris, L. V., Wu, S.-S., & Finnegan, C. L. (2005). Predicting retention in online general education courses. *American Journal of Distance Education*, *19*(1), 23-26. doi:10.1207/s15389286ajde1901_3

Muse, H. E., Jr. (2003). The web-based community college student: An examination of factors that lead to success and risk. *The Internet and Higher Education*, *6*(3), 241-261. doi:10.1016/S1096-7516(03)00044-7

Nash, R. D. (2005). Course completion rates among distance learners: Identifying possible methods to improve retention. *Online Journal of Distance Learning Administration, 8*(4). Retrieved from http://www.westga.edu/~distance/ojdla/winter84/nash84.htm

Neuhauser, C. (2002). Learning style and effectiveness of online and face-to-face instruction. *American Journal of Distance Education*, *16*(2), 99-113. doi:10.1207/S15389286AJDE1602_4

Peng, X., Le, T., & Milburn, R. K. (2011). Predicting a student's success at a post-secondary institution. *Journal of Applied Research in the Community College, 19*(1), 42-49.

Romero, M., & Barberà, E. (2011). Quality of learners' time and learning performance beyond quantitative time-on-task. *The International Review of Research in Open and Distance Learning*, *12*(5), 125-137. Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/999/1870

Schoenfeld-Tacher, R., McConnell, S., & Graham, M. (2001) Do no harm – a comparison of the effects of on-line vs. traditional delivery media on a science course. *Journal of Science Education and Technology*, *10*(3), 257-265. doi:10.1023/A:1016690600795

Schofield, C., & Dismore, H. (2010). Predictors of retention and achievement of higher education students within a further education context. *Journal of Further and Higher Education, 34*(2), 207-221. doi:10.1080/03098771003695478

Smith, A. R., Garton, B. L., Killingsworth, J. L., Maxwell, L. D., & Ball, A. L. (2010). Does prior college credit matter? A longitudinal investigation of academic success, retention, and degree completion. *Journal of Agricultural Education, 51*(3), 76-87. doi:10.5032/jae.2010.03076

Smith, V. C., Lange, A., & Huston, D. R. (2012). Predictive modeling to forecast student outcomes and drive effective interventions in online community college courses. *Journal of Asynchronous Learning Networks*, *16*(3), 51-61. Retrieved from http://www.sloanconsortium.org/sites/default/files/jaln_v16n3_5_Predictive_Modeling_to_Forecast_Student_Outcomes_and_Drive_Effective_Interventions_in_Online_Community_College_Courses.pdf

Steinweg, S. B., Davis, M. L., & Thomson, W. S. (2005). A comparison of traditional and online instruction in an introduction to special education course. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 28*(1), 62-73. doi:10.1177/088840640502800107

Stewart, C., Bachman, C., & Johnson, R. (2010). Students' characteristics and motivation orientations for online and traditional degree programs. *MERLOT Journal of Online Learning and Teaching, 6*(2), 367-379. Retrieved from http://jolt.merlot.org/vol6no2/stewart_0610.htm

Torres, V., Gross, J. P. K., & Dadashova, A. (2011). Traditional-age students becoming at-risk: Does working threaten college students' academic success? *Journal of College Student Retention: Research, Theory and Practice, 12*(1), 51-68. doi:10.2190/CS.12.1.d

Urtel, M. G. (2008). Assessing academic performance between traditional and distance education course formats. *Educational Technology & Society*, *11*(1), 322-330. Retrieved from http://www.ifets.info/journals/11_1/23.pdf

What are college placement tests? (2014). Retrieved from http://bigfuture.collegeboard.org/find-colleges/academic-life/what-are-college-placement-tests

Wojciechowski, A., & Palmer, L. B. (2005). Individual student characteristics: Can any be predictors of success in online classes? *Online Journal of Distance Learning Administration, 8*(2). Retrieved from http://www.westga.edu/~distance/ojdla/summer82/wojciechowski82.htm

Wolff, B. G., & Dosdall, M. R. (2010). Weighing the risks of excessive participation in asynchronous online discussions against the benefits of robust participation. *MERLOT Journal of Online Learning and Teaching, 6*(1), 55-61. Retrieved from http://jolt.merlot.org/vol6no1/wolff_0310.htm

Xu, D., & Jaggars, S. (2011). *Online and hybrid course enrollment and performance in Washington State Community and Technical Colleges* (CCRC Working Paper No. 31). New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved from http://ccrc.tc.columbia.edu/media/k2/attachments/online-hybrid-performance-washington.pdf

Zavarella, C. A. (2008). *Computer-based instruction and remedial mathematics: A study of student retention at a Florida community college* (Doctoral dissertation). Retrieved from http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1576&context=etd