Effectiveness of Fully Online Courses for College Students: Response to a Department of Education Meta-Analysis

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SUMMARY: Proponents of postsecondary online education were recently buoyed by a meta-analysis sponsored by the U.S. Department of Education suggesting that, in many cases, student learning outcomes in online courses are superior to those in traditional face-to-face courses. This finding does not hold, however, for the studies included in the meta-analysis that pertain to fully online, semester-length college courses; among these studies, there is no trend in favor of the online course mode. What is more, these studies consider courses that were taken by relatively well-prepared university students, so their results may not generalize to traditionally underserved populations. Therefore, while advocates argue that online learning is a promising means to increase access to college and to improve student progression through higher education programs, the Department of Education report does not present evidence that fully online delivery produces superior learning outcomes for typical college courses, particularly among low-income and academically underprepared students. Indeed some evidence beyond the meta-analysis suggests that, without additional supports, online learning may even undercut progression among low-income and academically underprepared students.

Introduction and Background

Over the past decade, online learning has become an increasingly popular option among postsecondary students. Yet the higher education community still regards fully online courses with some ambivalence, perhaps due to the mixed results of a large (if not necessarily rigorous) body of research literature. On the one hand, research suggests that students *who complete online courses* learn as much as those in face-to-face instruction, earn equivalent grades, and are equally satisfied (e.g., see Jahng, Krug, & Zhang, 2007; Phipps & Merisotis, 1999; Sitzmann, Kraiger, Stewart, & Wisher, 2006; Zhao, Lei, Yan, Lai, & Tan, 2005). On the other hand, online students are less likely to complete their courses (Beatty-Guenter, 2003; Carr, 2000; Chambers, 2002; Moore, Bartkovich, Fetzner, & Ison, 2003).

Skeptics of online learning raise concerns about the quality of online coursework. Some note that rather than developing approaches to teaching that would take advantage of the capabilities of computer-mediated distance education, instructors in many cases simply

transfer their in-class pedagogy to an online format (see Cox, 2005). Others suggest that student-teacher and student-student interactions are often limited (Bambara, Harbour, Davies, & Athey, 2009). These practices may contribute to low online course completion rates. Institutions harbor particular concern about online course performance among underprepared or traditionally underserved students, who are already at risk for course withdrawal and failure.

Advocates of online learning, in contrast, argue that technology-enhanced education can lead to superior learning outcomes, and that higher online dropout rates are due not to the medium per se but rather to the characteristics of students who choose online courses (see, e.g., Howell, Laws, & Lindsay, 2004). Advocates are also particularly optimistic about the potential of fully online coursework to promote greater access to college by reducing the cost and time of commuting and, in the case of asynchronous approaches, by allowing students to study on a schedule that is optimal for them. Indeed, this goal of improved access is one of the top drivers of institutional decision-making regarding increases in distance education offerings (Parsad & Lewis, 2008).

Recently, proponents of postsecondary online education were buoyed by a meta-analysis commissioned by the U.S. Department of Education (2009) which concluded that, among the studies considered, student learning outcomes in hybrid-online and fully online courses were equal to or better than those in traditional face-to-face courses. This conclusion included the caveat, however, that the positive effect for online learning outcomes was much stronger when contrasting hybrid-online to face-to-face courses than when contrasting fully online to face-to-face courses. In addition, the positive effect was much stronger when the hybrid-online course incorporated *additional* materials or time on task which was not included in the face-to-face course. Ignoring these subtler implications, popular media discussions of the findings (e.g., Lohr, 2009; Lamb, 2009; Stern, 2009) focused on the report's seemingly clear-cut generalization that "on average, students in online learning conditions performed better than those receiving face-to-face instruction" (U.S. Department of Education, Office of Planning, Evaluation, and Policy Development, 2009, p. ix). This interpretation has also extended into the discourse of the higher education community. For example, higher-education experts participating in an online panel for *The New York Times* cited the meta-analysis as showing that students in online courses typically have better outcomes than those in face-to-face courses ("College degrees without going to class," 2010). In this paper, we argue that such an interpretation is not warranted when considering fully online courses in the typical postsecondary setting. We also discuss implications of the studies for student access and progression among traditionally underserved populations.

Scope and Relevance of the Meta-Analysis

In contrast to previous reviews and meta-analyses that included studies of widely varying quality, the Department of Education report attempts to update and improve our understanding of online learning effectiveness by focusing on only rigorous research: random-assignment or quasi-experimental studies that compare learning outcomes between online and face-to-face courses. The meta-analysis includes both fully online and hybrid courses in its definition of "online courses." However, for institutions that aim to increase student access, fully online course offerings are a much more relevant concern, given that most hybrid courses require students to spend a substantial proportion of time on campus. For example, of the 23 hybrid courses that were examined in studies included in the meta-analysis, 20 required the students to physically attend class for the same amount of time that students in a face-to-face course would attend; the online portions of these courses were either in on-campus computer labs or were completed in addition to regular classroom time. Scaling up such hybrid course offerings is unlikely to improve access for students who have work, family, or transportation barriers to attending a physical classroom at specified times.

In keeping with the notion of improved student access as a strongly emphasized rationale for online learning, we first narrowed our focus to the 28 studies included in the Department of Education meta-analysis that compared fully online courses to face-to-face courses. Unfortunately, the majority of these studies are not relevant to the context of online college coursework for one of two reasons discussed more fully below: (1) conditions are unrepresentative of typical college courses, or (2) target populations are dissimilar to college students.

First, over half of the 28 studies on fully online learning concerned not a semester-length course but rather a short educational intervention on a discrete and specific topic, with an intervention time as short as 15 minutes. Moreover, some researchers who conducted the studies noted that they chose topics for the intervention that were particularly well-suited to the online context, such as how to use an Internet search engine. These studies, in general, may demonstrate that students can learn information on a specific topic from a computer as readily as they can a human, but the studies cannot address the more challenging issues inherent in maintaining student attention, learning, motivation, and persistence over a course of several months.[1] Given that many college students do not complete their online courses, student retention across the semester is a particularly important issue. As a result, these studies are minimally helpful to college administrators who are contemplating the potential costs and benefits of expanding semester-length online course offerings.

[1] Some practitioners question the utility of the Carnegie system of awarding credits on the basis of "seat time" in semester-length courses; they suggest that online learning could help convert instruction and learning into assemblages of short modules, with credits based on mastery of specific skills and topic areas. While this is an interesting frontier for further discussion and exploration, it does not now (nor will it in the near future) represent a widespread phenomenon at postsecondary institutions. Accordingly, we feel it makes most sense to focus on postsecondary courses as they are now typically structured.

Second, the studies were conducted across widely varying target populations, including primary school students and professionals outside of the college setting. When considering only those studies conducted with undergraduate or graduate students in semester-long online courses, the set of 28 studies is reduced to 7. Below, we discuss these seven studies in more detail.

Comparison of Student Learning Outcomes in the Seven Relevant Studies

In each of the seven studies of fully online semester-length college courses included in the meta-analysis, the courses were asynchronous such that students could log on and view lectures or other course materials at any time, although some required periods of synchronous chat. In all studies, the lectures, materials, learning modules, quizzes, and tests presented in the online and face-to-face classrooms were reasonably equivalent.

- Caldwell (2006) examined an introductory computer science class (focused on the programming language C++) at a historically Black state university. Students enrolled in the class were randomly assigned to one of three course modes: face-to-face (face-to-face lecture and labs, no web materials), web-assisted (lecture and course materials online, face-to-face lab), and online (all materials and lab assignments online), with 20 students in each group. The online group's only communication with the instructor was via email, and the only communication with other students was through voluntary means such as chat or discussion boards. Across the course of the semester, no students from any group withdrew from the course. Six outcome measures were examined, including two multiple-choice midterm exams, three programming assignments, and a "proficiency" final exam. There were no significant differences between the groups on any of these outcomes.
- Cavus and Ibrahim (2007) focused on a Java programming course at a private international university. Students enrolled in the course were randomly assigned to one of three course modes (face-to-face, online with standard collaboration tools, online with advanced collaboration tools), with 18 students in each mode. Both online courses included web-based course notes and quizzes, as well as voluntary chat and discussion forums. Students using the "standard" collaboration tool worked jointly with other students on programming code, then ran the programs on their own PCs. In addition, the "advanced" tool allowed students to run their programming projects online and to automatically share their outputs with other students and the instructor. Each online course met synchronously for two hours a week using the relevant collaborative tool, and online students also had the option of using the tools more often (although the extent to which they did so was not stated). Face-to-face students had no access to either online tool, and it is unclear whether other collaborative methods were built into the face-to-face course; it is also unclear whether the face-to-face students were taught in a lecture or a computer laboratory setting. Student withdrawal rates were not mentioned. The advanced-collaboration online course significantly outperformed both the standard-collaboration online and face-to-face courses on the midterm and final

exam; there was no significant difference between the standard-collaboration online course and the face-to-face course in terms of those learning outcomes.

- Davis, Odell, Abbitt, and Amos (1999) considered an introductory educational technology course for pre-service teachers at a state university. Course content included using common software packages, manipulating digital images, developing websites and multimedia instruction modules, and evaluating educational software. Students enrolling in the course were randomly assigned to either an online (learning modules/tutorials online, with all communications voluntary through chat, email, or phone), face-to-face (traditional lecture), or integrated mode (face-to-face lecture in conjunction with the web-based modules), with 16 to 18 students in each mode. Student withdrawal rates were not mentioned. Learning outcomes were evaluated using pre- and post-tests designed to assess students' overall understanding and skill level with educational technology. There was no significant difference among the three groups in terms of their increase in the learning outcome.[2]
- LaRose, Gregg, and Eastin (1998) assessed a large lecture-hall introductory course on telecommunications at a state university; 49 students were recruited to participate, with half remaining in the lecture hall and half taking the course online (lectures and notes online, with all communications voluntary through chat or bulletin board). Withdrawal rates were not mentioned. Learning outcomes were measured with three multiple-choice exams, which were summed together to create a total test score for each student. Results showed no significant difference between groups in terms of total test score.[3]
- Mentzer, Cryan, and Teclehaimanot (2007) focused on an introductory early childhood education course for undergraduates admitted to a teacher licensure program at a public university. Students enrolling in the course were invited to participate in the study; those who assented were randomly assigned to either an online or face-to-face section, with 18 students in each group. Online students were required to attend two hour-long synchronous chat sessions each week; they were also required to participate in small-group online activities. Student withdrawal rates were not mentioned. Across the semester, students in the online and face-to-face classes had the same test scores, but the online group was less likely to turn in assignments, leading to significantly lower overall grades for the online group (an average grade of B) in comparison with the face-to-face group (an average grade of A-minus).
- Peterson and Bond (2004) targeted postgraduate students seeking a certificate in secondary education at a public university who took either a course on the teaching of secondary reading or a course on the secondary curriculum. For each course, students chose to enroll in either a face-to-face or online section, with approximately 20 students in each of the four sections. Both types of classes

[2] The meta-analysis classified this effect size as positive (see U.S. Department of Education, Office of Planning, Evaluation, and Policy Development, 2009, Exhibit 4a), denoting that online group outcomes were (non-significantly) superior to face-to-face outcomes. In contrast, Davis et al. (1999, Table 1) reported that the face-to-face group increased more strongly, denoting a negative effect for the online course.

[3] The Department of Education meta-analysis reported the effect size direction as positive (i.e., in favor of online learning); however, the direction of the effect was not specified in the source article.

included discussion; online courses accomplished this through an asynchronous discussion board. Student withdrawal rates were not discussed. Performance was assessed based on the quality of a course project. As the study did not randomize students, the researchers attempted to control for potential pre-existing differences between groups by administering a pre-assessment of students' general understanding of the principles underlying the project. However, the pre-assessment was taken "well into the first half of the semester." Online students scored statistically significantly higher on the pre-assessment; after controlling for this difference, the two groups scored equivalently on the final project. Given the tardiness of the pre-test assessment, it is difficult to interpret this result. Did more-prepared students select into the online course, which was reflected in the pre-test scores? Or did the early weeks of the course prepare online students significantly better in terms of underlying project principles? Even without controlling for their pre-test advantage, however, the online group still scored similarly to the face-to-face group on the post-test, indicating that the online students did not retain their advantage over time.[4] In addition, eight students who had taken both an online and a face-to-face teacher education course from the two participating instructors were interviewed, and all eight felt that the face-to-face course had better prepared them for teaching.

- Schoenfeld-Tacher, McConnell, and Graham (2001) examined students in an upper-division tissue biology course at a state university. Students chose to enroll in either an online or face-to-face version of the course; subsequently, 11 students from the online course and 33 from the face-to-face course agreed to participate in the study. It was not clear whether these volunteers represented a majority of each classroom, a small subset of each classroom, or (given the unequal N) a majority of the face-to-face enrollees and a small subset of the online enrollees. The face-to-face course included traditional lecture and laboratory sessions; the online course included web-based versions of these materials as well as instructor-led synchronous discussions and voluntary learner-led online review sessions. Student withdrawal rates were not discussed. Learning outcomes were assessed using multiple-choice pre- and post-tests. In an attempt to remove potential selection effects due to the non-randomized design, student pre-test scores were treated as a control in the comparison of the group post-tests. Curiously, however, the pre- and post-test scores were not related (with $\eta^2 = 0.000$). Pre-test scores were also extremely low, with group averages of 10–15 on a scale that seemed to range to 100 (given that post-test group averages were in the 70-80 range with standard deviations above 10). Accordingly, it seems likely that the multiple-choice pre-test scores represented student random guessing and thus did not capture pre-existing differences between the groups in any substantive way. After controlling for the pre-test, online students showed significantly higher adjusted post-test scores; however, given the ineffectiveness of the pre-test, this result may merely reflect differences between students who chose to enroll in the online versus face-to-face course.

[4] The Department of Education meta-analysis classified this effect size as positive. However, the pre-post assessment increase was twice as strong for the face-to-face group compared with the online group, which would more properly be interpreted as a negative effect for online learning.

Summarizing across the seven studies, several themes are apparent:

Lack of consistent differences in outcomes between online and face-to-face. Across the seven studies, three showed no statistically significant differences in learning outcomes between the two types of courses (Caldwell, 2006; Davis et al., 1999; LaRose et al., 1998). Another study showed no quantitative differences but noted that qualitatively students felt they were better prepared by the face-to-face course (Peterson & Bond, 2004). It could be argued that the studies showing no statistically significant effects did so only due to small sample sizes; however, effect sizes in these studies were also quite small, and descriptively the direction of effects was mixed. For example, in Caldwell (2006) face-to-face students performed slightly better on three learning outcomes, while online students performed slightly better on the other three.[5]

The fifth study (Cavus & Ibrahim, 2007) provided two distinct results. First, as with the first four studies, students in the "standard" online course and the traditional face-to-face course had similar learning outcomes. Second, the incorporation of collaborative code-editing and output-review into the standard online course (thus composing the "advanced" course) resulted in outcomes superior to both the standard online course and the face-to-face course. Given the lack of information concerning the face-to-face course structure, it is difficult to interpret the meaning of this finding. If face-to-face students were given little or no opportunity for collaboration, then similarly superior results would likely be achieved by incorporating these features into the face-to-face course structure (e.g., via computer-based laboratory sessions). On the other hand, if the face-to-face course already incorporated similar collaborative methods, then perhaps the superiority of the *online* version of the tool lay in its 24/7 accessibility. The latter interpretation would provide a stronger argument for the potential strengths of online coursework, although it should be noted that such online tools could be equally readily incorporated into web-enabled face-to-face courses, hybrid courses, or fully online courses.

The sixth study showed that students in online courses were less likely to turn in their assignments and therefore earned lower grades (Mentzer et al., 2007). The final study found positive results for online students (Schoenfeld-Tacher et al., 2001); however, this study had the most dubious research strategy among all seven studies—it combined initial self-selection into course mode with volunteerism (at unknown and potentially unequal rates) into the study, and it included only a single and uninformative covariate—

[5] The three negative effect sizes for online learning (on both multiple-choice exams and the last midterm programming exercise) were stronger than the three positive effect sizes (on the first two midterm programming exercises and the final programming proficiency exam). The Department of Education report noted that while midterm examinations and assignments were considered appropriate for inclusion in the meta-analysis, when source articles included multiple outcomes, the authors typically selected the single outcome "that could be expected to be more stable and more closely aligned to the instruction" (p. A-5). Accordingly, the meta-analysts chose to include only the final programming proficiency exam, which showed a positive effect size for online learning. While this was certainly a reasonable choice, it does cloud the fact that the set of effect sizes for the Caldwell study was quite mixed and on average trended in a negative direction.

raising the strong possibility that the positive finding was an artifact of student self-selection.

Overall, then, the online courses showed no strong advantage or disadvantage in terms of learning outcomes among the samples of students under study. As a side note, in the meta-analysis summary table (U.S. Department of Education, Office of Planning, Evaluation, and Policy Development, 2009, Exhibit 4a), the reader finds that the effect sizes for six of these studies were reported as positive while one was reported as negative. Our re-examination of the studies suggests, however, that three should be classified as negative (Davis et al., 1999; Peterson & Bond, 2004; Mentzer et al., 2007), one as mixed (Caldwell, 2006), two as positive (Cavus & Ibrahim, 2007; Schoenfeld-Tacher et al., 2001), and one as unclassifiable based on information provided in the published article (LaRose et al., 1998). The strongest positive result (Schoenfeld-Tacher et al., 2001) was based on the lowest quality research design, and the other positive result (Cavus & Ibrahim, 2007) was due to the inclusion of a collaborative pedagogical tool which seemed to be unavailable to the face-to-face class.

Course selectivity. More than half of the studies targeted courses that explicitly taught technology or electronic communication concepts, perhaps because these topics were thought to be particularly well suited for online teaching and learning. As one author noted, the instructors felt it would be appropriate to create an online version of the course because "we would be using technology (the Internet) to teach how to use technology" (Davis et al., 1999). All online courses were small, typically containing 18 to 20 students. As a basis for comparison, only one third of online college courses contain 20 students or fewer (National Education Association, 2000). As a result, the findings from these studies may not generalize to large online classes or to classes addressing non-technology-oriented topics.

Student selectivity. All seven studies were conducted at mid-sized or large universities, with five rated as "selective" or "highly selective" by *U.S. News and World Report*, and all seemed to involve relatively well-prepared students. Four targeted students who were advanced in their course of study (Davis et al., 1999; Mentzer et al., 2007; Peterson & Bond, 2004; Schoenfeld-Tacher et al., 2001). Another (Caldwell, 2006) included primarily freshmen at a less selective institution, but prerequisites for the course included a high school computer science course and at least a C in a college-level algebra course, which represents a fairly high standard for entering college students, particularly for those at less selective and nonselective colleges. In three studies (LaRose et al., 1998; Mentzer et al., 2007; Schoenfeld-Tacher et al., 2001), students volunteered to participate. While participation rates were not explicitly specified, the rate was approximately one-third in Mentzer (who noted that 36 students volunteered from a pool of "100+") and approximately 21% in LaRose et al. (who reported the lecture-hall size as 230 for the previous semester but did not report the size for the semester under study). None of the studies specified how student volunteers differed from students who did not participate, but it is likely that the volunteers were more prepared or more motivated than students who chose not to participate. For example, another study of lecture-hall students who were recruited to participate in a study of online learning (and were then randomly

assigned to either the online or face-to-face group) showed that volunteers had significantly stronger subject knowledge at the beginning of the course than did students who chose not to participate in the study (Miller, Cohen, & Beffa-Negrini, 2001).

As an indicator of course and student selectivity, it is instructive to note that in Caldwell (2006) no students withdrew from any of the three studied courses, while in the remaining studies student withdrawal was not mentioned. This omission is striking, given that most instructors experience at least some rate of course withdrawal subsequent to the census date, regardless of whether the course is online or face-to-face. For example, one program at a highly selective university had an average course withdrawal rate of 12% (Cohoon, 2007), while a moderately selective university had course withdrawal rates of 26% (Cornwell, Lee, & Mustard, 2003). Studies of community colleges typically report course withdrawal rates in the 20–30% range, with higher withdrawal rates for online courses (Beatty-Guenter, 2003; Carr, 2000; Chambers, 2002; Moore, Bartkovich, Fetzner, & Ison, 2003). For example, a recent survey of community college administrators indicated that course retention was 65% for distance-education courses compared to 72% for face-to-face courses (Instructional Technology Council, 2009). For studies included in the meta-analysis that omitted mention of the course withdrawal rate, we are faced with two possibilities: (1) the students were highly selective at the outset, being so prepared or motivated that none withdrew; or (2) an unknown proportion of students withdrew, and only those who remained were compared in terms of their learning outcomes. In either case, the study results are applicable only to higher-performing and more-motivated students.

Even worse, if a higher proportion of lower-performing students withdraw from an online course than from a face-to-face course, then the students remaining in the online learning group will appear to have superior learning outcomes merely due to this unequal attrition. For example, in a study of a developmental writing course in a community college, students in the online version of the course were substantially more likely to withdraw over the course of the semester than were students in the face-to-face version (after controlling for initial reading and writing placement scores, gender, minority status, full-time student status, late vs. early registration for the semester, and age). It may not be surprising, then, that students who *stayed* in the online course were more likely to earn a good grade than were face-to-face students who stayed (Carpenter, Brown, & Hickman, 2004).

Summary across the seven studies. Perhaps one of the most interesting insights that emerged for us from reading the Department of Education meta-analysis is the small number of reasonably rigorous studies in this area despite the rapid growth of online education and the enthusiasm and high hopes associated with it. Although the meta-analysis was heralded as evidence of the superiority of online courses in higher education, we find that the analysis does not refute the common wisdom stated at the outset of this essay—that in comparison to face-to-face courses, the typical online college course has higher student withdrawal rates but equal learning outcomes among those who complete the course. Moreover, the evidence in regard to equality of learning outcomes seems applicable only to relatively well-prepared students. With these results in mind, we

discuss the implications of online learning for access and progression, particularly among low-income and academically underprepared students.

Implications for Low-Income and Underprepared Student Access and Success

The studies' focus on well-prepared or advanced students may not be surprising given that success in online courses is thought to require high levels of motivation, self-efficacy, persistence, communication skills, and computer literacy (Liu, Gomez, Khan, & Yen, 2007). However, this observation raises a key concern. A primary assumption underpinning the increase in online course offerings is that they increase educational access (Allen & Seaman, 2008; Beatty-Guenter, 2002; Cox, 2005; Epper & Garn, 2003; Kuenzi, Skinner, & Smole, 2005; Parsad & Lewis, 2008; Rogers, 2001), presumably for those who are traditionally underserved, such as low-income, rural or inner-city, first-generation, or academically underprepared students. These students may struggle with a variety of challenges that limit their ability to attend classes on campus: child care and other family responsibilities, full-time employment, prohibitive transportation costs, or a time-consuming commute. Thus it seems reasonable that the convenience and flexibility of fully online learning will particularly benefit them. Thus far, however, there is little evidence that online learning has increased college access or academic success for low-income and underprepared students.

Access. We know of no studies that have examined whether the postsecondary enrollment of low-income and underprepared students has accelerated as a result of the past decade's explosion in online learning. It seems clear, though, that this population will be underrepresented among the group of students who are enticed by the online modality to enroll in college. Low-income students may face significant barriers to both enrollment in and successful completion of online courses, such as lack of high-speed Internet access at home. In 2007, only 43% of households with incomes less than $40,000, 48% of adults who had at most a high school degree, and 52% of African Americans had high-speed Internet access at home (Rainie, Estabrook, & Witt, 2007). For many low-income students, then, there may be other options that would improve college access and progression more than would an increase in online course offerings. When asked to choose from a list the option that would most help them return to school, only 7% of college dropouts said that putting classes online would help the most—far below the proportion who selected cutting the cost of college by a quarter (25%), providing more loans (14%), allowing part-time students to qualify for financial aid (13%), or providing day care (12%) (Johnson & Rochkind, 2009).

Success. In addition to potential financial and technology barriers to online coursework, low-income and academically underprepared college entrants may also struggle with social and psychological skills, such as self-direction, self-discipline, and help-seeking, which most institutions feel are required for success in distance education (Liu et al., 2007). Of the seven studies included in the Department of Education meta-analysis that focused on postsecondary students in fully online semester-length courses, only one examined the impacts of the course method on lower-performing students: Peterson and

Bond (2004) performed a descriptive analysis suggesting that the lower one-third of students performed substantially better in the face-to-face setting than in the online setting. A larger scan of the research literature on online learning effectiveness uncovered only a few additional studies focusing specifically on low-income or academically underprepared students.[6] First, one additional experimental study was released after the publication of the meta-analysis (Figlio, Rush, & Lin, 2010). Similar to the studies included in the meta-analysis, relatively well-prepared university students were randomized into online or face-to-face sections of a microeconomics course. The study found no significant difference between the two groups overall but noted that among students who had low prior GPAs, those in the online condition scored significantly lower on in-class exams than did those in the face-to-face sections (Figlio, Rush, & Lin, 2010). Second, studies using institutional data suggest that underprepared community college students are more likely to withdraw from online than face-to-face courses, even after including a variety of controls. As noted above, Carpenter et al. (2004) controlled for an array of demographic factors and found that community college developmental writing students were statistically significantly more likely to withdraw from an online course. Similarly, a study of developmental mathematics in community colleges found that course withdrawal rates were two to three times higher in online sections than in face-to-face sections of each course (Blackner, 2000), a gap which remained significant after controlling for math anxiety, locus of control, and learning style. Another study of developmental mathematics students in community college found that completion rates were higher for face-to-face (80%) than online (61%) courses, a difference which remained consistent and was statistically significant after controlling for age, ethnicity, marital status, gender, and social-interaction learning style (Zavarella, 2008). In the Zavarella study, approximately half of the students who withdrew provided the reason for their withdrawal. Although sample sizes were small, 70% of online students withdrew because of technical problems, computer-based learning issues, or other factors related to the online nature of the course. These findings imply that low-income and underprepared students' academic success and progression may be reduced by participation in online courses. Overall, though, we have been struck by the dearth of relevant research in this important area.

Conclusions. Most institutions place a strong value on increasing access for underserved students. And much of the postsecondary reform agenda promulgated by major foundations, as well as by the current administration, is focused explicitly on improving the probability of success for students after they first enroll. Does online learning meet these goals? For well-prepared and motivated students, perhaps it does; the Department of Education meta-analysis demonstrates that online coursework does no harm to this population, and online education clearly offers these students the benefit of convenience and flexibility in the location and scheduling of their studies. For low-income and underprepared students, however, an expansion of online education may not substantially improve access and may undercut academic success and progression through school.

[6] The dearth of relevant studies discussed in the meta-analysis was not due to limited efforts on the part of the authors of that report; rather, the additional studies we uncovered would not have met the meta-analysts' criteria for experimental or quasi-experimental designs.

This does not mean that online education should not be expanded, but it does mean that a program designed to improve low-income and underprepared student access via online learning will need to attend to several important problems. First, in order for expanded online learning to translate to increased *access* for low-income students, the cost to students must be reduced, both in terms of tuition and at-home technological infrastructure. President Obama's 2009 proposal to expand education through freely available online courses appeared to be a step in the right direction, but this provision was eliminated when the Health Care and Education Reconciliation Act was passed. Free high-quality online courses would be particularly helpful if paired with the low-cost provision of high-speed Internet access and laptops to low-income students (for example, see Fairlie & London, 2009). In order for increased online course offerings to translate to improved *academic success and postsecondary progression* for low-income and academically underprepared students, we need to develop and evaluate programs and practices explicitly designed to improve such students' retention in online courses. Without a more critical examination of the pedagogical factors, student supports, and institutional structures that reinforce online students' academic commitment and motivation, it is unlikely that an increase in online offerings will result in a substantial increase in educational attainment among low-income and underprepared students.

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