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Prior online course experience and G.P.A. as predictors of subsequent online STEM course outcomes

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ABSTRACT

This study found that G.P.A. and prior online experience both predicted online STEM course outcomes. While students with higher G.P.A.s were also more likely to have successfully completed prior online courses, prior online course experience added significant information about likely future STEM online outcomes, even when controlling for G.P.A. Students who had successfully completed all prior online courses had significantly higher rates of successful online STEM course completion at all G.P.A. levels than students who had failed to complete even one prior online course successfully. Students who had dropped or earned a D or F grade in even one prior online course had significantly lower rates of successful online STEM course completion than students with no prior online experience, even when controlling for G.P.A. This suggests that prior online course outcomes should be combined with G.P.A. when attempting to identify community college students at highest risk in online STEM courses.

1. Introduction

This paper investigates the extent to which the nature of a student's prior online course experience may be a good predictor of subsequent online course outcomes, even when controlling for general academic performance (as measured by G.P.A.) and other characteristics. In particular, this study seeks to compare subsequent online course outcomes for students with no prior online experience and students with different types of prior online course experience (students who completed all prior online courses successfully with a "C-" grade or higher; students who did not complete any prior online courses successfully; and students who completed some but not all prior online courses successfully). By controlling for G.P.A. (and other student characteristics), we seek to explore the extent to which prior online course experience and outcomes may provide information about a community college Science, Technology, Engineering and Mathematics (STEM) student's likelihood of succeeding in the online environment specifically, as opposed to their likelihood of doing well in academic courses (both online and face-to-face) more generally.

1.1. Growth of online learning

In response to rapid advancements in technology, shifting life styles, and expanding enrollments, higher education has embraced online learning; online learning is now a standard method of instruction at most colleges and universities (Downes, 2005; Larreamendy-Joerns & Leinhardt, 2006; Sutton & Nora, 2008). This trend towards online learning is reflected in online enrollment growth rates that are over ten times higher than the growth in overall higher education enrollments (Allen & Seaman, 2010, 2013). Moreover, some experts assert that soon up to half of all traditional campus-based programs will be available online; the surge in online enrollment is expected to keep ascending with no plateau in sight (Allen & Seaman, 2011, 2013; Howell, Williams, & Lindsay, 2011).

The shift to online learning is particularly prevalent at the community college level. Research has established that community college students are more likely to take an online course than traditional 4-year students, and student demand for online learning opportunities at the community college level continues to rise (Capra, 2011; Horn & Nevill, 2006). In response, community colleges have almost universally embraced online learning as a way to better serve their large numbers of non-traditional students (Allen & Seaman, 2010, 2013; Community College Research Center (CCRC) (CCRC), 2013; Parsad, Lewis, & Tice, 2008). Almost half of all U.S. online programs are hosted by community colleges, and community colleges have the highest enrollment rates of all post-secondary institutions that offer online courses (Obama, 2012; Parsad et al., 2008; Ruth, Sammons, & Poulin, 2007). Since 2010,

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community college online enrollments have risen over 29%; today, over 60% of community college students have taken at least one course online (Community College Research Center (CCRC) (CCRC), 2013; Pearson Foundation, 2011).

1.2. Attrition in online learning

The rapid adoption of online learning does not necessarily equate to successful course outcomes. Online attrition rates are 30–40% in the U.S. and significantly greater than what is found in face-to-face courses (Boston & Ice, 2011; Carr, 2000; Hachey, Conway & Wladis, 2013a, 2013b; Howell et al., 2011; Morris & Finnegan, 2008-9; Patterson & McFadden, 2009; Tyler-Smith, 2006). Online attrition has been linked to overall academic non-success in higher education, prompting the concern that attrition in the increasing proportion of online courses offered at community colleges will have an adverse impact on degree completion rates which are already unsatisfactory (Boston & Ice, 2011; Diaz, 2002; Hachey, Conway & Wladis, 2013a, 2013b; Wladis, Hachey & Conway, in press). In particular, online attrition may impact degree completion of first-generation college students, low-income students, female students and students of color who make up the majority of community college students and who are already at greater risk of dropping out of degree programs (Bean & Metzner, 1985; U.S. Department of Education, 2003, 2009; Wladis, Hachey & Conway, 2012, in press; Zamani-Gallaher, 2007).

1.3. Community colleges and the need for STEM success

Research specifically focused on community colleges is warranted because of their unique role in U.S. higher education. Today, nearly half of all college freshmen begin their academic career at a community college (Finnegan, Morris, & Lee, 2008-9; Mooney & Foley, 2011). At a cost that is slightly more than a third of four-year colleges, and with open admission policies, community colleges are a crucial point of access for minority, low income, and first-generation postsecondary students who currently remain underrepresented in STEM fields (Anderson & Kim, 2006; Attewell, Lavin, Domina, & Levey, 2006; CCRC, 2013; American Association of Community Colleges, 2013; Ginder & Kelly-Reid, 2013; Huang, Tadese, & Walter, 2000; National Science Board, 2008; Provasnik & Planty, 2008).

Moreover, the research shows that almost half of all bachelor's and master's degree recipients in science, engineering and health have enrolled in classes at a community college (Fast Facts, 2011; Mooney & Foley, 2011). Data from a six year longitudinal study found that: 1) students who entered a STEM field associate's degree program were far less likely to have attained a degree than those who began in a baccalaureate program; 2) almost half of all students entering a STEM program changed majors or dropped out of college six years later; 3) older, independent, Black or Hispanic students were less likely to attain a STEM bachelor's degree in comparison to other students; and 4) only 7.3% of students who began at a community college received a STEM bachelor's degree after six years, in comparison to 45% of students who started in a baccalaureate program (U.S. Department of Labor, 2007). This has prompted an emphasis on building a STEM pipeline starting at the community college level; both enrollment and outcome data clearly indicate a vital need to improve the gateway into STEM programs and to provide assistance towards completion of STEM courses at the community college level (Mooney & Foley, 2011; U.S. Department of Education, 2009; Wladis, Hachey & Conway, 2012, in press).

With the rise of online learning, the proportion of students taking STEM courses online at community colleges is likely growing rapidly. However, there is currently little data available on the number of STEM courses offered online, particularly at community colleges. One recent study of Washington state community college students indicated that approximately 10% of all course enrollments were in online classes, with computer science classes showing greater enrollments than the average and math and natural science classes showing less than average online enrollments (Xu & Jaggars, 2013). According to the American Association for the Advancement of Science (AAAS), the majority of STEM studies have been conducted at Research Extensive and Research Intensive universities, and there is a gap in the literature on STEM enrollment, retention and graduation at the community college level (George, Neale, Van Horner, & Malcolm, 2001). The available, limited data report on fully online programs only, not courses offered, citing that the proportion of institutions offering fully online STEM programs ranged from 17% in engineering to 31% and 33% in computer sciences and health professions and related sciences (Allen & Seaman, 2010). However, the number of community colleges offering online courses within STEM disciplines is likely much higher (XXXX, 2012, in press).

1.4. Research on online STEM courses

There is a dearth of research on community college online learning, although some recent studies have focused on this important group of students (Jaggars & Xu, 2010; Xu & Jaggars, 2011a, 2011b, 2013). Most research on higher education, including the evaluation of online learning, is based on 4-year institutions and, because of differences in the student populations, it is difficult to generalize to community colleges (Capra, 2011; Marti, 2008). With research lagging, there is still not a clear understanding of the factors affecting online course outcomes, especially at the community college level (Community College Research Center (CCRC), 2013; Hachey, Wladis, & Conway, 2012, 2013a, 2013b). This gap in empirical knowledge is impeding effective interventions targeted to at-risk students, which Yen and Liu (2009) assert has kept attrition in online learning high at community colleges.

There is even less literature specifically devoted to the study of online STEM learning. The few research studies which have focused on STEM online learning specifically have all been at the baccalaureate or higher level, and have had relatively small sample sizes and methodology issues, thus they lack generalizability and applicability to community college online STEM courses specifically (Bowen, Chingos, Lack, & Nygren, 2012; Christou, Dinov, & Sanchez, 2007; Enriquez, 2010; Inov & Sanchez, 2006; Plumb & LaMere, 2011; Reuter, 2009; Riffell & Sibley, 2005; Smith & Ferguson, 2005). Recently, we conducted several studies at the community college level using a relatively large dataset and controlling for instructor and course taken, and we found that the gap between online and face-to-face attrition rates for the same course was significantly higher for STEM than for non-STEM courses. This points to the strong need for more research that can be used to target support services for online STEM students at community colleges. More focused research has the potential to dramatically improve STEM completion, in particular for traditionally disadvantaged and underrepresented groups in STEM fields that make up the bulk of community college student populations (Wladis, Hachey, & Conway, 2012; in press).

1.5. Research on academic preparation and previous online experience

Identifying students most likely to be at-risk in the online environment, so that targeted support can be provided, is a primary strategy for minimizing online course failure and dropout (Liu, Gomez, Khan, & Yen, 2007). However, to date, no single set of variables has been determined that is able to best predict which online students are at greatest risk, although several factors have been implicated in the existing research (Street, 2010). Although not yet rigorously researched, two of those most often cited as critical in the early detection of at-risk online students are previous G.P.A. and prior online experience.

Previous academic preparation, measured by G.P.A., has been posited as a key predictor of retention in online learning (Boston, Ice, & Burgess, 2012; Diaz, 2002; Muse, 2003; Nora, Barlow, & Crisp, 2005; Rovai, 2003; for a review see Xu & Jaggars, 2013). Aragon and Johnson (2008) cite G.P.A. as a strong predictor of online outcomes: they found that students who successfully completed their online course had an