

# Foundational MBA accounting and finance knowledge acquisition: Pedago's Quantic vs. traditional MBA programs

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# Executive summary

## Introduction

This study is a comparison of the outcomes of foundational MBA accounting and finance concepts learned through Quantic online courses compared to those learned through traditional brick-and-mortar business schools in the United States. We recruited 105 recent MBA graduates and current students (“MBA group”) who had completed relevant accounting or finance coursework, with 51 and 54 participants in the Accounting and Finance groups, respectively. MBA participants came from 26 U.S. universities. The comparison group that went through the Quantic program (“Quantic group”) is composed of 77 college graduates (34 Accounting, 43 Finance) who had not studied anything in the respective subject matter areas.

Pedago funded this study and provided significant input and support for the design and execution of the research. The authors, however, provided independent data analysis and conclusions, and advised on all aspects of participant recruitment, selection, communication, and assessment.

## Assessment

Pedago partnered with subject-matter experts to create two custom, online assessments in each subject. Participants in the Quantic group took a one-hour pre-test, completed Quantic courses in their respective subject matter areas (including receiving at least an 80 percent pass rate on quizzes), and then completed a post-test. Participants in the MBA group completed the post-test only. Preliminary analyses show that learners in the Quantic groups performed as well as or better than MBA participants at post-test.

## Coursework

The Quantic Accounting participants completed the Quantic courses *Accounting I: Fundamentals* and *Accounting II: Revenue and Expenses*. These courses help students discover financial statement preparation principles, learn bookkeeping mechanics for basic transactions, and take a deeper look at how to account for revenues and expenses, including the cost of goods sold and depreciation.

The Quantic Finance participants completed the Quantic courses *Finance: Time Value of Money*, *Valuation I: Discounted Free Cash Flow*, and *Cost of Capital I: Capital Structure*. These courses are intended to help students acquire basic mathematical ability around the time value of money, gain familiarity with some financial terminology, use tools to forecast a company’s future free cash flows, apply financial math to value a company by discounting those cash flows back to the present, and evaluate a company’s balance between debt and equity as a means of assessing the profitability of proposed projects.

## Findings

### Improvement (pre-test to post-test): Quantic participants

Quantic participants improved an average of 29 percentage points (Accounting) and 33 percentage points (Finance) from pre-test to post-test. Statistical analyses indicate that there are significant changes from pre-test to post-test for the participants in both Accounting and Finance.

Course	Number of participants	Mean test score		Score Improvement
		Pre-test	Post-test	
Accounting	34	57%	86%	29 points
Finance	43	49%	82%	33 points

Though Quantic participants took a similar test twice within two weeks, it is unlikely that this improvement is due to practice or memory effects. After the pre-test, Quantic participants did not receive feedback on their performance, could not view correct answers, and could not view the test again.

### Post-test performance: Quantic versus MBA

Quantic groups performed as well as, in the case of Finance, or better than, in the case of Accounting, the MBA groups on assessments of the topics studied.

Course	Quantic		MBA	
	Mean Post-test score	Number of participants	Mean Post-test score	Number of participants
Accounting	86%	34	75%	50
Finance	82%	43	81%	54

### Time Spent in Quantic Courses

On average, Quantic participants spent 147 minutes completing accounting coursework and 118 minutes completing finance coursework. These times were in line with course estimates of 128 minutes for Accounting and 111 minutes for Finance.

### Participant evaluation of Quantic custom assessment

At the end of the post-test, all participants were asked, “Do you think this was a fair assessment of your [accounting / finance] knowledge? (Yes / No)”, and were also asked to explain their response. A majority of participants said that the custom Quantic Accounting assessment was fair (85 percent Quantic, 86 percent MBA); the Finance assessment was also considered fair (84 percent Quantic, 69 percent MBA).<sup>1</sup> Representative comments include:

**MBA (Accounting)** “It asked the fundamentals that I learned in Accounting I”

**Quantic (Finance)** “I was pleasantly surprised that the answers I had zero clue about in the pre-assessment, I now understood.”

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<sup>1</sup> Only 26 of 54 the MBA Finance participants answered this question. The question for this group was sent out via email a few weeks after the post-test was taken, so the lower response rate may have just been circumstantial and should not be taken as an intentional unwillingness among this group to answer this question.

## Quantic participant satisfaction (Net Promoter Score)

Quantic participants were asked to respond (at the conclusion of the second test) to a standard satisfaction question, “How likely are you to recommend Quantic to a friend?”, on a scale of 0 (Would not recommend) to 10 (Definitely would recommend). The Net Promoter Score, NPS, is calculated as the percentage of respondents answering 9 or 10 (promoters), less the percentage of respondents answering 0 to 6 (detractors), with scores ranging from -100 to 100.

The Quantic accounting course had 58 percent promoters and 6 percent detractors, receiving an NPS score of 52. The Quantic finance course had 49 percent promoters and 9 percent detractors, receiving an NPS score of 40. These scores are in line with recent NPS scores for the Harvard MBA program and Wharton MBA program of 41 and 51, respectively.<sup>2,3</sup> Representative comments include:

**Accounting**      “I actually really loved the courses. I felt like I learned a lot and was consistently engaged - the layout was great and constantly answering questions and clicking through was super entertaining/helpful. I would definitely take more courses in the future if offered.”

**Finance**            “Excellent. I feel I learned an extraordinary amount in a short period of time. The challenges and questions were the perfect balance between challenging and fun.”

## Conclusions

Many companies are looking for the skills developed while pursuing an MBA. However, the pursuit of an MBA may not always be the right choice for all learners, either due to financial, geographic or time constraints.

This study supports the assertion that some of the foundational accounting and financial concepts taught in traditional brick-and-mortar MBA program can be learned independently, online through Pedago’s targeted Quantic active-learning courses. Significant improvement in students’ knowledge can be gained in as little as two hours of engagement with these courses.

In addition to being taken on their own as part of a comprehensive independent study MBA program, these courses could be used as supplements to existing MBA programs. First, they could be used as remedial materials for incoming MBA students who need to enhance their understanding of basic concepts in certain subject matter areas. Second, they could be used by MBA instructors as pre-requisite work for blended-learning classes. By having students learn basic concepts and complete structured practice exercises on their own, instructors could devote more classroom time to deeper learning through case studies and group work.

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<sup>2</sup> Steven Hind, “What is HBS’s NPS?” *The Harbus*, February 5, 2015, ([www.harbus.org/2015/the-harbus-survey-says-hbs-mba-program-more-walgreens-than-apple/](http://www.harbus.org/2015/the-harbus-survey-says-hbs-mba-program-more-walgreens-than-apple/))

<sup>3</sup> Natalie Kitroeff, “MBAs are more Satisfied at Wharton than at Harvard Business School”, *Bloomberg*, March 31, 2015 ([www.bloomberg.com/news/articles/2015-03-31/mbas-are-more-satisfied-at-wharton-than-at-harvard-business-school](http://www.bloomberg.com/news/articles/2015-03-31/mbas-are-more-satisfied-at-wharton-than-at-harvard-business-school)).

# Detailed report

## Introduction

Quantic is an online educational technology platform by Pedago LLC that replaces traditional lecture-based instruction with active, individualized lessons available on any device. Quantic lessons rely on the principles of active learning, requiring learners to solve real problems several times per minute by answering questions that include multiple choice, fill in the blank, and matching formats. Every lesson builds on previously learned concepts so that students' understanding is continually tested as they are introduced to new concepts.

After taking an action within Quantic, the learner receives immediate constructive explanations about errors; learners are encouraged to explore why answers are right or wrong, aiding a better understanding. Quantic's "bite-sized" lessons make learning more manageable by building on previously learned concepts, and providing immediate feedback. Quantic is optimized for both desktop and mobile devices, so learners can complete coursework at their convenience. As of May of 2016, Quantic lessons had a 96-percent learner approval rating.

The Quantic MBA curriculum consists of nine core subject areas. Each area contains required courses, with up to 120 interactive, feedback-based lessons, each between 5 and 10 minutes in duration. A course consists of 5-7 lessons, the final lesson being a SMARTCASE, a short assessment of the concepts taught in the previous lessons.

The purpose of this study was to investigate whether accounting and finance concepts learned in foundational courses at traditional brick-and-mortar business schools in the United States are learned as effectively through Quantic courses. This question was addressed by comparing the scores of recent graduates and current students from U.S. MBA programs to those of Quantic students on custom, online assessments of foundational concepts in the respective subject matter areas.

## Recruitment and eligibility

### Recruitment

All participants were recruited from 100+ online social media MBA groups using one of three screens. No compensation was received for completing a screen, and over 810 people completed at least one question on the screen. Candidates were required to be in the age range of 18-44 years to be considered for participation in the study.

### Eligibility

#### *MBA groups*

All MBA participants had to have completed an undergraduate degree. Participants in the MBA Accounting group must have also completed at least one accounting course in an accredited MBA program. Participants in the MBA Finance group must have also completed both corporate finance and financial accounting (or equivalent) courses in an accredited MBA program. From those screened, 51 participants were selected to take the Accounting post-test and 54 participants were selected to take the Finance post-test.

### *Quantic groups*

Participants in the Quantic groups could not have completed any MBA program nor completed an undergraduate degree in business, finance, or accounting. Additionally, participants must not have completed related courses outside of an MBA program or held a job in that field. For Quantic Accounting participants, this included courses in accounting or a job as an accountant. For Quantic Finance participants, this included courses in finance or a job with “finance” in the title. From those screened, 93 participants were selected to take the Quantic Accounting pre-test and 119 participants were selected to take the Quantic Finance pre-test. Of those invited, 62 participants in each group completed the pre-test. For Accounting, 49 participants started the coursework and 40 participants both finished the coursework requirements and took the post-test. For Finance, 47 participants started the coursework and 43 participants both finished the coursework requirements and took the post-test.

Participants in both MBA and Quantic groups were assigned either to a Finance or Accounting group, and could not be included in both even if they completed tests and/or coursework for both subject areas. Neither MBA nor Quantic participants had previously completed any Quantic courses prior to the study.

### **Test development**

Both the Accounting and Finance tests were created by Pedago’s content development team, which includes full-time employees and contracted professors. Existing MBA course exams in these fields were used as a guideline for development.

### **Evaluation and pilot testing**

The tests were evaluated by Pamela Drake, PhD, CFA, Chandler/Universal Eminent Professor of Finance at James Madison University and Patrick Gosselin, MBA, CFP. A Spanish-language version of the test was piloted with students from Universidad Politécnica de Madrid in Spain (an institutional partner of Pedago) to evaluate the time required to complete each test.

Pilot tests were conducted with groups of current MBA students recruited through ten online social media MBA groups to ensure that questions were a good test of MBA-level knowledge. One pilot test with eight participants was conducted for the Accounting test, while two pilots were conducted for the Finance test with 15 and 31 participants. Participants were paid \$25 each and met the same eligibility requirements as MBA participants in the main study. One question on the Accounting test was removed and ten questions on the Finance test were either removed or changed based on this testing.

### **Final tests**

The final pre-test and post-test in Accounting contained fourteen questions and the final pre-test and post-test in Finance contained sixteen questions. Many questions in the Accounting tests contained multiple parts. Therefore, participants were required to provide forty-three answers for the Accounting tests. The Finance tests included seventeen answers.

Pre-tests included a question again asking students about prior coursework in the respective subject matter areas. Post-tests also contained one question asking whether the test was a fair assessment of subject matter knowledge (either MBA course knowledge or Quantic course knowledge, respectively) and a follow up question where participants could explain their answer. Post-tests also included a Net Promoter Score (NPS) question for Quantic participants to indicate whether they would recommend the Quantic course to a friend, and why or why not.

## Participation

### *MBA group*

Once selected, participants in the MBA group were given a few days from when they were notified of being accepted into the study to complete the MBA post-test. Quantic students were given up to two weeks to complete their pre-test, Quantic coursework, and post-test. All participants communicated with a research lead who monitored their progress, answered any questions about the research study procedures, and sent reminders to complete the study.

MBA group participants were paid \$50 to complete the one-hour post-test. Quantic participants were paid \$50 to complete the one-hour pre-test, \$100 to complete all necessary coursework (approximately 2-2.5 hours), and \$50 to complete the one-hour post-test.

107 MBA participants were sent a link to complete the Accounting post-test and 95 MBA participants were sent the link to complete the Finance post-test. From this group, 51 participants completed the Accounting post-test and 54 participants completed the Finance post-test.

### *Quantic group*

Each Quantic participant received an account for the respective courses and was emailed a username and a temporary password. Quantic lessons provide detailed feedback on both correct and incorrect answers and allow students to retake SMARTCASES, short quizzes at the end of each chapter. Quantic participants were required to receive at least 80 percent on all course quizzes to be eligible to take the post-test. All participants that met these requirements were emailed the post-test to complete by the end of the initial allotted time for the entire study period.

## Quantic coursework

Accounting participants completed the Quantic courses *Accounting I: Fundamentals* and *Accounting II: Revenue and Expenses*. These courses are intended to help students discover financial statement preparation principles, learn bookkeeping mechanics for basic transactions, and take a deeper look at how to account for revenues and expenses, including the cost of goods sold and depreciation.

Finance participants completed the Quantic courses *Finance: Time Value of Money*, *Cost of Capital I: Capital Structure*, and *Valuation I: Discounted Free Cash Flow*. These courses help students apply the principles related to a company's balance between debt and equity, assess the profitability of proposed projects, acquire basic mathematical ability with the time value of money, gain familiarity with financial terminology, forecast a company's future free cash flows, and value a company by discounting those cash flows back to the present.

Based on course estimates, students should have been able to complete all lessons within 128 minutes for Accounting and 111 minutes for Finance. Detailed course syllabi including course structure, as well as concepts about and time requirements for each lesson within the required courses, are available in the Appendices.

## Testing

Once participants qualified, instructions for participating in the study were emailed to each candidate. The pre- and post-tests were administered over Google Forms.

Participants were told that each test should take less than an hour to complete. Though strict time limits were not enforced, students were encouraged to spend no more than 3 minutes on each question.



Participants were informed that they would be unable to change an answer once it was submitted, and participants were advised not to look up any answers to questions using external references. However, this could not be enforced due to the nature of the testing platform and protocol used.

The mean time between pre-tests and post-tests in the Quantic group was five days for Accounting participants and six days for Finance participants; the minimum was less than one day and the maximum was twelve days. After the pre-test, Quantic participants did not receive any feedback on their performance, could not view correct answers, and could not view the test again. Based on these factors, it is unlikely that any improvement would be due to practice or memory effects, despite the short interval between tests. Additionally, more than 95 percent of MBA participants were current MBA students. Therefore, they had completed the required courses within at least the last two years and should have also had relatively recent exposure to the knowledge being tested.

## **Final study sample**

### *Final groups*

The final MBA groups consisted of 51 participants for Accounting and 54 participants for Finance. From the eligible Quantic groups, 40 participants and 45 participants completed the coursework and took the post-test for Accounting and Finance, respectively. Some of those candidates were excluded from the final analysis based on updated information on prior knowledge in the subject areas being tested. The final Quantic groups consisted of 34 participants for Accounting and 43 participants for Finance.

### *Test answers*

All answers were included in the final analysis of the Finance pre-and post-tests (17). Two answers for the same question were excluded from the analysis of the Accounting pre- and post-tests due to ambiguity in the wording of the question. Therefore, the final analysis of both Accounting tests included only 41 answers.

### *Participation by gender*

Most of the groups are fairly equally-divided by gender, as we show in Table 1. The MBA Accounting group is composed of 39 percent women and 61 percent men, and the Quantic Accounting group is composed of 44 percent women and 53 percent men. For Finance, the MBA group contained 43 percent women and 58 percent men, while the Quantic group contained 57 percent women and 43 percent men. One participant in each group did not indicate gender.

### *Participation by age*

**Quantic participants tended to be slightly younger than MBA participants, as we show in Table 2. Whereas over 90 percent of participants in the MBA Finance and MBA Accounting groups were 25-34 years of age, the Quantic groups tended to be more evenly divided between ages 25-34 (53 percent Accounting, 58 percent Finance) and ages 18-24 (44 percent Accounting, 37 percent Finance). Most groups also had 1-2 participants in the range of 35-44 years old.**

**Table 1. Participation by gender**

Gender	Accounting				Finance			
	MBA		Quantic		MBA		Quantic	
	Proportion	Number of participants	Proportion	Number of participants	Proportion	Number of participants	Proportion	Number of participants
Women	39%	20	44%	15	43%	23	57%	24
Men	44%	31	53%	18	57%	31	43%	18
Total		51		33		54	100%	43

**Table 2. Participation by Age**

Age range	Accounting				Finance			
	MBA		Quantic		MBA		Quantic	
	Proportion	Number of participants	Proportion	Number of participants	Proportion	Number of participants	Proportion	Number of participants
18-24	4%	2	44%	15	4%	2	37%	16
25-34	92%	47	53%	18	93%	50	58%	24
35-44	2%	1	0%	0	4%	2	4%	2
Not disclosed	2%	1	3%	1	0%	0	2%	1
Total		51		34		54		43

## Findings

### Quantic pre-course performance vs. MBA performance

All Quantic participants had at least a bachelor’s degree, so we expect that most of the participants in the Quantic group would have had a lay knowledge of at least some of the concepts in each of the subject areas being tested, but not as much knowledge as MBA students who had completed formal coursework in these subjects. We compared pre-test scores for Quantic participants with post-test scores for MBA participants to examine this issue.

As we show in Table 3, the mean score for the 34 Quantic Accounting participants is 56.7 percent and the median is 53.7 percent, with a low score of 26.8 percent and a high score of 80.5 percent. For the 43 Quantic participants in finance, the mean score for Quantic participants is 49.2 percent and the median is 52.9 percent, with a low score of 11.8 percent and a high score of 82.4 percent.

We calculated the t-statistic for the test of the means of the Quantic participants versus the MBA participants to ensure that the initial knowledge of the Quantic participants was different from that of the MBA participants. We provide these results in Table 3. Our test of difference in means indicates that there is a statistically significant difference between the mean pre-test scores for Quantic participants and the mean post-test scores for MBA.

<b>Panel A: Accounting</b>					
	<b>Number of participants</b>	<b>Mean Score (Mean)</b>	<b>Median</b>	<b>Lowest score</b>	<b>Highest Score</b>
Quantic pre-test	34	57%	54%	27%	80%
MBA post-test	51	75%	76%	41%	93%
t-statistic for test of difference in means, p-value in ( )		6.40 (<0.0001)			
<b>Panel B: Finance</b>					
	<b>Number of s</b>	<b>Mean score</b>	<b>Median</b>	<b>Lowest score</b>	<b>Highest Score</b>
Quantic pre-test	43	49.2%	53%	12%	82%
MBA post-test	54	82.4%	8%	29%	100%
t-statistic for test of difference in means, p-value in ( )		-8.58 (<0.0001)			

## Time spent in Quantic courses

Accounting participants spent an average of 147 minutes to complete all required lessons, with the shortest time being 81 minutes and the longest time being 342 minutes. Finance participants spent an average of 118 minutes to complete all required lessons, with the shortest time being 60 minutes and the longest time being 186 minutes.

## Course effectiveness: Pre-test to post-test Improvement for Quantic participants

On average, participants who took the Quantic course improved by 29 percentage points and 33 percentage points from pre-test to post-test for Accounting and Finance, respectively. All but one participant in each group achieved a higher score at post-test than at pre-test. We provide the results of the test of the mean of the differences between pre- and post-test scores for Quantic participants in Table 4.

Quantic course	Number of participants	Mean score		Change from pre to post test	t-statistic for test of difference pre- to post-test p-value in ( )
		Pre-test	Post-test		
Accounting	34	57%	86%	29.1%	12.39 (<0.0001)
Finance	43	49.2%	82.4%	33.2%	12.11 (<0.0001)

Some Quantic participants did relatively well even at pre-test (with scores up to 80 percent in Accounting and 82 percent in Finance), so we also examine whether pre-test performance was related to improvement at post-test.

We split each Quantic group into low and high pre-test scores, and low and high improvement, using the median scores as cutoffs. We calculated a chi-squared test of independence, with the result of a significant relationship between pre-test performance and improvement for both Accounting and Finance.<sup>4</sup> For both Quantic groups, participants with lower pre-test scores were more likely to be in the high improvement group. However, even participants who started with higher scores at pre-test improved, on average. This result is consistent with reversion to the mean -- a statistical phenomenon in which high and low scorers tend to get closer to the mean scores at re-test -- and with an overall learning effect for Quantic participants.

We also take another, more robust approach to examining the scores for the Quantic group. We estimate the regression of post-test scores on the pre-test scores, controlling for the time spent on the Quantic material (Time). We estimate this regression for both the Finance and the Accounting Quantic groups, and provide the results in Table 5. The results are consistent with participants with higher pre-test scores

<sup>4</sup> For Accounting, chi-squared statistic is 10.25 with one degree of freedom, resulting in a  $p < 0.01$ . For Finance, the chi-squared statistic is 12.64 with one degree of freedom, and a p-value 0.01

showing the most improvement in scores. For accounting participants, the greater the time spent on the material, the greater the change in the test scores from pre-to-post-test.<sup>5</sup>

**Table 5. Explaining score improvement**

The dependent variable is the change in the test score. Estimated coefficients, with p-values in parentheses below coefficients

	Finance	Accounting
Intercept	0.5398 (<0.0001)	0.63865 (<0.0001)
Pre-test score	0.2842 (0.0241)	0.3857 (0.0164)
Time	0.0013 (0.0383)	0.0001 (0.8335)
R-squared	0.2041	0.1889
F-statistic	5.13 (0.0104)	3.61 (0.0390)

### Quantic Post-test performance vs. MBA performance

We provide the results of comparing the Quantic post-test scores with the MBA group scores for the Accounting and Finance courses, respectively, in Table 6. As we indicate with a t-statistic to test the difference in means scores between the Quantic group and the MBA group, the Quantic Accounting group outperformed the MBA group, with the difference in mean scores significant at most reasonable levels of significance. The Quantic Finance course participants score no differently than those in the MBA group, as indicated by a *p*-value of the test statistic that is above reasonable levels of significance.

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<sup>5</sup> The pre-test score and time together explain 20 percent of the variation in test scores for Finance participants, and almost 19 percent for Accounting participants.

**Table 6. Comparison of post-test performance between Quantic and MBA groups**

Course	Quantic		MBA		t-statistic (with <i>p</i> -value in parentheses) for test of difference in mean scores	
	Mean	Number of participants	Mean	Number of participants	Assuming equal variances	Assuming unequal variances
Accounting	86%	34	75%	51	3.95 (0.0002)	3.97 (0.0002)
Finance	82%	43	81%	54	0.44 (0.6594)	0.46 (0.6473)

### Feedback from participants

All participants completing the post-test were asked if they thought the test was a fair assessment of their subject matter knowledge in the respective areas. For Accounting, 85 percent of Quantic participants and 86 percent of MBA participants indicated that the test was a fair assessment. For Finance, 84 percent of Quantic participants and 69 percent of MBA participants indicated that the test was a fair assessment of their subject matter knowledge.<sup>6</sup> We provide representative comments in Table 7 for Accounting groups, and in Table 8 for Finance groups.

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<sup>6</sup> Only 26 of 54 the MBA Finance participants answered this question. The question for this group was sent out via email a few weeks after the post-test was taken, so the lower response rate may have just been circumstantial and should not be taken as an intentional unwillingness among this group to answer this question.

**Table 7. Representative Comments: Test was fair assessment of accounting knowledge?**

	<b>MBA</b>	<b>Quantic</b>
<b>Yes</b>	<ul style="list-style-type: none"> <li>● <i>All of the questions were relevant to general accounting.</i></li> <li>● <i>Because it covered a wide variety of questions and the information was presented clearly.</i></li> <li>● <i>It asked about concepts important to accounting, especially those that are most frequently applied in real-world settings of reading financials and analyzing accounting transactions. The only thing missing was testing my understanding of what goes into different financial statements (e.g., income statement, cash flow statement, etc.).</i></li> </ul>	<ul style="list-style-type: none"> <li>● <i>All questions were very similar to the Quantic modules and seemed to be a fair overall test of knowledge.</i></li> <li>● <i>I have not had a thorough accounting lesson in many years, so going through the course and taking this post-exam shows my current understanding of what I retained.</i></li> <li>● <i>It was comprehensive and included realistic examples, similar to what one working in accounting would have.</i></li> </ul>
<b>No</b>	<ul style="list-style-type: none"> <li>● <i>Some of the questions were poorly worded. It was not clear what I was supposed to answer.</i></li> <li>● <i>There's much more to it than remembering easy-to-reference formulas by heart.</i></li> <li>● <i>I studied accounting with the case method, learning to make tough judgments about unique accounting situations that actual companies face. I don't remember T accounts, but I do remember principles that would be applied in actual situations.</i></li> </ul>	<ul style="list-style-type: none"> <li>● <i>I have not had to apply it in a human-to-human interaction. My knowledge is circumstantial and I would not feel confident sharing this knowledge in real life.</i></li> <li>● <i>Yes and no. While this assessment addressed the basics, I do not believe it tackled the more challenging lessons learned in Part 2 of the study materials.</i></li> <li>● <i>I think it's pretty specific to the Quantic test environment. I think there are a lot of things that I know through experience that weren't explored or captured here, but some more technical things like LIFO vs. FIFO that I was unfamiliar with that are. I would say it's a pretty good assessment based on the content of the lectures.</i></li> </ul>

**Table 8. Representative Comments: Test was fair assessment of finance knowledge?**

	MBA	Quantic
Yes	<ul style="list-style-type: none"> <li>• <i>It assessed basic building concepts of finance that should be learnt during introductory courses.</i></li> <li>• <i>The question itself was simple but require certain knowledge about finance.</i></li> <li>• <i>It captured the essentials any finance professional should know.. Of course, this only scratches the surface, but you managed to capture the essentials.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>I was a blank slate for finance knowledge. So anything I have or have not learned came directly from this platform!</i></li> <li>• <i>I was pleasantly surprised that the answers I had zero clue about in the pre-assessment, I now understood.</i></li> <li>• <i>The questions pertained to the material learned through the online modules. These questions were not too difficult, but also did not give away the answers.</i></li> </ul>
No	<ul style="list-style-type: none"> <li>• <i>It looked more at specifics instead of general principles</i></li> <li>• <i>Finance is more about conceptual knowledge than just numbers.. This assessment concentrated more on quantitative stuff.</i></li> <li>• <i>It was too basic</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Because the questions seems very simple and similar to Quantic content. It felt like the course taught to the test.</i></li> <li>• <i>Simply taking a course online without any extra study time does not accurately reflect my ability to take in and learn information. The questions in the final assessment were very detailed. It is hard to remember these details from just taking an online course once.</i></li> <li>• <i>There should be case based questions.</i></li> </ul>

### Quantic participant satisfaction (Net Promoter Score)

Quantic participants were asked (at the conclusion of the second test) to respond to a standard satisfaction question, the Net Promoter Score (NPS) question, “How likely are you to recommend Quantic to a friend?”, on a scale of 0 (Would not recommend) to 10 (Definitely would recommend). The NPS is calculated as the percentage of respondents answering 9 or 10 (promoters), less the percentage of respondents answering 0 to 6 (detractors), with scores ranging from -100 to 100.

The Quantic Accounting courses had 58 percent promoters and 6 percent detractors, receiving an NPS score of 52. The Quantic Finance courses had 49 percent promoters and 9 percent detractors, receiving an NPS score of 40. These scores are in line with recent NPS scores for the Harvard MBA program and Wharton MBA program, with NPS of 41 and 51, respectively.<sup>7,8</sup>

<sup>7</sup> Steven Hind, “What is HBS’s NPS?” *The Harbus*, February 5, 2015, ([www.harbus.org/2015/the-harbus-survey-says-hbs-mba-program-more-walgreens-than-apple/](http://www.harbus.org/2015/the-harbus-survey-says-hbs-mba-program-more-walgreens-than-apple/)).

<sup>8</sup>Natalie Kitroeff, “MBAs are more Satisfied at Wharton than at Harvard Business School”, *Bloomberg*, March 31, 2015 ([www.bloomberg.com/news/articles/2015-03-31/mbas-are-more-satisfied-at-wharton-than-at-harvard-business-school](http://www.bloomberg.com/news/articles/2015-03-31/mbas-are-more-satisfied-at-wharton-than-at-harvard-business-school)).



## **Conclusion**

Many companies are looking for the skills developed while pursuing an MBA. However, the pursuit of an MBA may not always be the right choice for all learners, due to financial, geographic, or time constraints.

This study supports the assertion that some of the foundational accounting and financial concepts taught in traditional brick-and-mortar MBA programs can be learned independently, online through Pedago's targeted Quantic active-learning courses. Significant improvement in students' knowledge is acquired in as little as two hours of engagement with these courses.

In addition to being taken on their own as part of a comprehensive independent study MBA program, these courses could be used as supplements to existing MBA programs. First, they could be used as remedial materials for incoming MBA students who need to enhance their understanding of basic concepts in certain subject matter areas. Second, they could be used by MBA instructors as pre-work for blended-learning classes. By having students learn basic concepts and complete structured practice exercises on their own, instructors could devote more classroom time to deeper learning through case studies and group work.

## **Limitations of the study**

The Quantic courses are still under development and few students have taken all of the courses that would be equivalent to all of the coursework in a given MBA subject matter area. Therefore, it is not currently possible to test comprehensive subject-matter knowledge. The tests used were developed in-house and intended specifically to cover the concepts taught in the current courses.

Whereas the tests used were deemed by students to be a fair assessment of their knowledge, many MBA students mentioned that the tests covered basic accounting principles, but did not cover other concepts they had learned in their accounting courses. For future studies with students who have completed an entire course series, it would be helpful to use a more-widely accepted test. First, such a test would allow for the assessment of a broader set of knowledge. Additionally, this sort of assessment would allow for comparison across a wider set of participants in traditional MBA programs. A more-widely accepted test would permit more cross-sections of the group, as well as a deeper analysis.

Additionally, the timeframe for the study was compact. Therefore, the time between starting a course and taking the post-test was relatively short, and may not represent the time that most students would take to finish a given course. It would be useful to test this same group again in 3-6 months to see how much of the course knowledge is retained over time.

## **Possible future studies**

### **Comparisons to other online, self-study platforms**

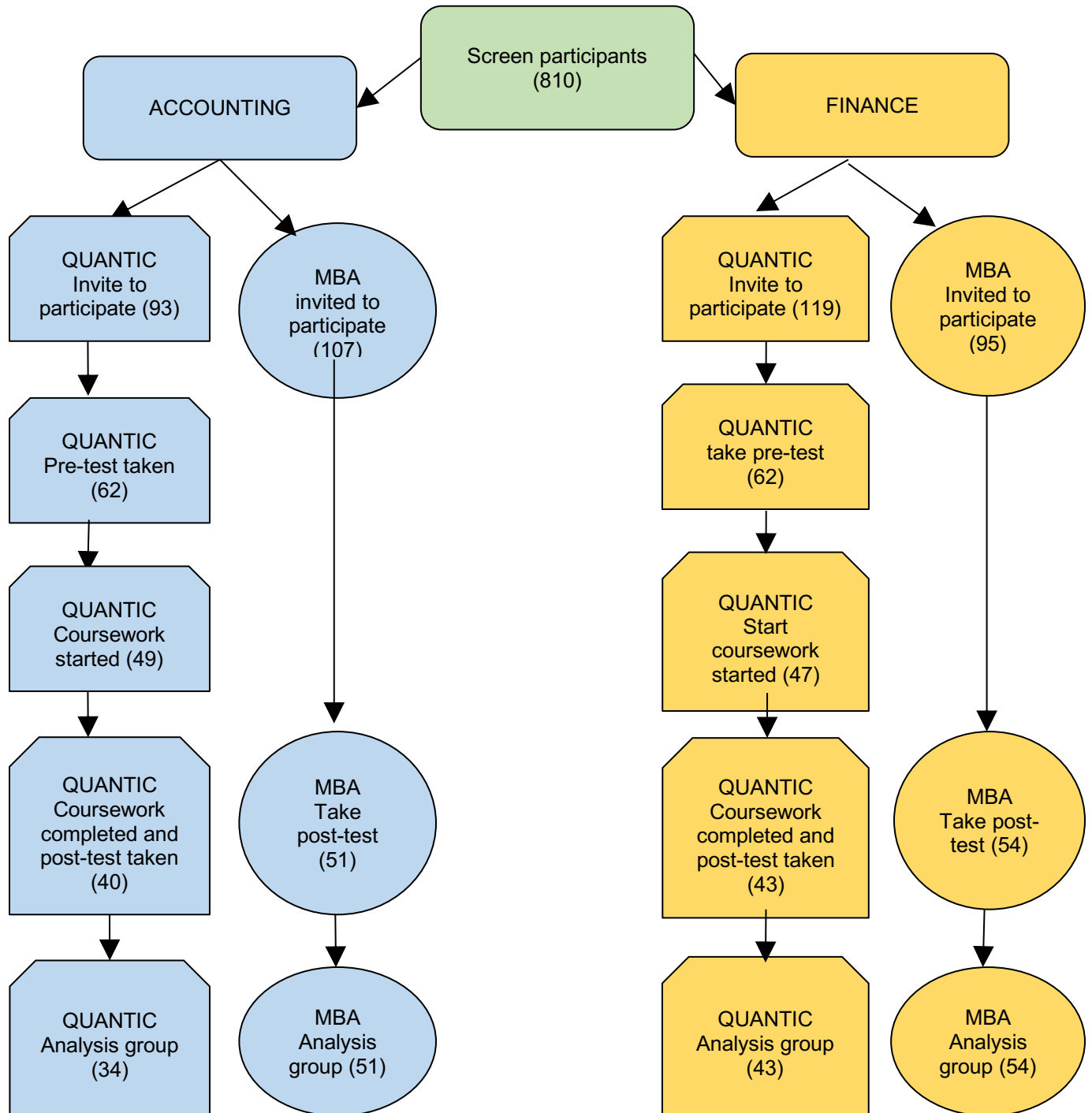
There are many free, online self-guided learning systems now available for students who are trying to improve their knowledge skills at a time and place that is most convenient for them. Pedago has designed Quantic's learning system to provide a different experience from these other systems by focusing on "bite-sized" lessons that incorporate active learning. It would be interesting to conduct pre-/post- evaluations with students taking specific subject matter courses on other platforms with those completing the courses in Quantic. This comparison would help to normalize some conditions that were not available in this study, including independent vs. classroom-based learning, and digital vs. analog learning.

## **Item analysis**

In this study, we did not examine learning outcomes for specific items on the test. However, we should review this data based on the concepts being assessed. Concept-specific analyses of the Quantic participant data is expected to highlight where students had the smallest gains in knowledge. Such results might indicate that the lessons on those concepts either may need to be improved or that additional lessons in those concepts may be required for the knowledge to be more fully acquired. Concept-specific analyses of the MBA data might be used to identify the concepts least likely to be retained over time, which could also help Pedago to make strategic decisions about how to structure their own content related to those items.

# Appendices

## Appendix A: Eligibility funnel



## Appendix B: Accounting - Detailed results

### Quantic Accounting group results (N = 34)

	Mean	Median	Mode	Minimum	Maximum
Pre-test scores	57%	54%	54%	27%	80%
Post-test scores	86%	89%	98%	49%	100%
% Change	59%	46%	38%	-9%	191%
Point Change	29	27	27	-5	61

### Quantic Accounting individual participant results (N = 34)

Student	Pre-test	Post-test	% change	Point change	Minutes to complete Quantic course	Retook Quizzes
Quantic Acctg Student 1	34%	61%	79%	27	135	Yes
Quantic Acctg Student 2	61%	88%	44%	27	173	Yes
Quantic Acctg Student 3	78%	98%	25%	20	126	No
Quantic Acctg Student 4	46%	90%	95%	44	99	No
Quantic Acctg Student 5	54%	95%	77%	41	179	No
Quantic Acctg Student 6	54%	90%	68%	37	176	No
Quantic Acctg Student 7	63%	93%	46%	29	81	No
Quantic Acctg Student 8	49%	93%	90%	44	101	No
Quantic Acctg Student 9	49%	71%	45%	22	233	Yes
Quantic Acctg Student 10	68%	95%	39%	27	342	No
Quantic Acctg Student 11	27%	78%	191%	51	155	Yes
Quantic Acctg Student 12	68%	85%	25%	17	157	Yes
Quantic Acctg Student 13	71%	98%	38%	27	134	No
Quantic Acctg Student 14	71%	98%	38%	27	122	Yes
Quantic Acctg Student 15	66%	90%	37%	24	141	No
Quantic Acctg Student 16	51%	78%	52%	27	95	Yes
Quantic Acctg Student 17	66%	98%	48%	32	123	Yes

**Quantic Accounting individual participant results (N = 34) (cont'd)**

<b>Student</b>	<b>Pre-test</b>	<b>Post-test</b>	<b>% change</b>	<b>Point change</b>	<b>Minutes to complete Quantic course</b>	<b>Retook Quizzes</b>
Quantic Acctg Student 18	49%	80%	65%	32	114	Yes
Quantic Acctg Student 19	78%	90%	16%	12	90	No
Quantic Acctg Student 20	44%	85%	94%	41	128	Yes
Quantic Acctg Student 21	76%	98%	29%	22	214	Yes
Quantic Acctg Student 22	49%	66%	35%	17	108	Yes
Quantic Acctg Student 23	61%	76%	24%	15	127	No
Quantic Acctg Student 24	59%	83%	42%	24	151	No
Quantic Acctg Student 25	44%	90%	106%	46	131	No
Quantic Acctg Student 26	80%	83%	3%	2	212	Yes
Quantic Acctg Student 27	37%	98%	167%	61	112	Yes
Quantic Acctg Student 28	39%	88%	125%	49	168	Yes
Quantic Acctg Student 29	59%	83%	42%	24	136	Yes
Quantic Acctg Student 30	54%	49%	-9%	-5	127	Yes
Quantic Acctg Student 31	54%	98%	82%	44	146	No
Quantic Acctg Student 32	54%	80%	50%	27	147	Yes
Quantic Acctg Student 33	76%	100%	32%	24	209	No
Quantic Acctg Student 34	41%	73%	76%	32	108	Yes

### MBA Accounting group results (N = 51)

	Mean	Median	Mode	Min	Max
Post-test scores	75%	76%	88%	41%	93%

### MBA Accounting individual participant results (N = 51)

MBA Accounting Student	Post-test score	MBA Accounting Student	Post-test score	MBA Accounting Student	Post-test score
MBA Acctg Student 1	93%	MBA Acctg Student 18	88%	MBA Acctg Student 35	88%
MBA Acctg Student 2	85%	MBA Acctg Student 19	78%	MBA Acctg Student 36	76%
MBA Acctg Student 3	90%	MBA Acctg Student 20	93%	MBA Acctg Student 37	68%
MBA Acctg Student 4	83%	MBA Acctg Student 21	80%	MBA Acctg Student 38	66%
MBA Acctg Student 5	78%	MBA Acctg Student 22	59%	MBA Acctg Student 39	76%
MBA Acctg Student 6	80%	MBA Acctg Student 23	90%	MBA Acctg Student 40	68%
MBA Acctg Student 7	59%	MBA Acctg Student 24	71%	MBA Acctg Student 41	76%
MBA Acctg Student 8	71%	MBA Acctg Student 25	73%	MBA Acctg Student 42	54%
MBA Acctg Student 9	88%	MBA Acctg Student 26	73%	MBA Acctg Student 43	88%
MBA Acctg Student 10	66%	MBA Acctg Student 27	54%	MBA Acctg Student 44	88%
MBA Acctg Student 11	68%	MBA Acctg Student 28	41%	MBA Acctg Student 45	80%
MBA Acctg Student 12	51%	MBA Acctg Student 29	80%	MBA Acctg Student 46	85%
MBA Acctg Student 13	90%	MBA Acctg Student 30	71%	MBA Acctg Student 47	93%
MBA Acctg Student 14	78%	MBA Acctg Student 31	71%	MBA Acctg Student 48	61%
MBA Acctg Student 15	73%	MBA Acctg Student 32	88%	MBA Acctg Student 49	66%
MBA Acctg Student 16	80%	MBA Acctg Student 33	61%	MBA Acctg Student 50	68%
MBA Acctg Student 17	66%	MBA Acctg Student 34	85%	MBA Acctg Student 51	83%

## Appendix C: Finance - Detailed Results

### Quantic Finance group results (N = 43)

	Mean	Median	Mode	Minimum	Maximum
Pre-test scores	49%	53%	65%	12%	49%
Post-test scores	82%	82%	88%	41%	82%
% Change	94%	60%	50%	0%	94%
Point change	33	35	29	0	33

### Quantic Finance individual participant results (N = 43)

Student	Pre-test	Post-test	% change	Point change	Minutes to complete Quantic course	Retook quizzes
Quantic Finance Student 1	24%	88%	275%	65	164	No
Quantic Finance Student 2	65%	88%	36%	24	85	No
Quantic Finance Student 3	71%	82%	17%	12	117	No
Quantic Finance Student 4	65%	100%	55%	35	90	No
Quantic Finance Student 5	47%	88%	88%	41	60	No
Quantic Finance Student 6	47%	76%	63%	29	101	No
Quantic Finance Student 7	47%	88%	88%	41	149	No
Quantic Finance Student 8	47%	76%	63%	29	130	No
Quantic Finance Student 9	29%	41%	40%	12	106	Yes
Quantic Finance Student 10	53%	94%	78%	41	150	No
Quantic Finance Student 11	29%	71%	140%	41	93	No
Quantic Finance Student 12	65%	76%	18%	12	127	Yes
Quantic Finance Student 13	18%	100%	467%	82	162	Yes
Quantic Finance Student 14	29%	94%	220%	65	129	No
Quantic Finance Student 15	41%	94%	129%	53	146	No
Quantic Finance Student 16	59%	94%	60%	35	172	No
Quantic Finance Student 17	53%	100%	89%	47	74	No





**Quantic Finance individual participant results (N = 43) (cont'd)**

Student	Pre-test	Post-test	% change	Point change	Minutes to complete Quantic course	Retook quizzes
Quantic Finance Student 18	35%	82%	133%	47	87	No
Quantic Finance Student 19	53%	65%	22%	12	123	No
Quantic Finance Student 20	35%	76%	117%	41	119	No
Quantic Finance Student 21	53%	82%	56%	29	108	No
Quantic Finance Student 22	47%	82%	75%	35	70	Yes
Quantic Finance Student 23	41%	65%	57%	24	81	No
Quantic Finance Student 24	41%	41%	0%	0	104	Yes
Quantic Finance Student 25	65%	82%	27%	18	61	No
Quantic Finance Student 26	59%	94%	60%	35	124	No
Quantic Finance Student 27	76%	100%	31%	24	163	No
Quantic Finance Student 28	65%	71%	9%	6	114	No
Quantic Finance Student 29	29%	88%	200%	59	115	No
Quantic Finance Student 30	76%	94%	23%	18	137	No
Quantic Finance Student 31	29%	82%	180%	53	85	No
Quantic Finance Student 32	65%	82%	27%	18	110	No
Quantic Finance Student 33	82%	88%	7%	6	73	No
Quantic Finance Student 34	59%	88%	50%	29	134	No
Quantic Finance Student 35	35%	76%	117%	41	110	No
Quantic Finance Student 36	53%	100%	89%	47	186	Yes
Quantic Finance Student 37	29%	71%	140%	41	133	No
Quantic Finance Student 38	76%	88%	15%	12	128	No
Quantic Finance Student 39	12%	65%	450%	53	101	No
Quantic Finance Student 40	35%	71%	100%	35	102	No
Quantic Finance Student 41	59%	88%	50%	29	178	No
Quantic Finance Student 42	59%	76%	30%	0	139	No
Quantic Finance Student 43	59%	88%	50%	29	112	No

### MBA Finance participant results (N = 54)

	Mean	Median	Mode	Minimum	Maximum
Post-test scores	81%	88%	100%	29%	100%

### MBA Accounting individual participant results (N = 54)

MBA Finance Student	Post-test score	MBA Finance Student	Post-test score	MBA Finance Student	Post-test score
MBA Finance Student 1	82%	MBA Finance Student 19	65%	MBA Finance Student 37	71%
MBA Finance Student 2	47%	MBA Finance Student 20	76%	MBA Finance Student 38	100%
MBA Finance Student 3	94%	MBA Finance Student 21	82%	MBA Finance Student 39	71%
MBA Finance Student 4	53%	MBA Finance Student 22	59%	MBA Finance Student 40	47%
MBA Finance Student 5	53%	MBA Finance Student 23	100%	MBA Finance Student 41	94%
MBA Finance Student 6	94%	MBA Finance Student 24	100%	MBA Finance Student 42	88%
MBA Finance Student 7	100%	MBA Finance Student 25	88%	MBA Finance Student 43	94%
MBA Finance Student 8	94%	MBA Finance Student 26	76%	MBA Finance Student 44	100%
MBA Finance Student 9	100%	MBA Finance Student 27	76%	MBA Finance Student 45	82%
MBA Finance Student 10	100%	MBA Finance Student 28	100%	MBA Finance Student 46	41%
MBA Finance Student 11	71%	MBA Finance Student 29	100%	MBA Finance Student 47	82%
MBA Finance Student 12	100%	MBA Finance Student 30	53%	MBA Finance Student 48	100%
MBA Finance Student 13	71%	MBA Finance Student 31	65%	MBA Finance Student 49	76%
MBA Finance Student 14	29%	MBA Finance Student 32	94%	MBA Finance Student 50	94%
MBA Finance Student 15	94%	MBA Finance Student 33	100%	MBA Finance Student 51	88%
MBA Finance Student 16	94%	MBA Finance Student 34	76%	MBA Finance Student 52	100%
MBA Finance Student 17	47%	MBA Finance Student 35	71%	MBA Finance Student 53	100%
MBA Finance Student 18	88%	MBA Finance Student 36	53%	MBA Finance Student 54	88%

## Appendix D: Details on tests

### Accounting tests

#### Question 1

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Balance sheet	Select the equation that is true of all balance sheets.	assets = liabilities + equity; equity = liabilities + assets; liabilities = assets + equity	assets = liabilities + equity	A1	Same as pre-test		

#### Question 2

Concept Tested	Question	Answer options	Correct answers	Answer #	Question	Answer options	Correct answers
Balance sheet	Label the following balance sheet accounts as assets, liabilities, or equity.  <b>Accounts Receivable; Bank Loan Payable; Cash; Inventory; Paid-In Capital; Prepaid Expenses; Property, Plant &amp; Equipment; Retained Earnings</b>	Asset; Liabilities; Equity	Assets	A2	Same as pre-test		
			Liabilities	A3			
			Assets	A4			
			Assets	A5			
			Equity	A6			
			Assets	A7			
			Assets	A8			
			Equity	A9			

**Question 3**

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Balance sheet	Money that a company owes to its vendors is recorded in the account _____.	Accounts Receivable; Accounts Payable; Allowance for Doubtful Accounts; Credits; Current; Debits; Noncurrent/Long-term; Retained Earnings	Accounts Payable	A10	Same as pre-test		
	Net income that is reinvested in the company is known as _____.		Retained earnings	A11			
	Liabilities and assets that are expected to be paid off or converted into cash within one year are said to be _____.		Current	A12			
	Money due to a company from its customers is recorded in the account _____.		Accounts Receivable	A13			
	Liabilities and assets with a longer timeframe are said to be _____.		Non-current/long-term	A14			
	In T-accounts, _____ always go on the left.		Debits	A15			
In T-accounts, _____ always go on the right.		Credits	A16				

**Question 4**

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
General ledger	Which of the following general ledger accounts are closed out at the end of each accounting period? (Select all that apply.)	Cash; Expenses; Net Income; Retained Earnings; Revenues	Expenses; Revenues	A17	Same as pre-test		

### Question 5

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
General ledger	For each type of account below determine whether the left side of the balance sheet records increases (+) or records decreases (-).  <b>Asset Account; Liability Account; Equity Account; Revenues; Expenses</b>	Plus; Minus	Plus	A18	Same as pre-test		
			Minus	A19			
			Minus	A20			
			Minus	A21			
			Plus	A22			

### Question 6

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Journal	A delivery of merchandise was made to a customer. The merchandise cost the seller \$3,500 to make. The customer paid \$1,500 and owes another \$4,000. In which order do the following terms appear in the first column of the balance sheet above? (One account doesn't belong.).  Accounts Receivable; Cash; Expenses; Inventory; Revenues; Deferred Revenue	1; 2; 3; 4; 5; Doesn't Belong	2	A23	Same as pre-test		
			1	A24			
			4	A25			
			5	A26			
			3	A27			
			Doesn't belong	A28			

### Question 7

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Conservatism principle	According to the conservatism concept, revenues are recorded when:	an order is placed cash is received and not before inventory is ready to be sold it is reasonably certain that they will be collected	it is reasonably certain that they will be collected	A29	Same as pre-test		

### Question 8

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Conservatism principle	Expenses are recorded as soon as they are:	Incurred; paid with cash; projected in a proposal; reasonably certain	incurred	A30	Same as pre-test		

### Question 9

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Manufacturing Overhead	Last year, a company had \$3 million in production overhead and spent \$1.5 million on direct labor costs. Using labor cost as its basis, select the correct overhead rate.	$\$3 \text{ million} \div \$1.5 \text{ million} = \$2$ ; $\$1.5 \text{ million} \div \$3 \text{ million} = \$0.50$ ; $\$3 \text{ million} \times \$1.5 \text{ million} = \$4.5 \text{ million}$ ; $(\$3 \text{ million} - \$1.5 \text{ million}) \div \$1.5 \text{ million} = \$1$ ;	$\$3 \text{ million} \div \$1.5 \text{ million} = \$2$	A31	Last year, a company had \$4.5 million in production overhead and spent \$1.5 million on direct labor costs. Using labor cost as its basis, select the correct overhead rate.	$\$4.5 \text{ million} \div \$1.5 \text{ million} = \$3$ ; $\$1.5 \text{ million} \div \$4.5 \text{ million} = \$0.33$ ; $\$4.5 \text{ million} \times \$1.5 \text{ million} = \$6.75 \text{ million}$ ; $(\$4.5 \text{ million} - \$1.5 \text{ million}) \div \$1.5 \text{ million} = \$2$	$\$4.5 \text{ million} \div \$1.5 \text{ million} = \$3$

### Question 10

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Depreciation	A fixed asset that cost \$200,000 has a service life of 5 years. Using straight-line depreciation, what will the annual depreciation expense be?	open-ended	40,000	A32	A fixed asset that cost \$300,000 has a service life of 6 years. Using straight-line depreciation, what will the annual depreciation expense be?	open-ended	50,000

### Question 11

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Journal	An asset has accumulated its entire \$4 million cost in depreciation over a 10-year period. A scrap dealer purchases the asset for \$5,000. Place the accounts below in the correct order that they would appear in the journal  <b>Accumulated Depreciation; Gain on Asset Disposal; Cash; PP&amp;E</b>	1; 2; 3; 4	2	A33	An asset has accumulated its entire \$3 million cost in depreciation over a 10-year period. A scrap dealer purchases the asset for \$4,000. Place the accounts below in the correct order that they would appear in the journal. <b>[Accumulated Depreciation] [Gain on Asset Disposal] [Cash] [PP&amp;E]</b>	1 2 3 4	2
			3	A34			3
			1	A35			1
			4	A36			4

### Question 12 (Excluded from analysis)

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Inventory	A store purchased inventory three times in June. 45 units of that inventory were sold. In the journal above, which corresponds to each of the following inventory cost methods? <b>[Method X]</b>	LIFO; FIFO	Method X	X1	A store purchased inventory three times in June. 45 units of that inventory were sold. In the journal above, which corresponds to each of the following inventory cost methods? <b>[Method X]</b>	LIFO FIFO	Method X
	A store purchased inventory three times in June. 45 units of that inventory were sold. In the journal above, which corresponds to each of the following inventory cost methods? <b>[Method Y]</b>	LIFO; FIFO	Method Y	X2	A store purchased inventory three times in June. 45 units of that inventory were sold. In the journal above, which corresponds to each of the following inventory cost methods? <b>[Method Y]</b>	LIFO FIFO	Method Y

### Question 13

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Journal	A craftsman purchased \$700 worth of materials on credit. She finished crafting a piece of merchandise worth \$200 and displayed it in her store with a price tag of \$450. Select which of the transactions above need to be recorded.	A; B; C	B	A37	A craftsman purchased \$900 worth of materials on credit. She finished crafting a piece of merchandise worth \$300 and displayed it in her store with a price tag of \$600. Select which of the transactions above need to be recorded.	A B C	B

### Question 14

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Journal	Complete the journal entries for selling \$2,000 of inventory for \$4,000 on credit. Reference this image. <b>Blank A; Blank B; Blank C; Blank D</b>	\$4,000; \$6,000; \$2,000; \$8,000	\$4,000.00	A38	Complete the journal entries for selling \$5,000 of inventory for \$9,000. <b>[Reference image]</b>	\$4,000 \$5,000 \$14,000 \$9,000	\$9,000.00
		Cash; Revenues; Inventory; Deferred Revenue	revenues	A39		Cash Revenues Inventory Deferred Revenue	revenues
		\$4,000; \$6,000; \$2,000; \$8,000	2,000	A40		\$4,000 \$5,000 \$14,000 \$9,000	\$5,000.00
		Cash; Revenues; Inventory; Deferred Revenue	Inventory	A41		Cash; Revenues; Inventory; Deferred Revenue	Inventory



## Accounting Test – Demographic and Opinion Questions

### Pre-test questions

Question #	Question	Answer options	Participants	Answer #
Question 15	Have you ever completed an accounting course?	Yes, in an MBA program; Yes, as an undergraduate or in a graduate degree program other than an MBA; No, I have never completed an accounting course	Quantic	A42

### Post-test questions

Question #	Question	Answer options	Participants	Answer #
Question 15	Do you think this was a fair assessment of your accounting knowledge?	Yes; No	Quantic and MBA	A43
Question 15	Why or why not?	open-ended		A44
Question 16	What did you think of the Quantic course experience? Please tell us anything positive or negative about the Quantic courses that you took.	open-ended	Quantic	A45
Question 17	How likely is it that you would recommend Quantic to a friend or colleague?	open-ended		A46

## Finance tests

### Question 1

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Time Value of Money	Discounting money allows you to calculate a _____.	open-ended	present value	A1	Compounding money allows you to calculate a _____.	open-ended	future value

### Question 2

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Time Value of Money	Which of the above formulae calculates the present value of a future cash flow?	A: $CF_0 \times (1 + r)^n$ B: $CF_0 \times r^n$ C: $CF_n / (1 + r)^n$ D: $ern / CF_n$	C	A2	Which of the above formulae calculates the future value of a present cash flow.	A: $rn + CF_0 \times (rt - rn)$ B: $CF_0 \times (1 + r)^n$ C: $CF_n / (1 + r)^n$ D: $CF_n \times ern$	B
			A	A3			C

### Question 3

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Time Value of Money	Which of the expressions above tells us how much \$6,000 will be in 4 years assuming it grows at 5% annually?	A: $(\$6,000 \times 1.05) / 4$ B: $\$6,000 \times (1.05)^4$ C: $1.054 / \$6,000$ D: $\$6,000 / 1.054$	net present value	A4	Which of the expressions above tells us how much \$4,000 was worth 5 years ago assuming it had grown at 6% annually?	A: $(\$4,000 \times 1.06)/5$ B: $(\$4,000 \times (1.06)^5)$ C: $1.065/\$4,000$ D: $\$4,000/1.065$	D

### Question 4

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Net present value	The present value of benefits (cash inflows) minus the present value of costs (cash outflows) is known as _____.	net present; value; gross margin; revenue; operating profit	net present value	A5	What is net present value?	the present value of benefits (cash inflows) minus the present value of costs (cash outflows); the present value of costs (cash outflows) minus the present value of benefits (cash inflows); the future value of benefits (cash inflows) minus the present value of costs (cash outflows); the future value of costs (cash outflows) minus the present value of benefits (cash inflows)	the present value of benefits (cash inflows) minus the present value of costs (cash outflows)

### Question 5

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Cost of capital	Match the source with each type of funding. [debt funding]	creditors owners	creditors	A6	Match the source with each type of funding. [debt funding]	creditors owners	owners
			owners	A7			creditors

### Question 6

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Cost of capital	Interest payments divided by debt will calculate a company's before-tax _____.	cost of debt; cost of equity; return on debt; debt margin	cost of debt	A8	Before taxes are factored in, cost of debt is equal to _____ divided by debt.	Interest payments; dividends; principal payments; net income;	interest payments

### Question 7

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Cost of capital	If B is the cost of debt before taxes and T is the effective tax rate, what is the formula for computing the after-tax cost of debt?	B x T; B x (T-1); B x (1-T); T x (B-1)	$B \times (1 - T)$	A9	If B is the cost of debt before taxes and T is the effective tax rate, what is the formula for computing the after-tax cost of debt?	B x T; B x (T-1); B x (1-T); T x (B-1)	$B \times (1 - T)$

### Question 8

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Cost of capital	Which of the following is most likely to be used as a risk-free rate?	the growth rate of the economy as a whole; the 10-year U.S. Treasury Constant Maturity Rate; the average of ten years of monthly returns of the S&P 500; a company's beta times the growth rate of the stock market as a whole	the 10-year U.S. Treasury Constant Maturity Rate	A10		Same as pre-test	

### Question 9

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Cost of capital	The volatility of a particular stock compared to the market as a whole is known as _____.	alpha ( $\alpha$ ); beta ( $\beta$ ); gamma ( $\gamma$ ); delta ( $\delta$ )	beta ( $\beta$ )	A11	Beta ( $\beta$ ) is a measure of _____	how volatile a particular stock is compared to the market as a whole.; change in the market as a whole from day to day; change in the market as a whole from the same day the previous year; how volatile a particular stock is compared to its performance during the last quarter	how volatile a particular stock is compared to the market as a whole.

### Question 10

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Capital asset pricing model	If the risk-free rate is 2%, the expected market return is 13%, and $\beta$ is 1.6, what is the cost of equity using CAPM?	$2\% + 1.6 \times (13\% - 2\%) = 19.6\%$ ; $1.6 \times (13\% - 2\%) = 17.6\%$ ; $1.6\% + (13\% - 2\%) = 12.6\%$ ; $13\% + 1.6 \times (13\% - 2\%) = 30.6\%$	$2\% + 1.6 \times (13\% - 2\%) = 19.6\%$	A12	If the risk-free rate is 3%, the expected market return is 13%, and $\hat{\beta}$ is 0.6, what is the cost of equity using CAPM?	$3\% + 0.6 \times (13\% - 3\%) = 9\%$ ; $0.6 \times (13\% - 3\%) = 6\%$ ; $0.6\% + (13\% - 3\%) = 10.6\%$ ; $13\% + 0.6 \times (13\% - 3\%) = 19\%$	$3\% + 0.6 \times (13\% - 3\%) = 9\%$

### Question 11

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Cost of capital	A company with a high proportion of debt is said to be highly _____.	leveraged; profitable; solvent; liquid	leveraged	A13	A company that is highly leveraged has a high proportion of _____.	debt; equity	debt

### Question 12

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Weighted average cost of capital	What is the weighted average cost of capital (WACC) of a company that has an effective tax rate of 25%, cost of debt of 7%, cost of equity of 11%, 40% equity financing, and 60% debt financing?	$(11\% \times 40\%) + (7\% \times 60\% \times 75\%) = 7.55\%$ ; $(11\% \times 60\%) + (7\% \times 40\% \times 75\%) = 8.70\%$ ; $(11\% \times 40\%) + (7\% \times 60\% \times 25\%) = 5.45\%$ ; $(11\% \times 60\%) + (7\% \times 40\% \times 25\%) = 7.30\%$	$(11\% \times 40\%) + (7\% \times 60\% \times 75\%) = 7.55\%$	A14	What is the weighted average cost of capital (WACC) of a company that has an effective tax rate of 30%, cost of debt of 6%, cost of equity of 12%, 40% debt financing, and 60% equity financing?	$(12\% \times 60\%) + (6\% \times 40\% \times 70\%) = 8.88\%$ ; $(12\% \times 40\%) + (6\% \times 60\% \times 70\%) = 7.32\%$ ; $(12\% \times 60\%) + (6\% \times 40\% \times 30\%) = 7.92\%$ ; $(12\% \times 40\%) + (6\% \times 60\% \times 30\%) = 5.88\%$	$(12\% \times 60\%) + (6\% \times 40\% \times 70\%) = 8.88\%$

### Question 13

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Valuation	What is the terminal value?	the present value at a point in time (whether now or in the future) of all cash flows from that point; a company's cost of capital weighted according to its capital structure; the return investors can expect to receive by investing in the stock market as a whole; the total market value of a company's assets	the present value at a point in time (whether now or in the future) of all cash flows from that point onwards	A15		Same as pre-test	

### Question 14

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Valuation	Using the income statement above and an effective tax rate of 26%, calculate the company's net operating profit after tax (NoPAT). (This is also called net operating profit less adjusted taxes, or NoPLAT.)	$\$168,938 \times (1 - 26\%) = \$125,014.12$ ; $(\$168,938 - \$24,415) \times (1 - 26\%) = \$106,947.02$ ; $\$70,975 \times (1 - 26\%) = \$52,521.50$ ; $(\$168,938 - \$73,548) \times (1 - 26\%) = \$70,588.60$	$\$168,938 \times (1 - 26\%) = \$125,014.12$	A16	Using the income statement above and an effective tax rate of 28%, calculate the company's net operating profit after tax (NoPAT). (This is also called net operating profit less adjusted taxes, or NoPLAT.)	$\$956 \times (1 - 28\%) = \$688.75$ ; $(\$956 - \$201) \times (1 - 28\%) = \$543.60$ ; $\$518 \times (1 - 28\%) = \$372.96$ ; $(\$956 - \$237) \times (1 - 28\%) = \$517.68$	$(\$956 - \$201) \times (1 - 28\%) = \$543.60$

### Question 15

Concept Tested	Question (Pre-test)	Answer options (Pre-test)	Correct answers (Pre-test)	Answer #	Question (Post-test)	Answer options (Post-test)	Correct answers (Post-test)
Valuation	If FCF stands for free cash flow, N is the year for which the terminal value is calculated, r is the discount rate, and g is the terminal growth rate, which of the formulae above will calculate the terminal value?	A: $FCFN+1 \times (r-g)$ B: $FCFN+1 \times (r+g)$ C: $(FCFN+1) / (r+g)$ D: $(FCFN+1) / (r-g)$ Note: $FCFN+1 + FCFN \times (1 + g)$	D	A17		Same as pre-test	

## Finance – Demographic and Opinion questions

### Question 16 (Pre-test only)

Question #	Question (Pre-test)	Answer options	Participants	Answer #
Question 16	Have you completed financial accounting and corporate finance (or equivalent courses) in an MBA program?	Yes, I have completed financial accounting in an MBA program; Yes, I have completed corporate nance in an MBA program.; No, but I have completed financial accounting or corporate finance in an undergraduate or graduate program other than an MBA.; No, I have not completed either of these courses (or their equivalents).	Quantic only	A18
Question 17	Have you completed any other finance courses besides the ones above in an MBA or another program?	open-ended		A19

### Post-test questions

Question #	Question (Pre-test)	Answer options	Participants	Answer #
Question 16	Do you think this was a fair assessment of your finance knowledge [gained through Quantic]?	Yes; No	Quantic Only	A20
Question 17	Why or why not?	open-ended		A19
Question 18	What did you think of the Quantic course experience? Please tell us anything positive or negative about the Quantic courses that you took.	open-ended		A20
Question 19	How likely is it that you would recommend Quantic to a friend or colleague?	0,1,2,3,4,5,6,7,8,9,10		A21
Question 18	Were there topics covered in this assessment that you were not exposed to during business school?	Yes; No	MBA Only	A24
Question 19	Please explain more	Open-ended		A25
Question 20	Have you completed financial accounting and corporate finance (or equivalent courses) in an MBA program?	Yes; No		A22
Question 21	Have you completed any other finance courses besides the ones above in an MBA or another program?	Yes; No		A23

## Appendix E: Screeners

1. Undergrad location
2. Undergrad School Acceptance Rate
3. What is your name?
4. What is your email address? (We will contact you at this email address) - Open-Ended Response
5. Have you started or completed any course on Quantic?
6. Version 1 - Do you have an undergraduate degree? Version 2 & 4 - Do you have an undergraduate degree or are you currently enrolled in an undergraduate program?
7. From what university did you receive your undergraduate degree? - Open-Ended Response
8. What year did you graduate from your undergraduate program?
9. What was your major? - Open-Ended Response
10. Version 1 - Do you have an MBA (or are you currently enrolled)? OR Version 2 & 4 - Have you ever been accepted into an MBA program?
11. Version 1 - Do you have a non-MBA graduate degree? If yes, please specify institution, degree, subject studied, and year of graduation. OR Version 2 & 4 - Do you have or are you pursuing a graduate degree that is not an MBA? If yes, please specify institution, degree, subject studied, and year of graduation.
12. Version 1 - Do you have a non-MBA graduate degree? If yes, please specify institution, degree, subject studied, and year of graduation. - Please specify institution, degree, subject studied, and year of graduation OR Version 2 & 4 - Do you have or are you pursuing a graduate degree that is NOT an MBA? If yes, please specify institution, degree, subject studied, and year of graduation. - Please specify institution, degree, subject studied, and year of graduation
13. Have you ever completed any accounting courses outside of an MBA program? If yes, please list them, and specify at which institution(s) the courses were taken.
14. Have you ever completed any accounting courses outside of an MBA program? If yes, please list them, and specify at which institution(s) the courses were taken. - Please specify courses and at what institutions the courses were taken.
15. Version 4 ONLY - Have you ever completed any finance courses outside of an MBA program? If yes, please list them, and specify at which institution(s) the courses were taken.
16. Version 4 ONLY - Have you ever completed any finance courses outside of an MBA program? If yes, please list them, and specify at which institution(s) the courses were taken. - Please specify courses and at what institutions the courses were taken.
17. Version 4 ONLY - How many finance courses did you complete during business school and what were they?
18. Version 4 ONLY - How many finance courses did you complete during business school and what were they? - The names of the finance courses I completed are:



19. At what university did you receive or are you pursuing your MBA? - Open-Ended Response
20. What is your year of graduation from your MBA program?
21. How many accounting courses did you complete during business school and what were they?
22. How many accounting courses did you complete during business school and what were they? - The names of the accounting courses I completed are:
23. Since graduating from your undergraduate institution, how many years of work experience do you have?
24. What is your current position? - Open-Ended Response
25. In what country do you currently live?
26. In what country do you currently live? - Other (please specify)
27. What is your country of citizenship (list all that apply)? - Open-Ended Response
28. What is your age?
29. What is your gender?
30. Which race/ethnicity best describes you? (Please choose only one.)
31. Which race/ethnicity best describes you? (Please choose only one.) - Multiple ethnicity / Other (please specify)

## Appendix F: Course Syllabi - Accounting I & II (128 minutes)

### Accounting I

Chapter 01: Balance Sheet Basics (31 minutes)			
Lesson	Lesson Title	Concepts taught	Estimated time to complete
Lesson 1	Introduction to the Balance Sheet	Assets, liabilities, and equity; The dual-aspect concept	7 minutes
Lesson 2	Fundamental Principles of Accounting	The entity and money-measurement concepts; Double-entry bookkeeping; Which items you would like to see on a balance sheet; Measuring assets at either fair value or cost	6 minutes
Lesson 3	All about Assets	Grouping assets into Current and Noncurrent Assets on the balance sheet; Current assets, including Accounts Receivable, Inventory, and Prepaid Expenses; Noncurrent assets, including PP&E; The going-current concept	6 minutes
Lesson 4	Liabilities & Equity	Current and noncurrent liabilities, including Accounts Payable, Bank Loan Payable, and Estimated Tax Liability; Equity, including Retained Earnings and Total Paid-In Capital.	6 minutes
Lesson 5	Sew You Think You Can Knit: Smartcase	Apply what you've learned about the balance sheet to a new business	6 minutes
Chapter 02: The Practice of Accounting (37 minutes)			
Lesson #	Lesson Title	Concepts taught	Estimated time to complete
Lesson 1	Debits & Credits	How to use T-accounts to keep track of every transaction a business makes; Where to record debits and credits on a T-account	5 minutes
Lesson 2	Revenues & Expenses	How to read and record transactions in Revenue and Expense accounts	5 minutes
Lesson 3	Income Statements	How to calculate net income; How to create an income statement	5 minutes
Lesson 4	General Journal	How to record transactions in the general journal	4 minutes
Lesson 5	General Ledger	How to keep track of all account balances with the general ledger; How to transfer transactions from the general journal to the general ledger; How to close out revenue and expenses; How to create a balance sheet and income statement using the general ledger	6 minutes
Lesson 6	Practice Makes Perfect	Review debits and credits, T-accounts, Revenues and Expenses, journals, and the general ledger	6 minutes
Lesson 7	Wrestling with Accounts	Apply what you've learned about the balance sheet, income statement, general journal, and general ledger to a new business	6 minutes

## Accounting II

<b>Chapter 01: Realizing Revenues and Expenses (27 minutes)</b>			
<b>Lesson #</b>	<b>Lesson Title</b>	<b>Concepts taught</b>	<b>Estimated time to complete</b>
Lesson 1	Revenue and cash	Cash and revenue do not measure the same thing; Revenues are recorded when they are reasonably certain; revenues are realized when products are delivered	6 minutes
Lesson 2	Expenses and the matching concept	Expenses are matched with the revenues they generate; The difference between expenditures and expenses.	6 minutes
Lesson 3	Realizing Revenues and Expenses over time	When to recognize revenues and expenses that span multiple periods.	5 minutes
Lesson 4	Bad debt	How to handle bad debt; Making provision for doubtful accounts	6 minutes
Lesson 5	Furnishing the Accounts: Smartcase	A review of the conservatism, realization, and matching concepts	4 minutes
<b>Chapter 02: Accounting for Assets (33 minutes)</b>			
<b>Lesson #</b>	<b>Lesson Title</b>	<b>Concepts taught</b>	<b>Estimated time to complete</b>
Lesson 1	Inventory and the Cost of Good Sold	How to calculate cost of goods sold (COGS); First-in, first-out(FIFO) versus last-in, last-out(LIFO)	6 minutes
Lesson 2	Manufacturing Inventory	How to account for the manufacture of inventory; How to assign cost of inventory	5 minutes
Lesson 3	Fixed assets & straight-line depreciation	Review non-current and tangible assets; Understand straight-line depreciation; Learn how salvage value affects depreciation	7 minutes
Lesson 4	Other depreciation methods	How to use units-of-production and accelerated depreciation methods; The implications of accelerated depreciation and taxes; Disposal of fixed assets	6 minutes
Lesson 5	Depletion & Amortization	Learn when to use depreciation, depletion, and amortization; Calculate depletion and amortization	5 minutes
Lesson 6	Golden Assets: Smartcase	Review the accounting of inventories and depreciation	4 minutes

## Appendix G: Course Syllabi - Finance (111 minutes)

### Finance: The Time Value of Money

<b>Chapter 01: The Time Value of Money (Part I) (24 minutes)</b>			
<b>Lesson</b>	<b>Lesson Title</b>	<b>Concepts taught</b>	<b>Estimated time to complete</b>
Lesson 1	The Time Value of Money	The value of money depends on time; What the present value of a cash flow is; What the future value of a cash flow is.	5 minutes
Lesson 2	The Timeline	Basic conventions used to solve time value of money questions; How to create timelines for solving time value of money problems.	6 minutes
Lesson 3	Moving Money Through Time: Compounding	The difference between compounding and discounting; How to calculate the future value (FV) of a lump sum of money in one year's time.	6 minutes
Lesson 4	Moving Money Through Time: Discounting	How to calculate the present value (PV) of a lump sum of money from one year to the future; How to quickly distinguish between the effects of compounding and discounting.	7 minutes
<b>Chapter 02: The Time Value of Money (Part II) (29 minutes)</b>			
<b>Lesson #</b>	<b>Lesson Title</b>	<b>Concepts taught</b>	<b>Estimated time to complete</b>
Lesson 1	Moving Money Forward Over Multiple Years	How to solve future value problems over multiple years; How the compounding formula and timeline change when multiple years are involved.	6 minutes
Lesson 2	Moving Money Backward Over Multiple Years	How to solve present value problems over multiple years; How the discounting formula and timeline change when multiple years are involved.	5 minutes
Lesson 3	Moving Cash Flows Through Time	How to move a series of cash flows to the present: How to move a series of cash flows to the future.	7 minutes
Lesson 4	Net Present Value	What net present value (NPV) is; How to calculate net present value (NPV); How to use net present value (NPV) to make investment decisions	7 minutes
Lesson 5	Fair Trade Finance (SMARTCASE)	Review the basic concepts for moving money through time; How to use TVM concepts to make investment decisions.	4 minutes

## Cost of Capital I - Capital Structure

Chapter 01 - Cost of Capital (23 minutes)			
Lesson #	Lesson Title	Concepts taught	Estimated time to complete
Lesson 1	Cost of Debt	What cost of debt is; Variables that influence the cost of debt; How to compute the cost of debt.	6 minutes
Lesson 2	Cost of Equity	What cost of equity is; The relationship between risk and reward; Variables that influence the cost of equity; Using the Capital Asset Pricing Model to estimate cost of equity.	6 minutes
Lesson 3	Capital Structure and WACC	What capital structure is; How to calculate the weighted average cost of capital; How companies and investors use WACC to determine investment plans.	7 minutes
Lesson 4	Capital Construction (SMARTCASE)	Real life applications of the cost of debt, cost of equity (CAPM), capital structure, and Weighted Average Cost of Capital formulas.	4 minutes

## Valuation I - Discounted Free Cash Flow

Chapter 01 - Discounted Free Cash Flow Valuation (35 minutes)			
Lesson #	Lesson Title	Concepts taught	Estimated time to complete
Lesson 1	Discounted Free Cash Flow Valuation	Basic steps for free cash flow valuation	5 minutes
Lesson 2	Free Cash Flow	What free cash flow is; Why we use free cash flow in discounted cash flow (DCF) valuation.	5 minutes
Lesson 3	Calculating Free Cash Flow	How to calculate free cash flow; How to calculate net operating profit after tax; Where to find relevant free cash flow information on a company's financial statements.	7 minutes
Lesson 4	Forecasting Free Cash Flow	How to forecast free cash flow; How to use a multi-stage growth forecast; How to calculate terminal value.	6 minutes
Lesson 5	Free Cash Flow Valuation	Learn to discount free cash flows to the present; Use WACC in a free cash flow valuation.	6 minutes
Lesson 6	How Much Is That Cat in the Catalog? (SMARTCASE)	Test your knowledge of discounted free cash flow valuation	6 minutes

## Appendix H: Fair assessment of subject matter knowledge? - Student comments

### MBA Accounting participant comments

Fair?	Comment	Participant
Yes	All of the questions were relevant to general accounting.	MBA Acctg Student 27
Yes	Basic knowledge focused around credit, debit, assets, liabilities, and retained earnings. Only concern is if you did not recall which side possessed the credits and which the debits you could reverse most of the exam	MBA Acctg Student 37
Yes	Basic questions asked although some parts of my knowledge needed to be refreshed.	MBA Acctg Student 41
Yes	Because it covered a wide variety of questions and the information was presented clearly.	MBA Acctg Student 34
Yes	Consistent to topics learned although I am rusty. Basic level accounting metrics and assessment. Thank you!	MBA Acctg Student 17
Yes	covered basic accounting principles that we'd learned	MBA Acctg Student 29
Yes	Covered most all of the general accounting knowledge that was taught in my MBA accounting course.	MBA Acctg Student 50
Yes	covers topics reviewed in class; format of some questions is challenging to follow and different than typical format in class.	MBA Acctg Student 33
Yes	Did it off the top of my head	MBA Acctg Student 15
Yes	Fair, clear questions.	MBA Acctg Student 14
Yes	Felt comprehensive and straightforward	MBA Acctg Student 40
Yes	For a person who took only several accounting courses, this assessment is fair because they are not tricky questions.	MBA Acctg Student 20
Yes	Great Questions	MBA Acctg Student 42
Yes	Having taken accounting courses before, I was somewhat familiar with the terms and concepts. Even if I was unfamiliar with the terms and concepts, this would have been a fair assessment as I would immediately know what areas I need to develop.	MBA Acctg Student 49
Yes	I am not an accountant, so can only answer the most basic accounting questions without references. Lack of practice has led to some erosion.	MBA Acctg Student 32
Yes	I guess, it is best to test knowledge when you are not just ramming it up and trying to understand the concepts. This conceptual check was good. Better would be if i get to know how i performed and which areas i need to focus more on.	MBA Acctg Student 12
Yes	I have an accountant and CFO for this ;)	MBA Acctg Student 38
Yes	I recognized all the terms	MBA Acctg Student 26
Yes	I remembered somethings, and forgot others. So I would say it was fair.	MBA Acctg Student 11

## MBA Accounting participant comments (cont'd)

Fair?	Comment	Participant
Yes	In terms of the MBA first-semester core finance class, yes; however, managerial accounting (rather than the fundamentals of T-accounts, etc.) seems to be more of an emphasis	MBA Acctg Student 36
Yes	It answered questions that I should've learned in my accounting class.	MBA Acctg Student 19
Yes	It asked about concepts important to accounting, especially those that are most frequently applied in real-world settings of reading financials and analyzing accounting transactions. The only thing missing was testing my understanding of what goes into different financial statements (e.g., income statement, cash flow statement, etc.).	MBA Acctg Student 35
Yes	it asked the fundamentals that I learned in Accounting I	MBA Acctg Student 45
Yes	It covered all the basic aspects on Accounting in a succinct way.	MBA Acctg Student 7
Yes	it covered many concepts	MBA Acctg Student 48
Yes	It covered the topics I learned during the last quarter, and I was able to answer with reasonable level of confidence.	MBA Acctg Student 23
Yes	It covers the basic accounting concepts one should know.	MBA Acctg Student 43
Yes	It seems pretty fair for a short, basic assessment. However, it does not cover many of the other concepts learned in accounting.	MBA Acctg Student 46
Yes	It tested basic accounting principles	MBA Acctg Student 8
Yes	It was a fairly good assessment but in the real world, one can always refer to the basics again.	MBA Acctg Student 30
Yes	It was basic accounting, but fair as a general assessment.	MBA Acctg Student 16
Yes	It was difficult to understand how the images needed to be explained in a few of the questions, other than that yes.	MBA Acctg Student 21
Yes	Questions included covered a variety of topics, assessing my foundational knowledge of accounting.	MBA Acctg Student 6
Yes	Remembering account principles off the top of my head were difficult because I was not an accounting major. Since I was unable to refer to notes or other sources, it took me longer to respond to questions. However, this assessment was a refresher of what I need to learn and apply during and after my MBA program.	MBA Acctg Student 10
Yes	Seemed like basic questions but not surprised I didn't remember all the concepts from my core semester class. It's part of a curriculum that makes me learn the very basics and I've retained some but not enough probably. I think one more deeper level class would have made sense for my total curriculum.	MBA Acctg Student 28
Yes	Some easy, some need to think	MBA Acctg Student 51

## MBA Accounting participant comments (cont'd)

Fair?	Comment	Participant
Yes	Tested balance sheet and basic journal entries	MBA Acctg Student 44
Yes	They were all concepts that had been covered and that should be understood if you've taken an introductory accounting class	MBA Acctg Student 13
Yes	This tested me on various aspects of accounting.	MBA Acctg Student 47
Yes	up to the par	MBA Acctg Student 5
Yes	Very basic knowledge in accounting	MBA Acctg Student 22
Yes	Very focused on t-accounts, which was less a focus of our class, but still useful	MBA Acctg Student 24
Yes	well, not every actually uses the T method, or we never learned it in class, but I think the organization and journal entry questions were fair	MBA Acctg Student 31
Yes	Yes, because all of this is content that I have covered in my intro accounting course (but have not remembered everything!).	MBA Acctg Student 18
No	I didn't study	MBA Acctg Student 39
No	I studied accounting with the case method, learning to make tough judgments about unique accounting situations that actual companies face. I don't remember T accounts, but I do remember principles that would be applied in actual situations.	MBA Acctg Student 4
No	It focused a little too much on bookkeeping, not management accounting. I don't remember which side of a "T" account does what! The MBA accounting knowledge is more about how to record revenues / expenses, how to read financial statements, assess a company's financial health, etc. It felt like there were too many questions about LITERALLY recording these in the books.	MBA Acctg Student 9
No	Never learned FIFO/LIFO; I remember overall accounting concepts relevant to doing business, but not the formats for journal entries very well anymore	MBA Acctg Student 25
No	Some of the questions were poorly worded. It was not clear what I was supposed to answer.	MBA Acctg Student 1
No	There's much more to it than remembering easy-to-reference formulas by heart.	MBA Acctg Student 2



## Quantic Accounting participants comments

Fair?	Comment	Participant
Yes	All questions were very similar to the Quantic modules and seemed to be a fair overall test of knowledge.	Quantic Acctg Student 31
Yes	Because honestly, with my education and experience, I didn't know a damned thing about accounting before this course.	Quantic Acctg Student 22
Yes	Covered full range of topics	Quantic Acctg Student 14
Yes	Everything tested in the quiz was taught in the lecture series. Thank you, this was a very helpful tool to give me a basic understanding of accounting!	Quantic Acctg Student 12
Yes	Having no background knowledge, I have applied the learning from the 2.5-3 hours of online lessons only. Hence, the assessment was fair	Quantic Acctg Student 28
Yes	I completed the assesment alone and without the use of study materials	Quantic Acctg Student 23
Yes	I did not refer to external resources and thought carefully about each question.	Quantic Acctg Student 25
Yes	I have not had a thorough accounting lesson in many years, so going through the course and taking this post-exam shows my current understanding of what I retained.	Quantic Acctg Student 2
Yes	I learned a lot from the course and applied to my best of ability.	Quantic Acctg Student 29
Yes	I recognized all topics I was asked about.	Quantic Acctg Student 9
Yes	I think it hit on most of the topics that I had learned throughout the classes, and the classes comprised most of my knowledge.	Quantic Acctg Student 4
Yes	I think it tested the concepts well. I don't really get the framing of the LIFO/FIFO question, though.	Quantic Acctg Student 7
Yes	It covered most of what the courses covered, and I improved a lot from start to finish.	Quantic Acctg Student 8
Yes	It covered the concepts covered in the accounting courses I took on Quantic.	Quantic Acctg Student 18
Yes	It focused on the highlights of what we learned in class.	Quantic Acctg Student 16
Yes	It refers to some concept of accounting and some examples.	Quantic Acctg Student 33
Yes	It was comprehensive and included realistic examples, similar to what one working in accounting would have.	Quantic Acctg Student 32
Yes	Most of the questions were straightforward	Quantic Acctg Student 3
Yes	Questions were based on topics learnt.	Quantic Acctg Student 30

## Quantic Accounting participants comments (cont'd)

Fair?	Comment	Participant
Yes	Relevant and challenging questions were asked to test knowledge gained from the courseware.	Quantic Acctg Student 21
Yes	Similar to course questions which is my only basis for assessing accounting knowledge	Quantic Acctg Student 24
Yes	Simple and concise	Quantic Acctg Student 1
Yes	The classes through Quantic are my only exposure to accounting. I recognize the concepts in the assessment from the blocks on instruction, however I think it is safe to say I didn't master the concepts.	Quantic Acctg Student 15
Yes	The questions asked exactly what we learned from the course.	Quantic Acctg Student 26
Yes	The questions covered a wide range of accounting topics.	Quantic Acctg Student 19
Yes	The questions were based on the fundamental accounting coursework that I learnt	Quantic Acctg Student 27
Yes	The questions were not too tricky and accurately corresponded to the knowledge learned during the lessons.	Quantic Acctg Student 6
Yes	The Quantic course was comprehensive and prepared me well	Quantic Acctg Student 34
Yes	This was a decent assessment, but my only comment is that I have already seen these questions either in the Quantic material or in the pre-assessment material. New questions might be a more fair assessment, but a challenge would be assessing whether improvement was made.	Quantic Acctg Student 10
No	I have not had to apply it in a human-to-human interaction. My knowledge is circumstantial and I would not feel confident sharing this knowledge in real life.	Quantic Acctg Student 5
No	I only wrote no because I don't like yes or no questions. I think a "rating" question would be better. I thought for the most part it was a fair assessment. However, there's a lot more of material that was not covered.	Quantic Acctg Student 11
No	I think it's pretty specific to the Quantic test environment. I think there are a lot of things that I know through experience that weren't explored or captured here, but some more technical things like LIFO vs. FIFO that I was unfamiliar with that are.	Quantic Acctg Student 17
No	I'm still a bit confused on the concepts.	Quantic Acctg Student 20
No	Yes and no. While this assessment addressed the basics, I do not believe it tackled the more challenging lessons learned in Part 2 of the study materials.	Quantic Acctg Student 13

## MBA Finance participant comments

Fair?	Comment	Participant
Yes	Basic knowledge	MBA Finance Student 52
Yes	Covered decent amount of topics	MBA Finance Student 49
Yes	I agree with result. Questions were formulated well, perhaps too easy for a finance major	MBA Finance Student 44
Yes	I honestly don't really remember the test	MBA Finance Student 29
Yes	It assessed basic building concepts of finance that should be learnt during introductory courses.	MBA Finance Student 23
Yes	It captured the essentials any finance professional should know.. Of course, this only scratches the surface, but you managed to capture the essentials.	MBA Finance Student 1
Yes	It covered a great deal of information that was actually relevant to what has been learned. deal	MBA Finance Student 14
Yes	It covered basic principles.	MBA Finance Student 38
Yes	It tested a variety of concepts covered in mba coursework	MBA Acctg Student 6
Yes	It was representative of what I learned in my finance courses.	MBA Finance Student 27
Yes	Seemed to ask the same types of questions that we were asked to learn during the MBA. However, sometimes the questions were phrased a little confusingly. Those questions were probably less accurate assessments of my knowledge.	MBA Finance Student 25
Yes	Seemed to ask very specific questions targeted at assessing the level the responder understands or does not understand finance, ranging from easy to hard questions, so yeah i thought it was fair.	MBA Finance Student 54
Yes	Similar questions demonstrated in course material	MBA Finance Student 30
Yes	The assessment evaluated basic financial concepts.	MBA Finance Student 24
Yes	The question itself was simple but require certain knowledge about finance.	MBA Finance Student 16
Yes	The questions have covered most of the corporate finance	MBA Finance Student 18
Yes	The questions made sense to me and I think should be a base level	MBA Finance Student 42
Yes	The questions spanned a broad range	MBA Finance Student 37
No	Finance is more about conceptual knowledge than just numbers.. This assessment concentrated more on quantitative stuff.	MBA Finance Student 35

### MBA Finance participant comments (cont'd)

Fair?	Comment	Participant
No	I felt the question's were really basic. If it's supposed to measure basic finance skills, spot on. But overall for someone in finance it doesn't give proper assessment as it was too basic and easy.	MBA Finance Student 7
No	it asked theories and definitions	MBA Finance Student 46
No	It looked more at specifics instead of general principles	MBA Finance Student 4
No	It was too Basic	MBA Finance Student 39
No	Question could have been harder	MBA Finance Student 43
No	To be honest, I can't remember. I do think that Stanford's finance curriculum is wholly inadequate and stultifying.	MBA Finance Student 50
No	Too easy	MBA Finance Student 9

## Quantic Finance participant comments

Fair?	Comment	Participant
Yes	All concepts were covered in the lessons	Quantic Finance Student 25
Yes	Because I tried as hard I could. But I am really bad at this stuff. I still learned a bit.	Quantic Finance Student 39
Yes	Covered the topics, major concepts and methodologies	Quantic Finance Student 34
Yes	I performed better than the first test, and Quantic was my only influence on the difference in my knowledge.	Quantic Finance Student 43
Yes	I really liked how I was able to get hints, use my keyboard entirely and be exposed to helpful and relatable examples.	Quantic Finance Student 13
Yes	I recognized a lot of the terms. The only issue was memorizing the formulas, which I didn't do!	Quantic Finance Student 11
Yes	I recognized all of the terms and equations that were presented in this quiz. I didn't necessarily study my notes diligently before taking this post-assessment, though; I would have done better had I studied as if it were an actual class or exam.	Quantic Finance Student 6
Yes	I think giving us the same questions before and after the courses is a useful way to test what we learned in the middle	Quantic Finance Student 22
Yes	I think it accurately covered most of the material that was taught through Quantic!	Quantic Finance Student 19
Yes	I was a blank slate for finance knowledge. So anything I have or have not learned came directly from this platform!	Quantic Finance Student 10
Yes	I was pleasantly surprised that the answers I had zero clue about in the pre-assessment, I now understood.	Quantic Finance Student 36
Yes	it adequately tested all the topics and formulae I just learned through Quantic	Quantic Finance Student 15
Yes	It asked questions directly related to the Quantic material.	Quantic Finance Student 1
Yes	It reviewed the material exactly as presented.	Quantic Finance Student 4
Yes	It tested the formulas I learned. I do think that you should test what the concepts actually mean.	Quantic Finance Student 3
Yes	It was definitely fair. I think that the Quantic courses did not ask for enough answers to questions without their "trick" support... ie : green /yellow font left room for guessing...	Quantic Finance Student 7
Yes	I've gone through the courses in a short time and completed the test with no help from outside sources.	Quantic Finance Student 20

## Quantic Finance participant comments (cont'd)

Fair?	Comment	Participant
Yes	Questions covered the material in the lessons	Quantic Finance Student 21
Yes	Questions were based on topics covered in Quantic courses. Course was knowledgeable and enjoyable.	Quantic Finance Student 16
Yes	Similar question format to the lessons.	Quantic Finance Student 23
Yes	Since I didn't specifically prepare for it, it reflects accurately the extent to which I would be able to rely on this training in the future.	Quantic Finance Student 14
Yes	The assessment allowed me to show which equations whose underlying relationships I understood. I probably got the answers wrong for questions where I didn't fully understand the concept taught through Quantic.	Quantic Finance Student 8
Yes	The assessment covers what I learn from the courses.	Quantic Finance Student 38
Yes	The assessment questions sum up the Quantic courses	Quantic Finance Student 37
Yes	The content was generally the same.	Quantic Finance Student 2
Yes	The courses were good but at times they went quickly	Quantic Finance Student 40
Yes	The material was covered in the lessons.	Quantic Finance Student 17
Yes	The questions are based on the online courses I learned on Quantic.	Quantic Finance Student 41
Yes	The questions pertained to the material learned through the online modules. These questions were not too difficult, but also did not give away the answers.	Quantic Finance Student 31
Yes	The questions were similar to the ones in the training	Quantic Finance Student 29
Yes	This covered parts from each of the different chapters/courses.	Quantic Finance Student 35
Yes	went over what the courses it	Quantic Finance Student 5
Yes	Yes because all topics questioned were covered. I think I got a few of the problems wrong where I had to apply real numbers to formulas I had previously learned as I am still not 100% familiar with each formula.	Quantic Finance Student 12
Yes	Yes, it was less difficult than I thought it would be	Quantic Finance Student 28

## Quantic Finance participant comments (cont'd)

Fair?	Comment	Participant
Yes	yes. I learned a lot	Quantic Finance Student 9
Yes	Review of lessons	Quantic Finance Student 42
No	Because the questions seems very simple and similar to Quantic content. It felt like the course taught to the test.	Quantic Finance Student 18
No	I was able to figure some out from the answers, but honestly would not be able to think of it and everything a formula means without the answer.	Quantic Finance Student 26
No	I worked in investment banking for almost two years	Quantic Finance Student 33
No	More calculation examples, as we had trough classes could have been included here, like "real case" examples.	Quantic Finance Student 30
No	Simply taking a course online without any extra study time does not accurately reflect my ability to take in and learn information. The questions in the final assessment were very detailed. It is hard to remember these details from just taking an online course once.	Quantic Finance Student 24
No	Some of the assesment questions were purely commonsense. In Part 3, I would have loved to solve one of the cases again which would have trained me further on practical applications. Also, Part 3 was exactly the same as Part 1 which means I already knew the common sense answers to many problems.	Quantic Finance Student 27
No	There should be case based questions	Quantic Finance Student 32