Outcomes of distance education in quantitative business courses

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ABSTRACT

Comparative learning outcomes within the context of quantitative business courses offered remotely through the internet versus those offered in a traditional classroom setting remain an understudied topic. This paper reviews what is known about this relationship from prior research, and also adds to empirical evidence by comparing uniform CPA exam pass rates of graduates of remote-delivery accounting programs with those of more traditional classroom-based accounting programs. CPA exam pass rates are a well-known and highly respected measure of student accounting knowledge at graduation. This study finds graduates of remote-delivery accounting programs score, on average, much lower on the uniform CPA examination than do graduates of traditional classroom-based accounting programs. Further, remote-delivery accounting programs have surprisingly lower degree completion rates after six years, and have graduates who are much less likely to attempt the uniform CPA exam after graduation. These negative outcomes associated with remote-delivery accounting coursework are robust even in comparisons of remote-delivery accounting programs with subsets of classroom-based accounting programs including only less selective "open admission" classroom-based programs, and excluding from the classroom-based programs all "highly selective" and "selective" classroom-based programs based on ACT ratings.

Keywords: online, remote-delivery, quality, CPA exam, outcomes

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INTRODUCTION

The growth of distance education over recent decades, particularly in business, has been notable (Redpath, 2012; and Bryant, Kahle, and Schafer, 2005). Ubiquitous ownership of personal computers along with increasing access to a high-speed internet makes access to university coursework via electronic means, from any location, a practical possibility for an ever increasing percentage of the U.S. population. Distance education as a delivery mode is predicted to grow in the future (Ng, 2011; Gagne and Shepherd, 2001).

Growth of remote-delivery education has not been without its critics. Educators, employers, and others have expressed concerns about impact on educational quality. Academic research in a variety of academic context has investigated several aspects of "educational quality". Most of this research queries whether remote-delivery outcomes (course completion rates, student satisfaction, self-perceptions of learning, and actual learning) are comparable to classroom-based learning. Studies are most often done in the context of a single university within a single course offered both in the classroom and remotely with comparisons between student outcomes. At the present time, this literature is characterized as mixed, contentious, and unsettled (Arbaugh, Godfrey, Johnson, Pollack, Niendorf and Wresch, 2009).

Interpreting empirical studies which compare remote-delivery with classroom-based delivery has been particularly difficult because inherent limitations in research design, primarily related to differences in the types of students who enroll in each type of coursework, are unavoidable. Average age, gender composition, marital status, and average GPA are shown to differ systematically across groups seeking education remotely and in a classroom. Remote-delivery students tend to be older, male, married, and have higher cumulative GPA's than those of the average student enrolled in traditional classroom-based coursework (Schell, 2001). Gratton-Lavoie and Stanley (2009) and also Flanagan (2012) show not only do remote and traditional sections differ systematically on demographic variables (i.e. age, gender, marital status, GPA, SAT/ACT scores), these same variables are systematically correlated with educational outcomes making it difficult to separate the effects of delivery mode (remote versus in-class) from the effects of other factors differing across groups known to affect educational outcomes.

Not surprisingly, some conclude significant differences in the quality of remote education and traditional classroom-based education do not exist. Others have concluded just the opposite. A conclusion of "no (detectable) significant difference" between the educational outcomes of the two educational delivery models seems the most common finding in qualitative content areas including the more qualitative content business courses such as marketing and management. The two most recent literature reviews and one meta-analysis all conclude existing studies are mixed, confusing, and inconclusive overall. Outcomes are moderated by a variety of situational factors such as course content, student characteristics, and the measure of "quality" being tested when comparing outcomes (Arbaugh et. al., 2009; Shachar, 2008; Bekele and Menchacca, 2008).

In a very recent massive research study spanning five years (and published after the date of the literature reviews reported above) Xu and Jaggars (2013) track comparative persistence and other educational outcomes of remote-delivery education with traditional classroom-based education across a large group of community and technical colleges in a western state for five years. This study includes 125,218 course enrollments by 18,567 students and reports a robust negative result for remote learners both in terms of course persistence and course grades earned.

These findings are interpreted by the Xu and Jaggars as contradicting the conclusions drawn by many that there are "no (detectable) significant differences" in the two forms of education.

In spite of mixed outcomes in past research, a general public perception of the quality of distance education appears to be fairly negative (Metrejean and Noland, 2011; and Drago, Peltier, Hay, and Hodgkinson, 2005). Redpath (2012) suggests distance education in business is generally perceived in the workplace to be of relatively poor quality.

Studies do consistently show remote-delivery coursework has drop rates are notably higher than those in traditional classroom-based courses. Higher drop rates are most pronounced in undergraduate education (Xu and Jaggars, 2013; McClaren, 2004; and Diaz, 2002). Students having the highest satisfaction with, and the best learning outcomes from remote-delivery coursework tend to be married, graduate students, highly motivated, male, and living more than one mile from campus (Beqiri, Chase, and Bishka, 2010).

Of direct interst to this study is the relationship between course content, quantitative or qualitative, and comparative outcomes of remotely delivered education. Prior research has shown learning outcomes (measured by outcomes on common exams) differ most, and are most negative for remote delivery when course content is quantitative (Chen, Jones, and Moreland, 2013; Smith, Heindel and Torres-Ayala, 2008; Arbaugh, 2005; and Anistine and Skidmore, 2005). Prior studies have also shown lower student satisfaction with remote-delivery when course content is quantitative. No studies, in the specific context of quantitative content, find equal satisfaction or equal learning outcomes for remote-delivery education. Findings of "no significant difference" appear to be entirely confined to qualitative coursework.

There are surprisingly few published studies directly comparing *learning outcomes* (as differentiated from student satisfactionor student self-reported learning in remotely delivered quantitative business courses. Five studies of this type have been identified after an extensive literature search and each is briefly summarized below. Two of these compare outcomes of remotely-delivered accounting sections with classroom-based accounting sections; two others compare remote-delivery microeconomics sections with classroom-based microeconomics sections; and the final study compares a remotely-delivered section of business statistics with a classroom-based section of the same course. All five studies compare average test scores on common examinations as the measure learning from each type of course. Each of the five studies is conducted within the context of a single course at a single university, taught by a single instructor, and keeping as many other variables constant as possible. Two of these studies include in their reported results statistical corrections for systematic differences found between the two groups which could also affect learning outcomes. All five studies also report comparative satisfaction of students with the two types of course delivery.

In an accounting course study, Vamosi, Pierce, and Slotkin (2004) compared two sections of introductory financial accounting course at a single southeastern university. The same instructor presented lectures to both sections. Half of all course topics (opposite halves in each section) were presented by traditional face-to-face lectures and by remote-delivery (recorded) lectures in the other section. Live and recorded lectures covered twelve separate accounting topic areas, six presented face-to-face, and six presented remotely. As noted above face-to-face lectures in one section were the recorded and remotely-delivered lectures in the other section and vice versa. At the end of the course, student satisfaction and student learning outcomes on common exams were gathered and compared between the live and remotely delivered parts of the course in each section. Results showed students in both sections were significantly less satisfied with topics presented remotely even though these were opposing topics in the two

sections. Results also showed markedly lower comparative examination scores on the topics covered remotely, even though these were opposing topics in each section. The authors conclude student satisfaction and student learning appears to be lower if lectures are presented remotely rather than face-to-face.

In a second accounting study, Chen, Jones, and Moreland (2013) compared student satisfaction and student learning in three separate accounting courses over a three year period at a single AACSB accredited public university. The three courses examined were a sophomore level introductory accounting course, a junior level cost/managerial accounting course, and a junior level intermediate financial accounting course. In each case outcomes were compared for sections receiving content under two different delivery modes, remotely versus classroom-based. Each course was taught by a single instructor remotely and later in person, using the same textbook material, and employing the same examinations over the three year period. During the three year time span each course was presented remotely several semesters, and in person several semesters. Remote sections received all lectures through the internet. The remote section lectures were recorded lectures actually presented to the in-person sections. Students in remote-delivery sections were also required to participate in discussion boards to replace classroom discussion in the in-person sections. Students in both remote delivery and face-to-face sections completed the same homework assignments and took the same examinations over the three year period. Results show for all three courses, student perceptions of course effectiveness (a variable comprised of elements of student satisfaction and student perceptions of amount learned) were higher in semesters in which the courses were presented in-person rather than remotely. Further, in all three accounting courses, learning outcomes measured through outcomes on common multiple choice examinations were significantly higher in the semesters in which the course lectures were presented in-person rather than remotely. Interestingly, results also show performance differences were proportionately larger in the two more advanced accounting classes than in the introductory accounting class.

In a third study, outcomes in an introductory microeconomics course were compared. Stephenson, McGuirk, Zeh, and Watts-Reaves (2005) compared learning outcomes in a large face-to-face section of introductory microeconomics (108 students) with two smaller remotely-delivered sections of the same microeconomics course having 22 and 36 students each. All sections were taught during the same academic school year at the same university. The classroom based section, and one of the two remote sections, were taught by the same instructor of record. The second remote section had a different "instructor of record", but nevertheless received recorded lectures of the same instructor teaching the other two sections. All three sections covered identical topics, used the same course materials, and took the same tests (multiple choice with some objective short-answer). Delivery of lectures (either remotely or face-to-face) was the single difference between the two groups. The classroom-based section received a total of 14 lectures, each two and one-half hours in length which were presented once a week in person. The remote learners were provided a web address through which they could access a recorded video of the same 14 lectures presented to the face-to-face section recorded earlier in the week when given. Identical "lecture outlines" were provided to all 3 sections but were posted online for the distance learners and provided in paper form to the face-to-face section. Over the course of the semester, students in all sections were given the same one hour examinations comprised of multiple choice questions, definitions, and some short-answer questions. All students had the same time to complete examinations and all examinations were proctored in the same way. Results show student satisfaction with the two remote sections was

significantly lower than in the classroom-based section. Remote students perceived they had learned less and were significantly less satisfied with the course. More importantly, exam outcomes on the common exams were significantly lower in the remote sections both before and after statistically adjusting for the effects of several factors known to be correlated with learning outcomes such as GPA, SAT scores, pre-course attitudes, and age of students in each section. An additional analysis showed lower learning outcomes on tests in the two remote sections were largest for those students with average or below average college aptitude scores.

In a second microeconomics study, Brown and Liedholm (2002) found significant differences in the learning outcomes of remote-delivery education and face-to-face education. Comparisons were made between a single large face-to-face section of principles of microeconomics and a single large virtual section of the same course offered during the same school year at the same university. Virtual students were provided access to recorded video-stream lectures of the actual lectures presented to the face-to-face section ensuring both sections had identical lecture content. Course testing in both sections included 37 common questions. These 37 questions were divided into three subscales based on level of question sophistication: 1) sixteen questions were definition/recognition type questions (basic definitional questions); 2) eleven questions required a simple application or extension of a microeconomic concept (moderately difficult questions), and; 3) ten questions required a more complex application or extension of a microeconomic concept (difficult questions). Findings showed that the remote section, even though demographically comprised of students having better learning characteristics entering the course (i.e. higher average ACT scores, higher average GPA's, and more math courses completed) scored lower overall on the 37 common questions at the end of the course. While no significant differences in learning were found for the basic definitional/recognition type questions, significant differences were found in the moderate and difficult application questions. The remote section scored lower on average. The differences between the two groups were described as largest on the most difficult questions subscale.

In a fifth study, Lawrence and Singhania (2004) investigated comparative student performance in online sections and face-to-face sections of a business statistics course offered over a seven semester period from spring 2001 through spring 2003. Remote-delivery sections of the course and face-to-face sections were each offered four times during this period. During the entire time period the sections were taught by a single instructor (using both delivery modes in different semesters) and included identical course topics with identical examination questions for the entire research period. As in the other studies, lectures from the face-to-face classes were recorded and provided to the remote delivery sections over the internet. Results show the distance learning students scored significantly lower on common examinations in every semester.

These five empirical studies, in the context of quantitative business courses, suggest satisfaction and student learning in remotely-delivered quantitative business courses, are lower than in face-to-face sections. Negative outcomes connected to remote delivery were robust even after statistical corrections in two of the studies to remove systematic demographic differences among students in the two groups known to be correlated with learning outcomes. No published studies investigating quantitative business courses has yet reported equivalent learning outcomes or equivalent student satisfaction for quantitative remote-delivery coursework.

MOTIVATION

This study contributes to an understanding of comparative learning outcomes of remote coursework by comparing outcomes of distance education in accounting with more traditional classroom-based accounting education at a programmatic level (across institutions) rather than within a single course and institution. The measure used for comparing the two groups in the following study is the average CPA exam success of a program's graduates at each of the two types of accounting education, remote or classroom-based. Do course level differences in learning outcomes identified in earlier studies compound over a four-year education in ways negatively impacting uniform CPA exam performance after graduation, and therefore limiting career potential?

DATA SELECTION AND RESEARCH METHODS

Schools selected for analyses were those universities and colleges intersecting two sets of published data further and further narrowed by several other minor selection requirements described below. One published data set, *NASBA 2013 Uniform CPA Examination Candidate Performance* (NASBA, 2014) was the starting place for sample selection. *NASBA 2013 Uniform CPA Examination Candidate Performance* is published annually by the National Association of State Boards of Accountancy (NASBA) and lists average CPA exam outcomes in 2013 for listed institutions by name, if and only if the institution had graduates completing five or more CPA examination sections during the calendar year. If fewer than five sections were completed by an institution's graduates, NASBA did not list it. All listed institutions in the NASBA data set were initially selected for sampling.

A second database was also examined which is a product of the U.S. Department of Education. The *Institute of Education Sciences, National Center for Education Statistics (IES, 2014)* annually publishes data describing characteristics of U.S. based institutions of higher learning. This data is available online and includes summary information about each institution's characteristics such as proportion of students completing coursework remotely, degree completion rates over six years, bachelor's degrees granted by field, average standardized test scores of admitted students, and other similar demographic and statistical information about each educational institution.

The final research sample included those institutions identified in 2013 NASBA data, Appendix H (NASBA, 2014) and also described by U.S Department of Education statistics as being a four-year college or university, granting bachelor's degrees in accounting, and admitting freshmen cohorts each year. The sample included 890 four-year institutions of higher learning each with graduates who completed five or more first-time testing events on the uniform CPA exam during calendar year 2013.

The 890 institutions of higher learning were next sub-classified into three groupings: remote-delivery universities, classroom-based universities, and in-between. This classification was somewhat arbitrary by necessity. Well over 75% of the 890 institutions identified had at least 1% of its graduates engaged in at least one online course before graduation (IES, 2014). Nevertheless, most of these are not typically characterized as online universities since only a

very small percentage of students actually engaged in online course work before graduation, and no degrees were earned 100% through online coursework.

As an example, Auburn University, a large public state university offers an online accounting curriculum online as well as face-to-face. No students at Auburn University graduate through completing 100% of the accounting curriculum online, and only 9% of students engage in any online coursework whatsoever before graduating (IES, 2014). Auburn University is not an institution most would characterize as an "online university" even though it offers some courses online. At the opposite end of the spectrum are universities at which a vast majority of students engage in online learning and most complete 100% of their coursework online. Even at these universities students do occasionally take one or two face-to-face classes, even if only a relatively small percentage of the total student body. These universities would not typically be viewed as face-to-face teaching universities on the basis that they offer very few face-to-face classes.

In today's world an overwhelming plurality of higher education institutions offer at least one or two online courses. The question requiring an answer for purposes of this research is, in the operational sense, how shall a "remote-delivery university" be defined and how shall a "classroom-based university" be defined? Rather arbitrarily, a "remote-delivery university" is defined for purposes of this research as an institution offering its entire accounting curriculum remotely, and also meeting one of three threshold levels of students actually completing their entire curriculum online. The three thresholds are one-fourth of all students complete 100% of all coursework remotely, half of all students complete all coursework remotely, and three-fourths of all students complete all coursework remotely. These three levels of remote education by students were ascertained using U.S. Department of Education statistical data (IES, 2014).

For purposes of this research "classroom-based universities" have been defined as those having no graduates completing the entire bachelor's degree remotely and not offering a full accounting curriculum online. These characteristics could also be ascertained from U.S. Department of Education statistical data (IES, 2014).

Using these variables definitions, 37 "remote-delivery" accounting programs were identified granting a total of 6,111 bachelor's degrees in accounting in 2013 (IES, 2014). Graduates of these programs completed 1,716 CPA exam testing events in 2013 NASBA, 2014).

A total of 384 classroom based accounting programs were also identified. These schools granted 14,383 bachelor's degrees in accounting during 2013. Graduates of these programs completed 37,580 testing events during 2013 (IES, 2014; NASBA, 2014)).

The remaining schools in the full sample of 890 were classified as "in-between" accounting programs, mixing remote and classroom-based accounting in varying degrees. "In-between" programs were excluded from analysis and not included in either group.

The statistical analyses which follow employ one-way analyses of variance (ANOVA) which can ascertain whether CPA exam outcomes differ systematically at remote-delivery and classroom-based accounting programs. ANOVA is a well-known test statistic useful for comparing the means of two or more groups for purposes of rejecting a null hypothesis that no significant differences exist among or between groups. In the present study, the null hypothesis was that no significant differences exist in the average CPA exam pass rates of graduates of remote-delivery accounting programs and classroom-based accounting programs.

Results of three separate analyses are reported below. In a first analysis, CPA exam outcomes of the 37 remote-delivery schools are compared to those at the 384 classroom-based schools. In a follow-up analysis, the 37 remote-delivery accounting programs are compared to a

subset of the classroom-based accounting programs limited to those with "open admission" per Department of Education statistical data (IES, 2014). More precisely, classroom-based schools not requiring standardized test scores for admission (such as an ACT or SAT score) were compared to the 37 remote-delivery programs. This smaller set of classroom-based programs is expected to mitigate differences in student selectivity at admission, a bias that could otherwise partially confound results.

In a third and final analysis, yet another subset of classroom-based schools are compared to the 37 remote-delivery schools. In this analysis classroom-based schools categorized by the ACT as "highly selective" or "selective" by the ACT were excluded from the analysis (ACT, 2014). Thus, the third analysis compares the 37 remote-delivery schools to classroom-based schools exclusive of all the highly selective and selective schools.

RESULTS—ANALYSIS 1

In analysis 1, the average CPA exam outcome on sections taken by graduates at the 37 remote-delivery schools is compared to that of the full sample of 384 classroom-based schools. Table 1 (appendix) provides a graphical summary comparing mean CPA outcomes of remote-delivery programs at each of three levels of 100% of remote-delivery completion (i.e. 25%, 50%, or 75%) to the mean CPA outcomes of all classroom-based programs. As can be seen, remote-delivery programs have accounting graduates scoring, on average, much lower on the uniform CPA exam. The graph also shows remote-delivery program pass rates decline as the percentage of graduates who complete 100% of their coursework online increases.

Tables 2-4 (appendix) show results of three one-way ANOVA's comparing CPA exam pass rates of remote learners at each of the three levels of 100% online coursework completion to classroom learners. The null hypothesis ($p. < .05$) can be rejected at each of the three comparison levels. CPA exam outcomes of remote-learners are not the same as those of classroom learners at any of the three levels of online coursework. CPA exam pass rates of accounting graduates completing work remotely are significantly lower than those completing accounting coursework in a traditional classroom.

Tables 5-6 (appendix) show means and weighted means for all CPA exam sections completed by graduates of each group, and at each of three levels of 100% online completion. The fact that weighted mean of the classroom-based learners (weighted by number of CPA exam sections taken) is higher than the simple mean indicates larger classroom-based programs are generating, on average, higher CPA exam outcomes than smaller schools in that classroom-based group. Interestingly, the reverse is found to be true for remote-delivery schools. In this group the weighted means are lower than simple means indicating larger remote delivery programs (which are more heavily weighted in weighted means) generally have lower institutional-level CPA exam pass rates than smaller remote-delivery programs.

Table 7 (appendix) reports the mean graduation rates six years after enrolling for each group based on U.S. Department of Education statistics (IES, 2014). Students at the remote-delivery schools, at all three levels, have graduation rates only 30-40% of those of students from face-to-face schools. As the proportion of students completing all coursework remotely increases, graduation rates decline.

Table 8 (appendix) reports a ratio of CPA exam sections taken by graduates of each test group as a percentage of student's graduated from the program. Students from remote-delivery schools attempt proportionately many fewer CPA exam testing events per graduate than their

counterparts at classroom-based schools. At remote-delivery schools this rate averages only 10-15% that at classroom-based schools. Further, as the proportion of coursework completed remotely goes up, the ratio of CPA exam testing events to number of graduates goes down. These data collectively suggest remote-delivery accounting education is associated with lower graduation rates, reduced propensity to sit for the CPA exam after graduation, and significantly lower pass rates for those who do graduate from remote-delivery schools and sit for the CPA exam.

RESULTS—ANALYSIS 2

This analysis considers average CPA exam outcomes of graduates of the 37 remote-delivery schools to those of a subset of classroom-based schools from the first analysis. In the second analysis, only "open admission" classroom-based schools (i.e. classroom-based schools requiring no standardized testing before admission) are compared to the 37 remote-delivery schools. Since most remote-delivery schools do not require standardized testing before admission, it is informative to compare these schools to a sample of classroom-based schools that similarly do not require standardized testing before admission.

Table 9 (appendix) provides a graphical summary comparing mean CPA outcomes of remote-delivery programs at each of three levels of 100% remote-delivery completion (i.e. 25%, 50%, or 75%) to the mean CPA outcomes of a subset of classroom-based programs (open admission only). Remote-delivery programs again have average CPA exam outcomes markedly lower than the subset of classroom-based programs with open admission.

Tables 10-12 (appendix) show results of three one-way ANOVA's comparing CPA exam pass rates of remote learners at each of the three levels of 100% online coursework completion to classroom-based learners. The null hypothesis ($p. < .05$) is again rejected at each of the three comparison levels. Outcomes on the CPA exam for accounting graduates of remote-delivery schools are significantly lower than those of graduates at open admission classroom-based schools.

Tables 13-14 (appendix) show means and weighted means of each group, remote-delivery and classroom-based open admission. Once again weighted means for the classroom-based group are noticeably higher than the simple means with the reverse true for remote-delivery schools. These results again suggest larger programs with more students and heavier weighting in a weighted mean have somewhat higher outcomes on the CPA exam in classroom-based programs, but the reverse is true at the remote-delivery schools. Larger remote-delivery programs have even poorer results than smaller.

Table 15 (appendix) reports the mean graduation rates six years after enrolling for each group based on U.S. Department of Education statistics (IES, 2014). Students at the remote-delivery schools, at all three levels, again have graduation rates much lower than of those of students from the "open admission" subset of face-to-face schools.

Table 16 (appendix) reports a ratio of CPA exam sections taken by graduates of each test group as a percentage of student's graduated from the program. Students from remote-delivery schools still attempt proportionately many fewer CPA exam testing events per graduate than do their counterparts at open admission classroom-based schools. These data collectively suggest, even in comparisons to a subset of "open admission" classroom-based learners, remote-delivery learners still have lower graduation rates, lower ratios of CPA exam sections taken per program

graduate, and significantly lower CPA exam outcomes than those of their counterparts at classroom-based schools with open admission.

RESULTS—ANALYSIS 3

In the third analysis, the 37 remote-delivery programs are compared to a somewhat different subset of classroom-based schools than in analysis 2. Classroom-based programs in this analysis include schools requiring standardized test scores to gain admission, but exclude all classroom programs categorized by the ACT admissions classification system as either *highly selective* or *selective* based on average ACT scores of admitted freshmen. This comparison excludes from the classroom-based group the nation's most selective schools in terms of admission.

Table 17 (appendix) provides a graphical summary comparing mean CPA outcomes of remote-delivery programs at each of three levels of 100% remote-delivery completion (i.e. 25%, 50%, or 75%) to the mean CPA outcomes of a subset of classroom-based programs (low selectivity only). Remote-delivery programs again have average CPA exam outcomes markedly lower than the subset of classroom-based programs with lower selectivity at admission.

Tables 18-20 (appendix) show results of three one-way ANOVA's comparing CPA exam pass rates of remote learners at each of the three levels of 100% online coursework completion to classroom learners. The null hypothesis ($p. < .05$) is again rejected at each of the three comparison levels. Outcomes on the CPA exam for accounting graduates of remote-delivery schools are significantly lower than those of graduates at classroom-based schools with lower student selectivity at admission.

Tables 21-22 (appendix) show means and weighted means of CPA pass rates of the two groups. Once again, weighted means in the classroom-based group are higher than simple means with the reverse being true for the remote learner groups.

Table 23 (appendix) reports the mean graduation rates six years after enrolling for each group based on U.S. Department of Education statistics (IES, 2014). Students at the remote-delivery schools, at all three levels, again have graduation rates much lower than of those of students from the subset of face-to-face schools with lower selectivity at admission.

Table 24 (appendix) reports a ratio of CPA exam sections taken by graduates of each test group as a percentage of student's graduated from each program. Students from remote-delivery schools again attempt proportionately many fewer CPA exam testing events per program graduate than do their counterparts at lower selectivity classroom-based schools.

DISCUSSION AND CONCLUSIONS

After reviewing prior empirical research concerned with learning outcomes of remote-delivery and classroom-based education in quantitative business courses (i.e. accounting, microeconomics, and business statistics), additional evidence is presented showing remote-delivered accounting education in 2013 is correlated with lower CPA outcomes of graduates of these programs. The evidence presented here is unique in its broader approach to comparing outcomes at the programmatic level across many institutions and using average CPA exam outcomes of graduates of each group to compare groups. Significant differences are found in the average CPA scores of each group.

Results consistently show lower outcomes on the CPA exam for learners at remote-delivery programs than learners at classroom-based programs. Lower pass rates of remote-learners are robust even in comparisons with the subsets of "open admission" classroom-based schools, and lower selectivity classroom-based schools.

Results also show graduation rates six years after first enrollment are much lower at remote-delivery accounting programs, and are only 30-40% of those reported by classroom-based schools. Lower graduation rates at remote-delivery accounting programs remain in comparisons to only "open admission" and "lower selectivity" classroom-based programs.

Lastly, differences in the ratio of CPA exam sections attempted after graduation per program graduate also is consistently lower for remote learners. This ratio appears to be only 15-20% of that of classroom-based learners.

Collectively results have important implications for university trustees, university administrators, and faculty who are evaluating the desirability of increasing remote delivery of accounting education within an institution. While remotely delivered accounting education may increase the geographic area from which an institution can recruit, may reduce some "brick and mortar costs", may reduce faculty salaries in larger enrollment online courses, may be more convenient and flexible for non-traditional students, it appears also to come with some significant negative outcomes. Conclusions of "no significant difference" between the two forms of education are not consistent with the empirical results reported here which are in the context of quantitative business course content, in particular accounting coursework.

Current and future accounting students may also benefit from knowledge of these findings. Those who hope one day to become certified public accountants would be well advised to consider both the positive and negative aspects of completing an accounting education remotely.

LIMITATIONS AND FUTURE RESEARCH

This study has some limitations. For instance, it cannot logically be generalized to widely different contexts. Prior research reviewed suggests online education within the specific context of quantitative business courses appears to have inferior outcomes. From this it should not be inferred remotely delivered education in every context results in inferior results. Academic literature has reported there may be "no significant difference" in the two forms of delivery in courses and fields comprised primarily of qualitative content (Chen, Jones, and Moreland, 2013; Arbaugh, 2005).

To conclude, the purpose of this study has been twofold: to review existing empirical evidence that has already compared learning outcomes of remotely delivered and classroom-based coursework limited to the specific context of quantitative business courses, and secondly to advance knowledge in this area by describing the empirical relationship between educational delivery mode, remote or classroom-based, and CPA exam outcomes of each type of learner. Results provide persuasive evidence within a large sample of schools and students that remotely delivered accounting education is correlated with poorer average outcomes on the CPA exam, lower rates of graduation after six years, and lower ratios of CPA exam sections completed after graduation per program graduate.

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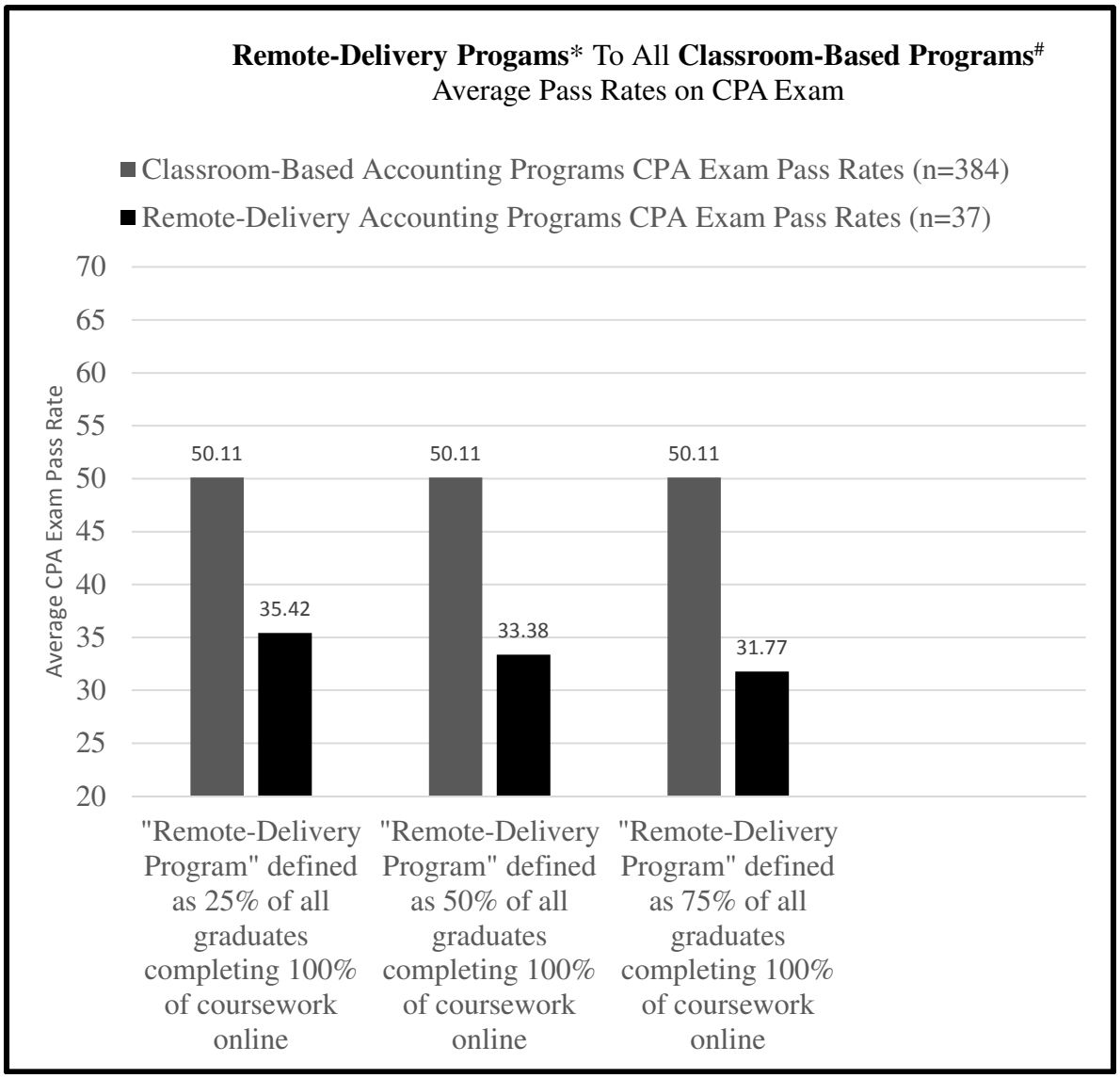
Appendix

Table 1
Graph Showing Comparative CPA Exam Outcomes By Education Type (All)



* -- Includes remote-delivery programs as defined (at three levels of remote course taking)
# -- Includes all classroom-based programs as defined

Table 2
ANOVA---25% of remote-delivery students graduating with 100% remote coursework (all)

Depend. Variable	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7275.246	1	7275.246	21.384	.00*
Within Groups	142548.731	419	340.212		
Total	149823.977	420			

*-statistically significant difference between groups; p. < .05

Table 3
ANOVA---50% of remote-delivery students graduating with 100% remote coursework (all)

Depend. Variable	Sum of Squares	Df	Mean Square		F	Sig.
Between Groups	5573.365	1	5573.365		16.372	.00
Within Groups	137192.080	403	340.427			
Total	142765.446	404				

*-statistically significant difference between groups; p. < .05

Table 4
ANOVA---75% of remote-delivery students graduating with 100% remote coursework (all)

Depend. Variable	Sum of Squares	Df	Mean Square		F	Sig.
Between Groups	3914.001	1	3914.001		11.309	.00
Within Groups	136355.949	394	346.081			
Total	140269.950	395				

*-statistically significant difference between groups; p. < .05

Table 5
Mean and sample size at 25%, 50% and 75% levels of 100% remote coursework (all)

Category	Mean % Pass Rate Of Schools 25% level	Mean % Pass Rate Of Schools 50% level	Mean % Pass Rate Of Schools 75% level
Classroom-Based (all)	**50.11** (n=384)	**50.11** (n=384)	**50.11** (n=384)
Remote-Delivery (all at level indicated)	**35.42** (n=37)	**33.38** (n=21)	**31.77** (n=12)

Table 6
W. A. Mean and sample size at 25%, 50% and 75% levels of 100% remote coursework (all)

Category	W.A. Mean % Pass Rate On Sections Taken 25% level	W. A. Mean % Pass Rate On Sections Taken 50% level	W. A. Mean % Pass Rate On Sections Taken 75% level
Classroom-Based (all)	**56.87** (n=37,580)	**56.87** (n=37,580)	**56.87** (n=37,580)
Remote-Delivery (all at level indicated)	**34.02** (n=1,716)	**33.03** (n=1,231)	**29.70** (n=763)

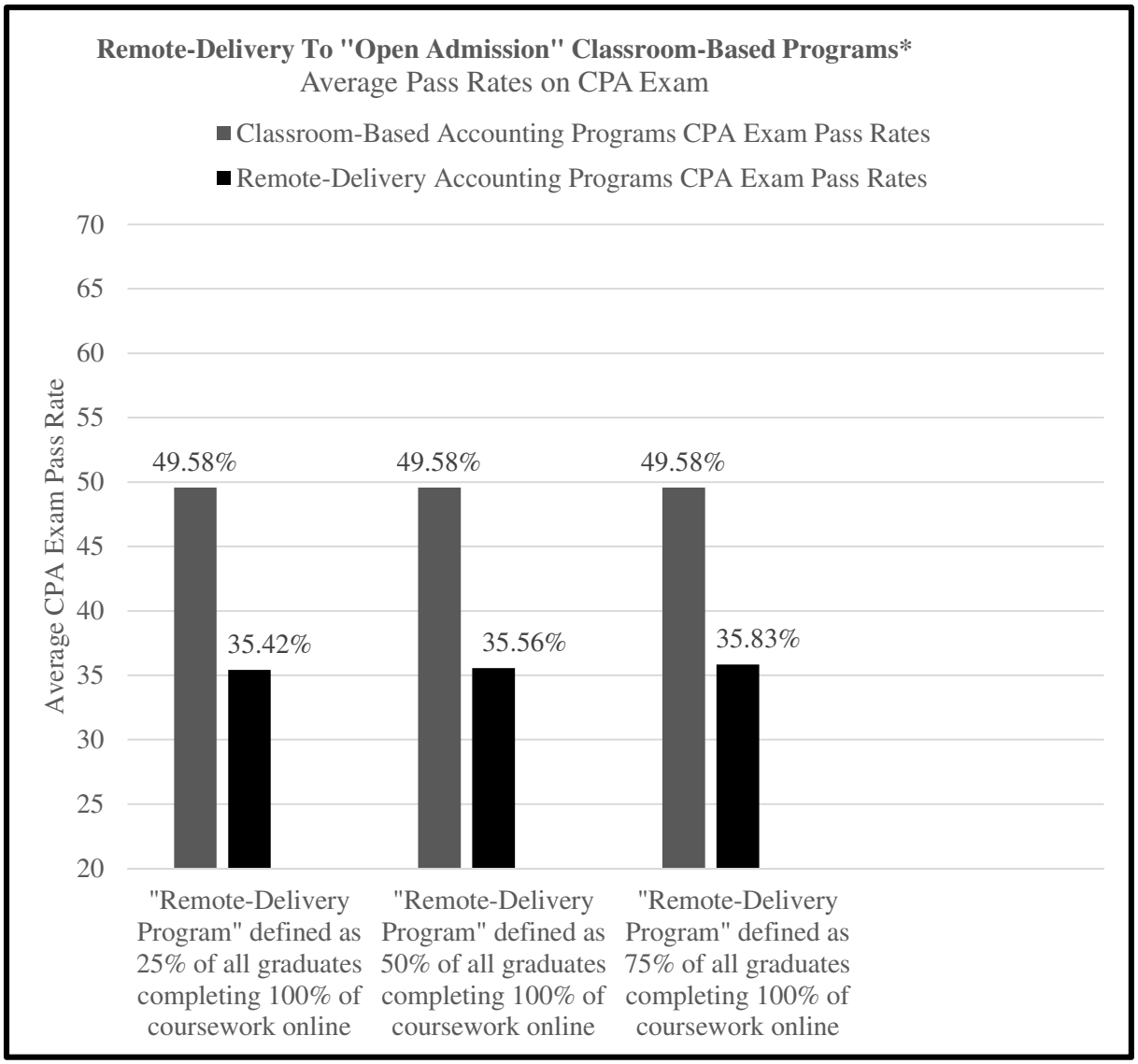
Table 7
Six-Year Graduation Percentages--Full-Time Graduating after 6 years (all)

Category	Graduation Rate 25% level	Graduation Rate 50% level	Graduation Rate 75% level
Classroom-Based (all)	**68.58%**	**68.58%**	**68.58%**
Remote-Delivery (all at level indicated)	**27.07%**	**23.62%**	**20.97%**

Table 8
Ratio of CPA exam sections attempted per accounting degree granted (all)

Category	Ratio of Exam Taking 25% level	Ratio of Exam Taking 50% level	Ratio of Exam Taking 75% level
Classroom-Based	**1.81**	**1.81**	**1.81**
Remote-Delivery	**0.25**	**0.21**	**0.16**

Table 9
Graph Showing Comparative CPA Exam Outcomes By Education Type
(Remote-Delivery to "Open Admission" Classroom-Based)



* -- Open admission schools are those that do not required standardized test scores for admission

Table 10
ANOVA---25% of remote-delivery students graduating with 100% remote coursework (compared to "open admission" classroom-based schools only)

Depend. Variable	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2918.427	1	2918.427	10.901	.00*
Within Groups	15796.241	59	267.733		
Total	18714.669	60			

*-statistically significant difference between groups; p. < .05

Table 11
ANOVA---50% of remote-delivery students graduating with 100% remote coursework (compared to "open admission" classroom-based schools only)

Depend. Variable	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2662.149	1	2662.149	12.111	.00*
Within Groups	11649.910	53	219.810		
Total	14312.059	54			

*-statistically significant difference between groups; p. < .05

Table 12
ANOVA---75% of remote-delivery students graduating with 100% remote coursework (compared to "open admission" classroom-based schools only)

Depend. Variable	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2222.820	1	2222.820	9.160	.00*
Within Groups	10919.958	45	242.666		
Total	13142.777	46			

*-statistically significant difference between groups; p. < .05

Table 13
Mean and sample size at 25%, 50% and 75% levels of 100% remote coursework (Includes "Open Admission" Classroom-Based Schools Only)

Category	Mean % Pass Rate Of Schools 25% level	Mean % Pass Rate Of Schools 50% level	Mean % Pass Rate Of Schools 75% level
Classroom-Based (open admission only)	**49.58** (n=24)	**49.58** (n=24)	**49.58** (n=24)
Remote-Delivery (all at level indicated)	**35.42** (n=37)	**35.56** (n=31)	**35.83** (n=23)

Table 14
W. A. Mean and sample size at 25%, 50% and 75% levels of 100% remote coursework
(Includes "Open Admission" Classroom-Based Schools Only)

Category	W.A. Mean % Pass Rate Of Candidates 25% level	W. A. Mean % Pass Rate Of Candidates 50% level	W. A. Mean % Pass Rate Of Candidates 75% level
Classroom-Based (open admission only)	**55.77** (n=58,507)	**55.77** (n=58,507)	**55.77** (n=58,507)
Remote-Delivery (all at level indicated)	**34.02** (n=1,716)	**34.77** (n=1,552)	**33.57** (n=1,137)

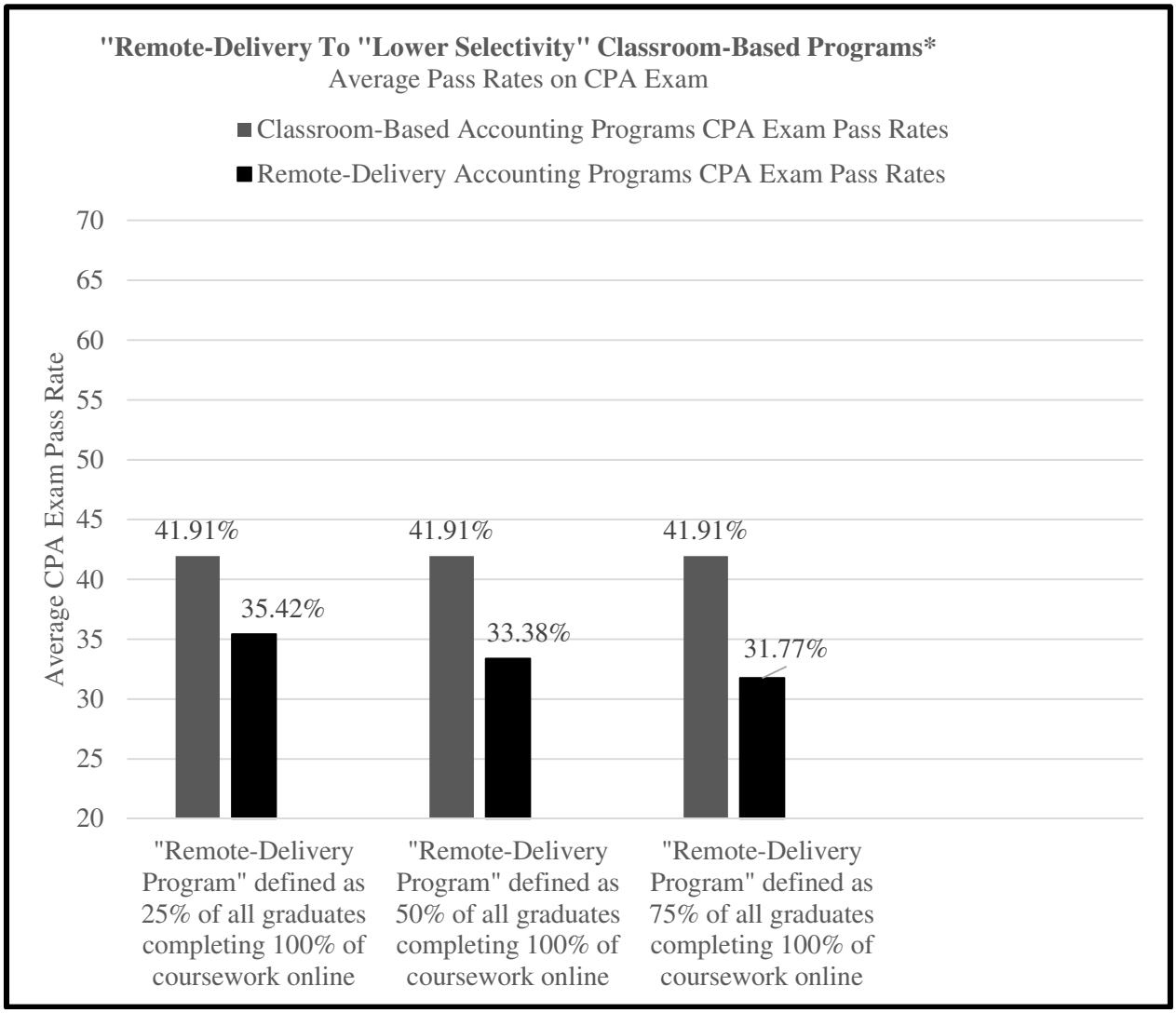
Table 15
Six-Year Graduation Percentages--Full-Time Graduating after 6 years
(Includes "Open Admission" Classroom-Based Schools Only)

Category	Graduation Rate 25% level	Graduation Rate 50% level	Graduation Rate 75% level
Classroom-Based (open admission only)	**55.98%**	**55.98%**	**55.98%**
Remote-Delivery (all at level indicated)	**27.07%**	**26.73%**	**25.61%**

Table 16
Ratio of CPA exam sections attempted per accounting degree granted
(Includes "Open Admission" Classroom-Based Schools Only)

Category	Ratio of Exam Taking 25% level	Ratio of Exam Taking 50% level	Ratio of Exam Taking 75% level
Classroom-Based	**1.51**	**1.51**	**1.51**
Remote-Delivery	**0.25**	**0.24**	**0.20**

Table 17
Graph Showing Comparative CPA Exam Outcomes By Education Type
(Remote-Delivery to "Lower Selectivity" Classroom-Based Programs)



* -- "Lower selectivity" classroom-based programs exclude all *highly selective* and *selective* schools per ACT selectivity classifications. *Highly selective* schools have composite ACT scores with the middle 50% centered around 27.5. *Selective* schools have composite ACT scores with the middle 50% centered around 23.5. The average composite ACT score of the face-to-face schools included in this comparison is 21.69.

Table 18
ANOVA---25% of remote-delivery students graduating with 100% remote coursework (compared to "lower selectivity" classroom-based schools only)

Dependent Variable	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1297.450	1	1297.450	4.570	.03*
Within Groups	62168.731	219	283.875		
Total	63466.182	220			

*-statistically significant difference between groups; p. < .05

Table 19
ANOVA---50% of remote-delivery students graduating with 100% remote coursework (compared to "lower selectivity" classroom-based schools only)

Dependent Variable	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1374.009	1	1374.009	4.910	.03*
Within Groups	56812.081	203	279.862		
Total	58186.090	204			

*-statistically significant difference between groups; p. < .05

Table 20
ANOVA---75% of remote-delivery students graduating with 100% remote coursework (compared to "lower selectivity" classroom-based schools only)

Dependent Variable	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1160.000	1	1160.000	4.020	.05*
Within Groups	55975.950	194	288.536		
Total	57135.950	195			

*-statistically significant difference between groups; p. < .05

Table 21
Mean and sample size at 25%, 50% and 75% levels of 100% remote coursework (Includes "Lower selectivity" Classroom-Based Schools Only)

Category	Mean % Pass Rate Of Schools 25% level	Mean % Pass Rate Of Schools 50% level	Mean % Pass Rate Of Schools 75% level
Classroom-Based (lower selectivity only)	**41.91** (n=184)	**41.91** (n=184)	**41.91** (n=184)
Remote-Delivery (all at level indicated)	**35.42** (n=37)	**33.38** (n=21)	**31.77** (n=12)

Table 22
W. A. Mean and sample size at 25%, 50% and 75% levels of 100% remote coursework
(Includes "Lower selectivity" Classroom-Based Schools Only)

Category	W.A. Mean % Pass Rate Of Candidates 25% level	W. A. Mean % Pass Rate Of Candidates 50% level	W. A. Mean % Pass Rate Of Candidates 75% level
Classroom-Based (lower selectivity only)	**56.88** (n=37,580)	**56.88** (n=37,580)	**56.88** (n=37,580)
Remote-Delivery (all at level indicated)	**32.85** (n=1,716)	**33.03** (n=1,231)	**29.70** (n=763)

Table 23
Six-Year Graduation Percentages--Full-Time Graduating after 6 years
(Includes "Lower selectivity" Classroom-Based Schools Only)

Category	Graduation Rate 25% level	Graduation Rate 50% level	Graduation Rate 75% level
Classroom-Based (lower selectivity only)	**68.58%**	**68.58%**	**68.58%**
Remote-Delivery (all at level indicated)	**27.07%**	**23.62%**	**20.97%**

Table 24
Ratio of CPA exam sections attempted per accounting degree granted
(Includes "Lower selectivity" Classroom-Based Schools Only)

Category	Ratio of Exam Taking 25% level	Ratio of Exam Taking 50% level	Ratio of Exam Taking 75% level
Classroom-Based	**1.81**	**1.81**	**1.81**
Remote-Delivery	**0.25**	**0.21**	**0.16**