

To Blend or not to Blend: A Case Study of On-line Learning in General Biology

Edwards, Yasmine ^{1a} and Faradj , Hisseine ^{2b}

^{1, 2} Bronx Community College of the City University of New York (CUNY)

^a Yasmin.edwards@bcc.cuny.edu, ^b hisseine.faradj@bcc.cuny.edu

Abstract

The drive to increase on-line course offerings has many motivations. The most compelling for Community College students is often the need to juggle family demands and the need to work while attempting to earn their college degree. On-line education began with the for-profit educational industry and the experiences of students in the for-profit arena has much to teach us. A significant feature is the high drop-out rates associated with massive on-line courses (MOOCs). Bronx Community College is a Hispanic Serving Community College, whose students could benefit from the flexibility on-line courses can provide. However, recent data suggests that these are the very students who tend to underperform in an on-line setting. The current work is a case study that compares the performance of students taking a hybrid general biology 1 course to students in the classic lecture sections of the course. The result indicates that students in the hybrid course sections show lower performance on common final exam assessments, lower passing grades and rates compared to students enrolled in the classic lecture sections of the course.

Keywords: Hispanic Serving Community College, general biology, online education.

The implementation of on-line course content is revolutionizing education. On-line courses, first adopted by for profit institutions is now also widely utilized by not-for profit institutions. The increasing reliance on the use of on-line instruction is occurring for many reasons. Potential advantages include increasing accessibility for non-traditional students balancing the multiple responsibilities of family, job and education (Wingard, 2004) . It has also been suggested that on-line instruction increases the interaction between students and faculty with the use of on-line discussion groups and various web based resources (Waddoups & Howell, 2002). Students and faculty have related positives to include flexibility, convenience and ease of interaction (Dziuban, Hartman, & Moskal, 2004). Students have rated the quality of their on-line experience as high or higher than their face-to-face courses (Waddoups & Howell, 2002). These are only some of the forces that have driven expansion of the on-line course format.

Massive on-line courses (MOOCs) have been a major driver in the evolution of on-line education. In theory, these courses can make educational opportunity available to all. However, some of the challenges observed in MOOC courses should be examined by not for profit institutions as they expand on line course offerings. In one report, of 35,000 students enrolled only 12% completed all the coursework. This trend is fairly typical across all MOOCs (Bernstein, 2013). While this level of attrition might be acceptable in the MOOC format, this is untenable in the classic educational format. Students who succeed in the on-line format tend to be self -motivated and are driven to complete the course based on strong interest. In a not for profit setting where students must often enroll

in courses not based on interest, but to satisfy graduation requirements, this presents an obvious hurdle.

In 2017, the Brookings Institute prepared a study titled “Promises and Pitfalls of on-line education” in which it was concluded that “student’s in on-line courses perform substantially worse than students in traditional in-person courses (Bettinger & Loeb, 2017).” Despite the many publications, which attest to the effectiveness of on-line course outcomes, the Brookings Institute Study suggests that there is cause to reevaluate the wide implementation of on-line courses. Specifically, the study indicated that these courses are especially difficult for students who are un-prepared for college level work in one or more subject areas. They determined that when these students take on-line courses their persistence and outcomes are subpar compared to similar students taking traditional face-to-face courses. At urban community colleges, where students often begin their college careers with the need for academic remediation – the findings of the Brookings Institute study suggest that greater thought and analysis should precede implementation of on-line courses, to ensure that students are spared the pitfalls revealed in the study. These challenges are especially relevant in Science, Technology, Engineering and Math (S.T.E. M) courses at minority serving institutions, where student preparation for college level courses is often deficient and is associated with low performance, increased dropout rates and low graduation rates.

Background

The student body of Bronx Community College (BCC) is a diverse group ethnically, consisting of 64% Hispanics, 32% blacks and 6% other groups, and by age

and demographics. Over one hundred languages are spoken by our students. As an open enrollment institution all New York State high school graduates or GED holders are given entry with most students requiring remediation in at least one subject area. Students are required to complete courses outside of their major in areas such as writing, science, mathematics and communications, social science and history. These requirements are meant to ensure that all students who complete an Associate's degree at BCC are prepared for the many paths our students choose to pursue. Some students go directly into the workforce through our professional programs such as the Nursing Program, Medical Laboratory Technician or Radiology programs, to name a few. Some students transfer to four-year colleges to complete the Bachelor's degree.

The non-major requirements ensure that educational gaps, which may have occurred due to years away from college for career changers, or high school drop outs who completed the General Education Diploma (G.E.D) to qualify for entry or recent high school graduates still requiring remediation – are addressed. Successful completion of the science requirement can be challenging for our students. In the Department of Biological Sciences at BCC the combined withdrawal and dropout rates for General Biology 1 (Biology 11) students can range between 30 - 40% each semester. Possible causes include, socioeconomic stressors, such as the time constraints experienced by students juggling school, family and work or lack of or loss of financial aid. Academic un-preparedness only adds to these difficult challenges.

The General Biology 1 course consists of two lecture hours per week and two, two - hour laboratory sessions per week. Students are given five lecture exams and four laboratory exams. The grades for laboratory and lecture are averaged and each contribute

fifty percent (50%) to the final grade. Students are instructed regarding the structure, function and differences between prokaryotic and eukaryotic cells, and are introduced to the structure and function of the human organ systems. For most students, this course is their first and possibly only laboratory-based science course. They are taught how to prepare slides, use a microscope and perform dissections of the sheep eye, brain and fetal pig during the laboratory section of the course. While students are invigorated by the new experiences, they are also overwhelmed by the course content. Often underestimating the study time required to succeed in the course. Poor study habits also precipitate the high withdrawal and dropout rates, and in part stem from the lack of previous exposure to a demanding laboratory-based science course before attending BCC.

The City University of New York like many not-for profit universities has been expanding on-line course offerings. No difference in implementation has been suggested between community colleges and four- year colleges, while these student populations vary greatly in their preparedness for college level work. Students admitted to the four-year colleges must meet higher criteria of entry not set for community college students. Faculty instruction related to teaching on-line sections, is that they teach the on-line version of the face-to- face lecture, using various media tools to replace face-to-face interaction. However, the 2017 Brookings study suggests that this will not be effective for the urban community college students we teach. The aim of this study is to determine how students enrolled a hybrid General Biology I course compare to those in a classic lecture section using common assessment questions.

Research method

The on-line General Biology course sections are taught using a blended format. This means that a portion of the course is taught on-line, in this case the lecture section and the laboratory section is fully face-to-face. Students who enroll for a hybrid section must have a minimum GPA of 2.5. They are required to review and complete the lecture content independently, using Blackboard. They are provided identical reading assignments, PowerPoint slides and homework. The on-line lecture section differs in that video links are included for each content area. Students are required to view the videos and complete on-line quizzes (face-to-face sections are given quizzes in-class) and participation in discussion boards (which replaces in-class discussions) is required. Hybrid students are instructed to attend office hours or use the discussion board or email to ask questions and to seek additional support. All students are referred to the departmental tutoring lab hours. The laboratory sections were taught identically.

Each semester all General Biology 1 students are required to answer common final questions, to assess student understanding of several core competencies. This is achieved using twenty-five (25) multiple choice questions which are scored by each instructor. For each course section, a benchmark of 70% of students answering a specific question correctly is the goal. Eight of the twenty-five questions were common to all the sections analyzed in the current study (the questions are updated each semester). Student withdrawal rates and impression of instructor were compared between hybrid and classic sections. Finally the grade distributions were also compared.

Results

Content areas covered by common final questions and comparison of percentage of incorrect answers for hybrid and classic lecture sections

Departmental assessments enable an objective comparison of student performance across all sections of the course taught in a given semester. These questions reflect content areas deemed most important by faculty teaching the course. These assessment questions are reviewed each semester allowing instructors to identify the concepts students find most challenging and adjust instruction as needed. Eight of these assessment questions were selected for analysis of four General Biology 1 sections. Two hybrid sections (asynchronous) meaning the lecture content was provided on-line and students could access the content and complete assignments using Blackboard at any time, and two of the sections were taught using the classical lecture format (two hours per week). Students in all four sections were required to attend in-class laboratory twice per week for a total of four laboratory hours per week.

In figure 1, the number of students who incorrectly answered the selected questions was averaged for the two hybrid sections ($n = 24$) and the two lecture sections ($n = 27$). Of the eight questions selected for comparison (because they were identical for all the sections selected). Over eighty percent of both hybrid and lecture students answered question 15 correctly (well above the departmental goal of seventy percent). On all other questions, the hybrid sections were ten (10%) percent points or more below lecture sections. The largest differences in performance were observed on questions related the concepts of homeostasis, plasma membrane structure and enzymes (questions 1, 6 and 8). In these areas, the difference between the hybrid and lecture sections was

over twenty percent, with the hybrid sections failing to meet the department mean of thirty percent incorrect or less. On five of the eight questions the hybrid sections failed to meet the department of goal of thirty percent incorrect or less, while for the lecture sections the average fell below department expectation on one of the eight questions (question 13 the graphing question). Quantitative analysis (question 13) was the one content area where both groups did not achieve the department mean.

Hybrid sections show lower withdrawal rates and higher perception of instructor compared to classic lecture sections

Students who register for a course only to find it very challenging often withdraw from the course. A comparison of withdrawal rates between groups might suggest how many students “feel” they are able to successfully complete the course after 7 weeks. In addition, students’ view of their instructor can be negatively impacted by instructional environments in which they do not see the professor face to face and their interactions are limited to on-line discussion groups. Figure 2 shows that the classic lecture sections demonstrate higher withdrawal rates compared to the hybrid sections. The classic lecture sections show a withdrawal rate of 44% compared to 30% for the hybrid sections. On a scale of 0 – 4, both groups rated the instructor above 3.5 (3.9 in the hybrid groups and 3.6 in the classic lecture groups). The impression of the instructor indicates that the hybrid students report a higher impression of the instructor which is coincident with lower withdrawal rates. On the other hand, the classic lecture sections report a somewhat lower impression of the instructor, which correlates with the higher withdrawal rates. These

results indicate that more of the hybrid students were confident in their ability to complete the course successfully.

Classic lecture sections achieve higher grades and course pass rates

Figure 3 indicates that the classic lecture sections achieved a greater distribution of higher grades. The same percentage (3%) of students in the hybrid and classic lecture sections achieved the highest grade in the course (A). However, a greater number of the classic lecture students achieved a grade of B - 11/27, compared to 5/24 of the hybrid students. While more of the hybrid students passed the course at the lowest passing grade of D - 8/24 compared to only 5/27 of the classic lecture students. The passing rates demonstrate that a lower percentage - 54% of the hybrid students passed the course with a grade of C or above (13/24). While 74% of the classic lecture students passed the course with a C or above (24/27). Indicating that a greater percentage of the hybrid students are achieving at the most basic level of competence, while a greater percentage of the classic lecture students demonstrate above average mastery of the content.

Discussion

The current analysis demonstrates that using an objective measure – namely the comparison of student performance on common final assessment questions tested in the same way (in person final exam) - the students enrolled in the hybrid sections did not achieve the minimum departmental standard for most of the questions reviewed. This is despite lower course withdrawal rates and rating the instructor more highly than the classic lecture students. The data supports the findings of the 2017 Brookings Study,

which indicate that on-line instruction needs to be modified to address the needs of community colleges students.

The fact that BCC students are required to have a 2.5 GPA to enroll in a hybrid course indicates that these students were performing at or above average in previous face-to-face classroom settings. For many students, the appeal of hybrid courses is having more free time to better juggle family demands and work while pursuing a college degree. However, no assessments have been done to determine how students manage the additional free time. Students should be assessed to evaluate whether there is a misperception regarding the time required to perform at or above average in a hybrid course. Thus, the assessment should evaluate the impact of the freed time on the performance of students by asking questions such as: how many hours of study are being dedicated to their course work? Are students working longer hours or taking up new jobs while enrolling in a hybrid course? Are students volunteering to help ailing family members or expecting/having newborn children?

Another area that the assessment may evaluate is the environment the students are immersed in while conducting the online assignments off campus. This is extremely important for students who live in urban settings such as the district of Bronx, New York. For example, are the students conducting online assignments in an environment conducive to learning, or are they distracted by domestic work? Are students conducting online assignments at home or at work? Are students able to access computers off campus, or are they relying on smartphones? The responses to these questions would direct the creation of student-centered solutions to improve performance. Interventions created to address the most pressing challenges could include the creation of structured

on- campus recitation classes, however, this would be a poor fit for students with severe time constraints. Alternatively, recitation sessions for small groups could be organized using Blackboard Collaborate. Ultimately, the application of any intervention intended to improve student performance in hybrid courses must be predicated on a thorough evaluation of the needs of the students.

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Figures

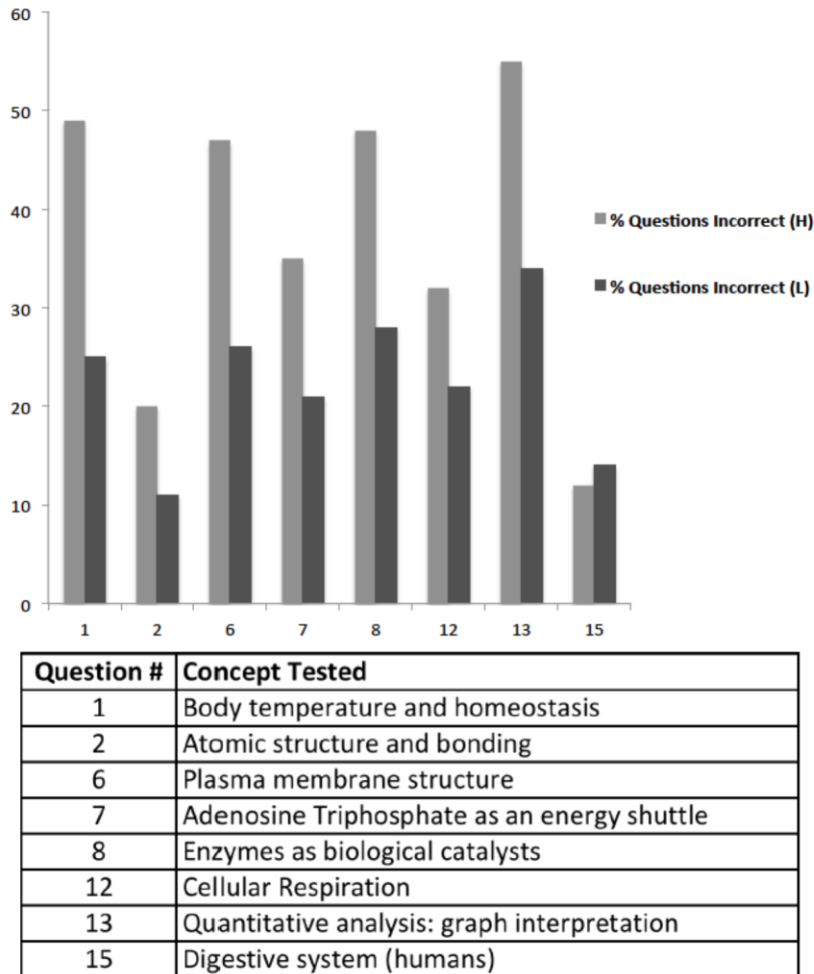


Figure 1: Comparison of student performance on assessment questions in both hybrid (H) (n = 24) and classic lecture (L) (n = 27) sections. The number of questions answered incorrectly are compared for eight common final questions. Two hybrid and two lecture course sections compared.

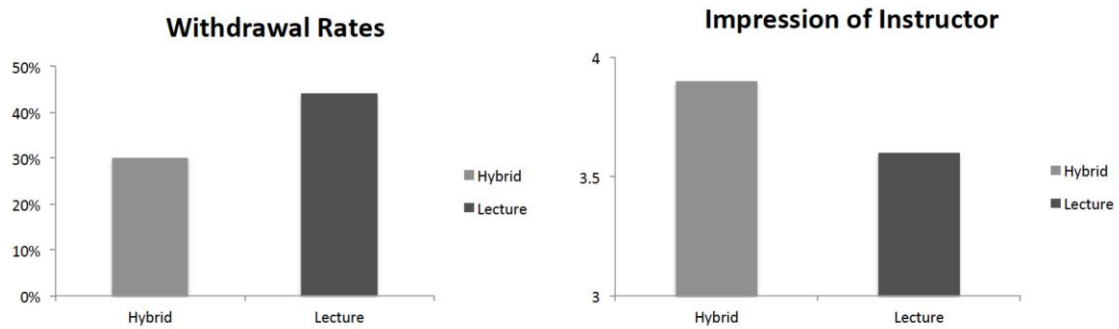


Figure 2: Higher withdrawal rates are observed in the classic lecture section compared to hybrid sections commensurate with lower impression of instructor

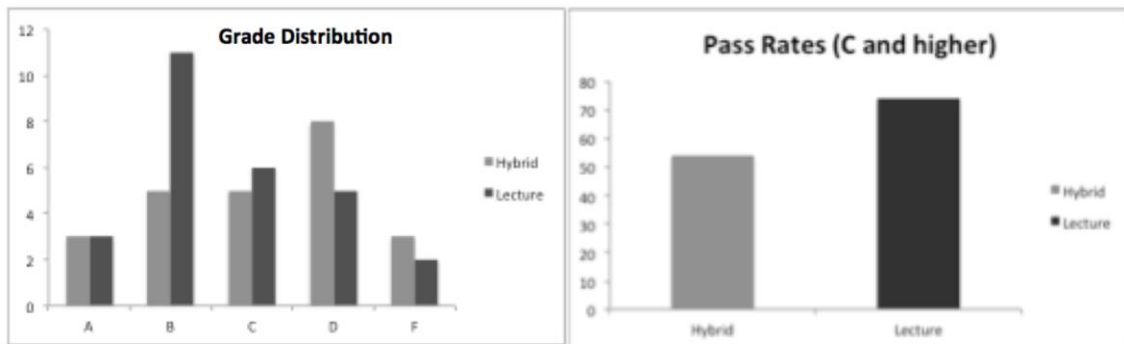


Figure 3: Classic lecture sections achieve higher grades and pass the course at higher rates.