

Are They Guessing? Confidence-Weighted Financial Knowledge Scores

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Policy is influenced by the failing financial literacy scores in many populations. However, there is the distinct possibility that some respondents who answer financial knowledge questions in assessments are simply guessing about the correct answers. Thus, the purpose of this paper was to explore a methodology to produce a confidence-adjusted objective financial knowledge score. The goal was to answer the question – do college students who take financial knowledge tests know when they are guessing about the correct answers? Does financial education change both knowledge and perceptions of whether one has correct knowledge?

Review of Literature

This paper draws upon literature related to measuring consumer confidence in knowledge question responses. Several previous studies have measured consumer confidence in knowledge responses, using different approaches. The Cognitive Economics Study (CogEcon), a longitudinal study of older Americans and their spouses, asks respondents to analyze eight financial statements (i.e., “Financially, investing in the stock market is no better than buying lottery tickets”) and make a judgment about how likely their response to each is to be true. Respondents circle 50% (indicating a complete guess) or 100% (indicating absolute certainty) or a number in between for each item (Dunning, Griffin, Milojkovic, & Ross, 1990). Similarly, Sundblad, Biel, and Gärling (2009) asked respondents to assess their confidence about their knowledge of climate for each of 44 true-false statements using a six-point rating scale (1, very uncertain; 2, fairly uncertain; 3, more uncertain than certain; 4, more certain than uncertain; 5, fairly certain; and 6, very certain).

Researchers also have asked respondents to rate their confidence to make predictions. Dunning et al. (1990) used this methodology (i.e., “estimate your confidence between 50% and 100%”) to examine consumer confidence in 20 predictions dealing with consumer preferences, hypothetical dilemmas, and personal habits or characteristics. Vallone, Griffin, Lin, and Ross (1990) examined undergraduate students’ confidence in their predictions about their own futures.

Confidence-adjusted financial knowledge scores for this research were generated following previous research. For each financial knowledge question, students were asked “On a scale from **1-5**, with **1** (a) being **least** confident and **5** (e) being **most** confident, how confident are you that your answer is correct?” This format was chosen primarily to match the five answer choices on the Scantron forms available at the university to score the exam.

Methodology

The data for this project came from a one academic credit hour elective financial literacy course taught at a major southeastern university each Fall and Spring Semester. The course is an elective for every student who takes it and the target population is seniors who have not previously taken a personal finance course for academic credit in college.

Administration of a paper-and-pencil 40-item pre- and post-test test in the most recent four semesters provided the data to create confidence-adjusted financial knowledge scores for this paper. Each of the 40 multiple-choice³ knowledge questions had four answer choices; don’t know was not an option. As described earlier, for each knowledge question, students evaluated their confidence in their responses on a 1 to 5 scale, where 5 was most confident. The data reported here are from the

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³ The exceptions were the three Lusardi and Mitchell (2008) questions.

administration of the pre-test and post-test (the exams were identical) in the course described above to 351 students across four semesters (Fall 2015-Spring 2017).

Mean knowledge and mean confidence scores were calculated for each question on both the pre-test and the post-test. In addition, a confidence-adjusted knowledge score was calculated for each student on both the pre-test and post-test by multiplying correct answers by 1 x the self-selected confidence score and incorrect answers by multiplying -1 x the self-selected confidence score. For example, a student who answered a question correctly and was highly confident in the answer selection would have a confidence-adjusted knowledge score of 5 for that question, while a student who answered a question incorrectly but was highly confident in their answer selection would have a confidence-adjusted knowledge score of -5. The maximum confidence-adjusted knowledge score a student could achieve was 200, while the minimum score was -200. To examine differences in pre- and post-test knowledge and confidence scores and differences in raw knowledge and confidence-adjusted knowledge scores by major and gender, t-tests were used.

Results

The demographic characteristics of the 351 students in this sample are described in Table 1. There were 10% more females than males in the course. Majors in two colleges (Arts and Sciences and Business) made up 62% of the students in the course.

The mean objective raw knowledge score on the pre-test across the 40 items ($n=351$) was 45.0% indicating students answered, on average, about 18 of the 40 questions correctly. The range in scores was from 5 to 33. The mean objective raw knowledge score on the post-test across the 40 items ($n=317^4$) was 63.9%, indicating students answered, on average, about 25 of the 40 questions correctly. The range in raw scores on the post-test was from 3 to 40.

The mean confidence score on the pre-test across the 40 items was 2.8 (on a 5 point scale). The mean confidence score on the post-test was 3.8. The range across the 40 questions on the pre-test was 2.0 to 4.0; the range on the post-test was from 3.3 to 4.5.

The mean confidence-adjusted knowledge score across the 40 items on the pre-test was -.641, indicating, on average that students were somewhat lacking in confidence in their responses; the range was from -105 to 122. The mean confidence-adjusted knowledge score on the post-test, at 51.95, was considerably higher, indicating far greater confidence among the students about their knowledge answers. The range in mean confidence-adjusted knowledge scores on the post-test was from -89 to 186.

Analyzing knowledge and confidence gains offers a new perspective beyond the big picture result that student knowledge scores on the post-test were, on average, almost 20 points higher. Among the questions taken from the Jump\$art Coalition for Personal Financial Literacy (J\$C) and the Lusardi and Mitchell (2008) questions (questions are in the appendix), all knowledge and confidence scores were significantly different on the post-test than on the pre-test at the 0.05 level except knowledge for J\$C15 ($t=1.945$, $p=0.53$). The largest knowledge gain was 39 points on J\$CQ6 (about credit reports and scores) and the one-point confidence gain was in the top three. The greatest confidence gain came on J\$CQ15 (about credit); although mean confidence increased by 1.2 points, the knowledge gain was only 7 points. J\$CQ26 (about life insurance) had the lowest knowledge gain (5 points). J\$CQ7 (about taxes) and Lusardi and Mitchell Q1 (compound interest) had the lowest confidence gains although the knowledge scores were quite different. Most (93%) correctly answered J\$CQ7 on the post-test compared to only 66% who correctly answered the compound interest question on the post-test.

Table 3 lists the pre- and post-test knowledge and confidence scores for the questions written by the author (available from the author). All of the knowledge and confidence scores were significantly different between the pre- and post-test except the knowledge scores for Q13 about taxes ($t=1.029$, $p=0.304$) and Q39 about home ownership ($t=1.325$, $p=0.186$). There was a 30 point gain in the knowledge scores on Questions 2 and 25 (both related to insurance) and Q27 (homeownership) and the increase in confidence was just less than 1 point on all three questions. Although the difference in the knowledge scores (45% v. 49%) was not significant for Q13 (about taxes), the increase in mean

⁴ Across the four semesters, 34 students dropped the course after the pre-test.

confidence was 1.1, a potentially concerning combination. The greatest increases in confidence were in Questions 4 (Insurance) and 26 and 28 (both about Retirement Planning).

Table 4 reports mean knowledge and confidence scores on the pre-test and post-test by content area, including all 40 questions. In the eight categories that included between two and four questions, the greatest mean gains in knowledge were in the financial institutions (25 point gain) and credit reports and scores (23 point gain) categories. The lowest knowledge gains were in the taxes (7 point gain) and credit (8 point gain) content areas; however, student confidence in their knowledge increased by 1.3 points in the credit and homeownership areas.

The exams included seven questions each in the retirement planning and insurance content areas and the knowledge scores increased by 24 and 22 points, respectively. The confidence scores in these categories increased by 1.0 and 0.9 point, respectively.

Conclusions, Implications, and Future Research

One interpretation of the results is that while college students may guess on financial knowledge exams, many tend to know if they are guessing. This result is no doubt influenced by several limitations of the sample used. One important limitation is selection bias. While the students who chose to take the personal finance elective from which the data were collected clearly represent a range of knowledge, they have one important characteristic in common – an interest in enrolling in a personal finance elective. It is unknown how that may influence the results but worthy of investigation.

A second limitation may be the differences in students' motivation to excel on the pre-test and post-test. While the exams were identical, the students' incentive to correctly answer the questions was different. Extra credit (and perhaps personal pride) were the only incentives to do well on the pre-test; in addition, some students may have mistakenly believed that "low-balling" the exam would somehow benefit them. On the post-test, the students' incentive to correctly answer the questions was a grade. However, that grade represented about only about 12% of the total points in the course. Some students may have seen this as insignificant. On the pre-test, students had little reason not to answer the confidence questions honestly. However, the students' perceptions of whether it was socially acceptable to admit they lacked confidence in a knowledge response may have changed after a semester-long course.

Another limitation is the possibility that students are more likely to correctly answer questions on the post-test and to indicate confidence in their answers because they recall the pre-test sufficiently well to see the post-test questions as familiar. While 15 weeks would appear to be a sufficient period of time for most students to forget the details of an exam given the first day of class, it is not outside the realm of possibility that some students would recall some questions. On the other hand, the instructor does not "teach to the test" nor review exam questions with students in the intervening period.

Finally, there is increasing evidence (see for example Donnelly, Iyer, & Howell, 2012) that personality characteristics may be as important if not more important than characteristics such as gender and major to explain differences in financial knowledge and confidence. Future research will include measures of a variety of personality characteristics to explore that possibility.

Assessing confidence in addition to knowledge presents a different dimension to the analysis. We can and should move beyond assessing the outcomes of our financial education efforts based on the results of multiple choice knowledge tests. Recent research has focused on overconfidence – a mismatch of objective and subjective financial knowledge. For example, Pak and Chatterjee (2016) used CogEcon data to demonstrate that overconfidence increases with age, and that overconfidence among older investors was associated with owning a riskier investment portfolio. If there is a parallel to be drawn to the current research, it might be that younger adults who are underconfident may choose less risky financial strategies (i.e., whether and how much student loan debt to acquire) than would be recommended for their age group. Those who are overconfident may choose financial strategies that are riskier than would be recommended for this age group. Future research could use content-specific confidence-adjusted knowledge scores to explore the role that overconfidence as well as underconfidence may play in young adults' adoption of appropriate financial strategies. However, little attention has been given to how educators go about increasing confidence and the relative importance of confidence vs. knowledge. It also is important to note that the confidence measured here is confidence in knowledge, not confidence about applying knowledge.

Calculation of confidence-adjusted knowledge scores presents a somewhat different picture of students' financial knowledge than raw knowledge scores alone. With confidence-adjusted knowledge scores, it was clear that on the pre-test most students lacked confidence in many of their answers – in other words, they often were guessing and they generally knew it. This was true even of questions that the majority of students answered correctly.

Using confidence-adjusted knowledge scores to examine post-test results provides insights beyond the 19 point improvement in raw knowledge scores between the pre-test and post-test. Use of confidence-adjusted financial knowledge scores indicated that on average students had far greater confidence about their correct answers and less confidence in their incorrect answers on the post-test than on the pre-test.

One of the greatest challenges for an educator is to change knowledge when the learner has great confidence in his/her incorrect knowledge. For example, confident and incorrect answers to pre-test Question 9 were largely influenced by the perception that the stock market is a relatively risky investment choice, even over the long term. Confident and incorrect responses to pre-test Question 16 were largely influenced by the belief that credit scores are routinely included in credit reports. Confidence in these incorrect assessments had dissipated by the time of the post-test. Knowledge of what students “know” when that knowledge is incorrect can be very helpful to the instructor.

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Table 1

Student Demographic Characteristics (N=352)

Variables	Value
Gender	
Male	45.0%
Female	55.0
College Major	
Agricultural and Environmental Sciences	10.0%
Arts and Sciences	38.0
Business	24.0
Education	3.0
Engineering	1.0
Environmental Design	1.0
Family and Consumer Sciences	8.0
Forestry and Natural Resources	0.5
Journalism and Mass Communication	10.0
Law	1.0
Pharmacy	0.5
Public Health	2.0
Public and International Affairs	6.0
Social Work	0.5

Note: The College Major variable totals greater than 100% as some students were double majors.

Table 2
Knowledge and Confidence Scores on Pretest and Posttest Questions from Other Sources

Question (Topic)	Pretest		Posttest		Change	
	Percent Correct	Mean Confidence	Percent Correct	Mean Confidence	Knowledge	Confidence
J\$CQ 6 (Credit reports and scores)	19	3.3	58	4.3	39	1.0
J\$C Q7 (Taxes)	72	3.6	93	4.1	21	0.5
J\$C Q11 (Saving & Investing)	19	3.1	47	4.0	27	0.9
J\$C Q15 Credit)	58	2.3	65	3.5	7	1.2
J\$C Q16 (Retirement planning)	59	2.8	80	3.6	21	0.8
J\$C Q26 (Insurance)	48	2.9	61	3.7	13	0.8
J\$C Q29 (Credit reports and scores)	93	3.9	98	4.5	5	0.6
L&M Q1 (Compound interest)	56	4.0	66	4.2	10	0.2
L&M Q2 (Inflation)	47	2.8	58	3.8	11	1.0
L&M Q3 (Saving & investing)	47	3.4	62	4.1	15	0.7
Mean	52%	3.2	69%	4.0	17	0.8

Table 3.
 Knowledge and Confidence Scores on Pretest and Posttest Questions Original to Author

Q	Topic	Pretest		Posttest		Change	
		Percent Correct	Mean Confidence	Percent Correct	Mean Confidence	Knowledge	Confidence
Q 2	Insurance	32	2.8	56	3.6	34	0.8
Q 4	Insurance	36	2.5	58	4.1	22	1.6
Q 25	Insurance	42	2.5	79	3.4	37	0.9
Q 29	Insurance	55	3.0	65	4.0	10	1.0
Q 34	Insurance	69	3.7	90	4.3	11	0.6
Q 38	Insurance	28	2.6	50	3.4	22	0.8
Q 5	Retirement planning	60	3.0	84	4.2	24	1.2
Q 8	Retirement planning	47	3.4	54	3.9	7	0.5
Q 26	Retirement planning	31	2.4	60	4.4	29	2.0
Q 28	Retirement planning	33	2.2	61	3.8	28	1.6
Q 40	Retirement planning	33	2.8	48	3.6	15	0.8
Q 7	Saving & investing	64	3.1	87	3.8	23	0.7
Q 10	Home ownership	30	2.0	55	3.6	25	1.6
Q 11	Home ownership	44	2.3	62	3.6	18	1.3
Q 27	Home ownership	44	2.7	78	3.8	34	0.9
Q 39	Home ownership	40	2.5	44	3.7	4	1.2
Q 13	Taxes	49	2.3	45	3.4	-4	1.1
Q 14	Taxes	23	2.5	32	3.3	9	0.8
Q 33	Taxes	70	3.1	85	3.6	15	0.5
Q 17	Financial institutions	69	3.3	94	4.2	25	1.2
Q 30	Financial institutions	27	2.5	49	3.4	22	0.9
Q 32	Financial institutions	32	2.5	60	4.0	28	1.5
Q 18	Credit cards	30	2.5	51	3.6	21	1.1
Q 19	Credit cards	48	2.5	68	3.8	20	1.3
Q 20	Credit cards	17	2.8	45	4.1	28	1.3
Q 21	Credit cards	52	2.5	61	3.4	9	0.9
Q 31	Credit reports & scores	40	2.7	61	3.9	21	1.2
Q 35	Credit reports & scores	48	3.2	76	3.7	28	0.5
Q 37	Credit	42	2.0	51	3.4	9	1.4
Q 36	General	49	2.9	58	3.8	9	0.9
Mean		43%	2.7	62%	3.8	15	1.2

Table 4
 Knowledge and Confidence Scores on Pretests and Posttests by Content Category

N of Questions	Topic	Pretest		Posttest		Change	
		Percent Correct	Mean Confidence	Percent Correct	Mean Confidence	Knowledge	Confidence
2	General	48	2.8	58	3.8	10	1.0
2	Credit	50	2.1	58	3.4	8	1.3
3	Financial inst.	43	2.8	68	3.7	2.5	0.9
3	Taxes	47	2.6	54	3.4	7	0.8
4	Credit rep & sco	50	3.3	7.3	4.1	23	0.8
4	Credit cards	37	2.6	56	3.7	19	1.1
4	Homeownership	40	2.4	60	3.7	20	1.3
4	Saving & invest	46	3.4	66	4.0	20	0.6
7	Insurance	44	2.9	66	3.8	22	0.9
7	Ret. planning	60	2.9	84	3.9	24	1.0

Appendix

JumpStart Coalition Questions

- J\$C6. Which of the following statements best describes your right to check your credit history for accuracy?
- Your credit record can be checked once a year for free.*¹
 - You cannot see your credit record.
 - All credit records are the property of the U.S. Government and access is only available to the FBI and Lenders.
 - You can only check your record for free if you are turned down for credit based on a credit report.
- J\$C7. Your take home pay from your job is less than the total amount you earn. Which of the following best describes what is taken out of your total pay?
- Social security and Medicare contributions.
 - Federal income tax, property tax, and Medicare and social security contributions
 - Federal income tax, social security and Medicare contributions*
 - Federal income tax, sales tax, and social security contribution.
- J\$C11. Sara and Joshua just had a baby. They received money as baby gifts and want to put it away for the baby's education. Which of the following tends to have the highest growth over periods of time as long as 18 years?
- A checking account
 - Stocks*
 - A U.S. Govt. savings bond
 - A savings account
- J\$C15. If you are behind on your debt payments and go to a responsible credit counseling service such as the Consumer Credit Counseling Services, what help can they give you?
- They can cancel and cut up all of your credit cards without your permission
 - They can get the federal government to apply your income taxes to pay off your debts
 - They can work with those who loaned you money to set up a payment schedule that you can meet*
 - They can force those who loaned you money to forgive all your debts

¹ This answer choice was modify to reflect Georgians' right to two additional free credit reports a year.

- J\$C16. Rob and Mary are the same age. At age 25 Mary began saving \$2,000 a year while Rob saved nothing. At age 50, Rob realized that he needed money for retirement and started saving \$4,000 per year while Mary kept saving her \$2,000. Now they are both 75 years old. Who has the most money in his or her retirement account?
- They would each have the same amount because they put away exactly the same
 - Rob, because he saved more each year
 - Mary, because she has put away more money
 - Mary, because her money has grown for a longer time at compound interest*
- J\$C26. If each of the following persons had the same amount of take home pay, who would need the greatest amount of life insurance?
- An elderly retired man, with a wife who is also retired
 - A young married man without children
 - A young single woman with two young children*
 - A young single woman without children
- J\$C29. Which of the following statements is true?
- Banks and other lenders share the credit history of their borrowers with each other and are likely to know of any loan payments that you have missed*
 - People have so many loans it is very unlikely that one bank will know your history with another bank
 - Your bad loan payment record with one bank will not be considered if you apply to another bank for a loan
 - If you missed a payment more than 2 years ago, it cannot be considered in a loan decision

Lusardi and Mitchell (2008) Questions

- L&M1. Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? More than \$102, Exactly \$102, Less than \$102
- L&M2. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy: More than today with the money in this account, Exactly the same as today with the money in this account, Less than today with the money in this account.
- L&M3. Do you think the following statement is true or false? "Buying a single company stock usually provides a safer return than a stock mutual fund." True False