

Outcome-Based Education: Innovative Co-Curricular Workshops on Options to Improve Financial Literacy in Colleges

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ABSTRACT

The literature laments college students' lack of financial literacy and their lackadaisical interest in learning. However, our research demonstrates that students can be enticed such that they get interested in acquiring financial skills. Generally, college students live hand-to-mouth and are happy to learn about money-making opportunities (not necessarily financial management). Students were informed that qualified faculty will conduct a series of workshops whereby they will learn financial tools and skills and will also get an opportunity to trade stocks and options first-hand. Literature on pedagogy confirms that experiential learning is the best way to learn. Students also prefer practical, hands-on learning more than listening to a lecture or reading a book. Moreover, if workshops (for which professionals charge exorbitant sums) are offered for free, students' interest soars, and they enrol in hordes. This is confirmed by our workshops which proved successful in enhancing student interest and imparting financial skills. The workshops were innovative and unique as they were online, interactive, tutored, and free. They were open to students from all majors, faculty, and staff. Students are excited about stock trading but are generally apprehensive of and intimidated by financial options. This was true of our sample of students as well, but the faculty-led, friendly, and riskless environment of hands-on learning provided a great opportunity, and over 100 individuals enrolled in our workshops. A comparison of pre- and post-survey quizzes shows that participants' interest in, and knowledge of options trading increased significantly due to the workshops.

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Introduction

The financial literature is replete with studies on financial literacy, or a lack thereof among young adults (Sabri, MacDonald, 2010; Robb, 2011; Lusardi, Wallace 2013; Moreno-García et al., 2013; and Chambers and Thorne, 2017). Adequate levels of financial literacy lead to greater financial stability and greater accumulation of household wealth (Behrman, Olivia, Soo, and Bravo 2012) whereas inadequate financial knowledge creates a disproportionate distribution of wealth, savings, and capital formation (Chinen and Endo, 2012; Kosier 2010). Some studies highlight the lack of adequate financial literacy among students at schools and colleges which persists with them when they grow up as adults. Understandably, the financial decisions made by such individuals often lead to poor choices and financial hardships. Collectively, when a sizeable majority makes poor financial decisions, it inevitably leads to a financial crisis. Some researchers blame financial illiteracy on a general lack of interest among young adults (Harrington and Smith 2016).

This paper discusses an innovative approach to use financial options to arouse interest among young adults thereby enhancing their knowledge of finance and a disciplined way to make money, balancing risk and return. If used wisely, financial options can be used to make profits and also to manage financial risk. A series of online workshops on financial options were offered at Georgia Gwinnett College, a four-year public college, which were open to students from all majors across all schools. The workshops were also available to the faculty and staff of the college. Our workshops were unique and innovative as the literature does not talk about any online hands-on workshops on financial options offered to college students. Professional brokerage houses and financial planning firms often advertise such workshops and seminars for a fee to investors. Usually, college students are not their primary targets and most students are neither interested nor have the financial resources to attend them. Our workshops were not only free but the professors

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were available to answer their questions and quiz them at various junctures. Students felt comfortable in the learning process both, during and after the sessions. They also freely utilized the chat box and the discussion board set up for this purpose. They seemed more comfortable with instructors who had a common bond with the college and often knew their names. The topic of financial options was in itself unique for most students. They may have attended lectures on financial planning, budgeting, savings, and even introductory investing but not a complex topic like financial options.

Participants were administered surveys and quizzes before- and after the workshops. Our results show that participants benefitted from the workshops in several ways. First, their interest in options trading and investing rose significantly. We initially planned to cap workshops' enrollment to about 30 participants. However, our first announcement resulted in over 100 interested individuals. The curiosity and the potential to make profits and manage financial risk seemed to make them very excited. In the end, what makes our workshops innovative is that they serve the purpose of raising the general financial literacy of college students through their enhanced knowledge about options.

The rest of the paper is organized as follows. Section II reviews some important research papers published in finance journals on the topics of financial literacy and how best to impart financial education to young adults. Section III specifically discusses Georgia Gwinnett College's institutional goals and learning outcomes. It also contains the description of workshop participants. Section IV explains in detail the *modus operandi* of the hands-on options workshops amounting to experiential learning. Section V analyzes the data collected *via* pre- and post-workshop surveys and quizzes. Some interesting results are observed and discussed. Finally, Section VI concludes the paper with a summary and directions for future research.

Literature Review

Researchers have been interested in studying the topic of financial literacy among young adults for several years. Among the more recent ones, Lusardi and Wallace (Lusardi, Wallace, 2013) state that young people are commonly the group with the lowest level of financial literacy in the United States and abroad and therefore demonstrate poor financial behavior. This group is also one of the most vulnerable and thus, financial literacy must emphasize a quantitative practical component. The practical component comprises hands-on experiential learning. Kim *et al* (2019) find that millennials have lower levels of objective financial knowledge and perceived financial knowledge. They find financial knowledge to be positively associated with performing positive short-term and long-term financial behaviors. Therefore, it is not surprising that young adults do not manage their money wisely and end up in financial problems.

Harrington and Smith (2016) investigate the demand for investing in financial literacy while in college using survey responses from a cross-section of students at a private college. Their results indicate that student interest in personal finance education is largely a function of perceived return, time cost, financial independence, and gender where female students have relatively more interest. Income, patience in consumption, credit experience, numerical ability, and other factors are not consistently significant to demand or interest in financial literacy. In other words, if we can somehow convince them that they can earn a better return on their investment (in time and money), they will get more excited and interested in learning about personal financial management. Harrington and Smith suggest offering learning opportunities for individual personal finance topics. Beale *et al* (2016) present empirical data that identify positive and negative influences on the awareness of financial markets and financial practical experiences of predominantly black young adults. Their findings also indicate that *interest* in financial markets influences one's practical financial experiences. Therefore, a key precursor to acquiring sound financial knowledge and skills is an inherent interest in the subject.

Researchers' interest in studying financial literacy among college students is not limited to the US only. Ramos-Hernandez *et al* (2020) compare financial literacy levels among college students between Mexico and Columbia to find similar trends as those portrayed in the US. They think that financial literacy can be enhanced in colleges because students are at an age to purchase different financial products and services in the market, such as bank accounts, credit cards, and insurance. College students have already joined the workforce or will do so soon. Philippas and Avdoulas (2019) study financial literacy and financial well-being among university students from Greece. Interestingly, they find that male students and students who keep expense records, or those whose fathers are highly educated are more financially literate. Ergun (2018) studied the level of financial literacy among university students in Estonia, Germany, Italy, Netherlands, Poland, Romania, the Russian Federation, and Turkey to find the relationship between financial knowledge and the demographic characteristics of students. The study finds a medium level of financial literacy. In their Colosseum Financial Literacy Model, Abdullah and Erdogan (2022) suggest that financial behavior is influenced by the other components shaping it, namely knowledge, skills, and affecting factors. As is well known, knowledge and skills can be best imparted by experiential learning, as proposed in this paper.

Experiential Learning via Hands-on Online Workshops

A series of online workshops on financial options were offered at Georgia Gwinnett College. The important logistical details of these workshops are as follows:

Initial Announcement of the Event and Assessing Interest

A college-wide announcement was made about the upcoming workshops 2-3 weeks ahead of the event. The nature of the workshops and the topics to be covered were included in the announcement. Participants were getting a chance to attend a series of workshops to learn about enigmatic investing in financial options. They looked at these workshops as a vehicle to enhance their knowledge of options trading firsthand which could provide them an opportunity to make money. Moreover, the workshops were available at no

cost to them. This created a lot of interest among the college community. Over 100 individuals signed up to attend the workshops. Weekly reminders were sent in advance of each workshop.

Days/times of Online Workshops Selected

After studying the weekly class schedule of courses offered at GGC and based on the authors' teaching schedules, we selected a 1½-hour slot on Tuesday evenings. Given the scope and complexity of the topic, it was decided to offer four weekly workshops during the Fall 2021 semester. The gap of a week was meant for the participants to digest the complex material presented during the workshops, pursue further personal studies, and answer quiz questions. The subject material includes some financial jargon and terminology that requires time and conscientious personal studies to digest. In retrospect, we feel that each of the four sessions was too concentrated and intense. When we offer the workshops again, we would prefer to spread it over six weeks with shorter durations, say one hour each.

Develop a List of Topics to be Covered in the Workshops

After careful in-depth brainstorming by the authors, a comprehensive list of topics was developed. This list was weened down to include a reasonable number of topics that could be covered conveniently over the four workshops. It was anticipated that participants would come with varied knowledge and different levels of preparation/experience, the topics started from the very basic topics to slightly more advanced topics. A complete list of topics covered in our workshops is included in the Appendix.

Diverse Group of Participants

Predictably, participants represented a diverse group of GGC constituents that included students, faculty, and staff, making it an interdisciplinary co-curricular event. The students came from various majors across schools and the faculty represented varied disciplines. They all had mixed levels of education, financial knowledge, varied levels of interest and experience with investing and money management, majors, and math skills. The diversity helped in making the learning process very meaningful.

Blackboard Collaborate Web Conferencing Platform

Each workshop session was conducted online *via* Blackboard Collaborate Web Conferencing and was recorded for later viewing by interested participants, or by those who had to miss a session for any reason.

Discussion Board

There was a discussion board set up for participants to ask questions and clarify any doubts that were not cleared during the workshop. Typically, the questions were answered on the same day to keep their interest alive.

Surveys and Quizzes

Surveys were given before and after the workshops. Quizzes were administered that were voluntary but highly encouraged because we strongly recommended they take the post-workshops survey to assess the extent of learning that happened due to the workshops.

Data Analysis

This section presents some descriptive data on participants and their experiences and attitudes on financial literacy. It further analyzes the data to make some inferences based on the pre- and post-workshop surveys and quizzes. Table 1 shows that the majority of workshop participants who completed the surveys and quizzes belong to the School of Business followed by students from the School of Science and Technology. Finance and Accounting happen to be the two most represented disciplines from the School of Business. Marketing, Economics, Supply Chain Management, Management, and General Business concentrations were also represented by the Business School. Mathematics and several Information Technology majors represented the School of Science and Technology.

Table 1: Workshop participant information a) Status (Faculty Student), b) School (School of Business/SBA, School of Science and Technology/SST, School of Liberal Arts/SLA), c) Experience with Stocks, d) Experience with Options, and e) Major or Teaching area

Status	Count	Percent	School	Count	Percent
Faculty	9	0.2093	SLA	1	0.0233
Students	34	0.7907	SST	10	0.2326
			SBA	32	0.7442
Table 1. a) Participant Status			Table 1. b) Participant School		

Level of Experience with Stocks	Count	Percent	Level of Experience with Options	Count	Percent
Advanced (More than 5 yrs)	0	0	Advanced (More than 5 yrs)	0	0
Intermediate (2 -5 years)	2	0.0465	Intermediate (2 -5 years)	0	0
Beginner (less than 2 years)	15	0.3488	Beginner (less than 2 years)	3	0.0698
None	26	0.6047	None	40	0.9302
Table 1c) Experience with Stocks			Table 1d) Experience with Options		

Major /Area	Count	Percent
Cinema Media Production	1	0.0233
IT-Enterprise Systems	1	0.0233
IT-Software Development	1	0.0233
Other	1	0.0465
Biology	2	0.0465
Business	2	0.0465
Management	2	0.0465
Economics	3	0.0698
Supply Chain Management	3	0.0698
Marketing	4	0.093
Math	5	0.1163
Accounting	7	0.1628
Finance	11	0.2558
Table 1e) Major/Faculty Area		

The options workshops were oversubscribed and had to be restricted to 60 participants. Student data was obtained from two main sources. The first involved attitudinal pre- and post-surveys: a pre-attitudinal course survey and a post-attitudinal course survey. The second involved course content multiple choice question quizzes of 35 questions (10 in week 1, 15 in week 2, and 10 in week 3), with pre and post-quizzes for students on each question. The pre-quiz was administered for all 35 questions before the beginning of the week, and the post-quizzes were administered by questions after the corresponding week’s workshop.

Analysis Results

Participant Characteristics

The post-attitudinal survey had only 12 respondents most of whom were faculty and so the data is mostly biased for statistical analysis. However, we do present important features from the pre-attitudinal survey which summarizes key information about course participants and participant demographics. These are summarized in Table 1 which provides information for participants by a) Status (Student/Faculty), b) School, c) Experience with stocks, d) Experience with options, and e) Student major/Faculty teaching area

Course quiz assessment summary with descriptive statistical analysis

One of the key ways in which the workshop was designed to be assessed was through the administration of (pre- and post-) quizzes by content area. These are multiple-choice questions, and the responses were recorded as “correct” or “incorrect” for each student. Ideally, each question should be a matched-pairs comparison (dependent) by question across all students. However, while matched-pair data was available for most of the 35 questions a couple of questions had insufficient (missing data) for sufficient matched pairs analysis. To that end, we present a descriptive summary of the results which captures all questions (pre-and post), followed by an inferential study of the matched pairs pre-post and quiz results by question. We begin by presenting a matrix of the quiz questions by question number, week, question text, and corresponding question objective from 1 of 4 objectives. The question description matrix is shown in Table 2.

Table 2: Matrix of 35 multiple choice questions by Number, Week, and Objective

#	Title	Question Text	Objective
1	WKS1Q1	A financial option _____	Basic Knowledge
2	WKS1Q2	In which country were futures markets first used?	Basic Knowledge
3	WKS1Q3	Options markets first appeared in _____	Basic Knowledge
4	WKS1Q4	In what decade did options appear to have made their debut in America?	Basic Knowledge
5	WKS1Q5	In what exchange are options traded in the US?	Basic Knowledge
6	WKS1Q6	Which of the following is NOT a use of options?	Basic Knowledge
7	WKS1Q7	In which way(s) can the option trader profit?	Basic Knowledge
8	WKS1Q8	Which of the following closely resembles options?	Basic Knowledge
9	WKS1Q9	Which agency or agencies regulate options trading?	Basic Knowledge
10	WKS1QT10	Which of the following can individual investors do with options?	Basic Knowledge
11	WKS2Q1	Which of the following is NOT part of an option?	Terminology
12	WKS2Q2	A ___ option grants the _____ the right to _____ the underlying stock at the _____ price before expiration	Terminology
13	WKS2Q3	In a call option, if its strike price is 2% higher than the price of the underlying stock, then the option is...	Practical Use
14	WKS2Q4	Which of the following is/are component(s) of the option premium?	Terminology
15	WKS2Q5	The buyer of an option has _____	Terminology
16	WKS2Q6	The strike price is _____	Terminology
17	WKS2Q7	When a put option is exercised, the _____	Terminology
18	WKS2Q8	The main component(s) of the extrinsic value are _____	Terminology
19	WKS2Q9	If the underlying stock's price remains in a narrow range until the option's expiration, the option's premium _____ due to _____	Greeks
20	WKS2Q10	If the underlying stock's price experiences sudden large variations, the option's premium _____ due to _____	Greeks
21	WKS2Q11	Which Greek is used to determine the change of the option premium for every dollar variation in the underlying stock's price?	Greeks
22	WKS2Q12	Which Greek is used to determine the change of the option premium as time goes by?	Greeks
23	WKS2Q13	Which Greek is used to determine the change of the option premium given changes in the underlying stock's volatility?	Greeks
24	WKS2Q14	Suppose XYZ is trading at \$100 on Aug 4. The Sept 15 put option with a \$95 strike is trading at \$2.16. What is the EXTRINSIC value of the option?	Practical Use
25	WKS2Q15	Suppose XYZ is trading at \$100 on Aug 4. The Sept 15 call option with a \$98 strike is trading at \$4.75. What is the INTRINSIC value of the option?	Practical Use
26	WKS3Q1	Which of the following is the price point at which the trader does not win or lose any money?	Practical Use
27	WKS3Q2	Which of the following is, usually, the option's strike price multiplied by 100?	Practical Use
28	WKS3Q3	Which of the following denotes the minimum account balance needed to place and/or maintain a trade?	Practical Use
29	WKS3Q4	Which of the following is the theoretical value of the account if all positions were to be converted to cash?	Practical Use

30	WKS3Q5	In the _____ strategy, the trader makes the max profit if the underlying stock price is _____ the strike price at expiration.	Practical Use
31	WKS3Q6	For which option strategy(ies) does the trader usually benefit with the passage of time?	Practical Use
32	WKS3Q7	Amanda has enjoyed considerable gains by holding 100 shares of XYZ stock for several years. However, presidential elections will happen next week and she is worried that XYZ may drop drastically after results are released. At the same time, she would like to profit if the stock increases after election. What would be the best strategy to protect her current gains without limiting potential upside?	Practical Use
33	WKS3Q8	Faruk is holding 100 shares of XYZ and would like to make extra money without taking additional risks. XYZ is a well-established company and he does not believe there will be sudden increases in price in the near future. Which strategy would work for him?	Practical Use
34	WKS3Q9	Kumiko saved \$9,000 to buy 100 shares of XYZ stock. Unfortunately, XYZ trades at \$100/share requiring \$10,000 to make the purchase. Instead of just waiting until XYZ drops to \$90, she could use an option strategy to get paid while waiting. Which strategy is that?	Practical Use
35	WKS3Q10	Margarita is a big risk-taker. She does not mind losing all her investments as long as she makes a lot of money if she is right. She read that XYZ is going to announce the release of a breakthrough product in 2 days. What strategy would allow her to potentially make multiple times the amount of her investment if XYZ increases dramatically after the announcement?	Practical Use

We now provide a descriptive statistical analysis of pre- and post-quiz results by question. First, we present the descriptive results for the pre- and post-quiz data for responses as correct or incorrect for responses. This summary does not pair the responses by students on pre and post responses to questions. The results are summarized in Table 3 which clearly demonstrate that the question success percentages increase across all questions from pre to post-workshops. Also note from Table 3 that though the success percentages increase from pre- to post-workshops, the standard deviations or variability does not essentially change from pre- to post. For instance, for WKS1Q5 (Week 1, Question #5) percent-correct improves from 19.3% to 81% and for WKS2Q13 (Week 2, Question #13) percent-correct improves from 0 to 70%. While the improvement is seen in all questions across all weeks, the standard deviation or the variability stays fairly comparable for all questions. This suggests that the participants increased their knowledge of the topics covered in the workshops.

Table 3: Summary of pre- and post-quiz question results (not matched or paired by student pre-and post-responses by questions but cumulatively by pre- and post- by question)

Question	Post				Pre			
	# Correct	Total	% Correct	St Dev	# Correct	Total	% Correct	St Dev
WKS1Q1	28	37	0.7568	0.435	29	57	0.5088	0.5044
WKS1Q10	28	37	0.7568	0.435	33	57	0.5789	0.4981
WKS1Q2	33	37	0.8919	0.3148	13	57	0.2281	0.4233
WKS1Q3	21	37	0.5676	0.5022	5	57	0.0877	0.2854
WKS1Q4	26	37	0.7027	0.4634	12	57	0.2105	0.4113
WKS1Q5	30	37	0.8108	0.3971	11	57	0.193	0.3981
WKS1Q6	18	37	0.4865	0.5067	16	57	0.2807	0.4533
WKS1Q7	16	37	0.4324	0.5022	19	57	0.3333	0.4756
WKS1Q8	18	37	0.4865	0.5067	9	57	0.1579	0.3679
WKS1Q9	12	37	0.3243	0.4746	2	57	0.0351	0.1856
WKS2Q1	19	24	0.7917	0.4149	20	57	0.3509	0.4815
WKS2Q10	18	24	0.75	0.4423	13	57	0.2281	0.4233
WKS2Q11	15	24	0.625	0.4945	24	57	0.4211	0.4981
WKS2Q12	18	24	0.75	0.4423	17	57	0.2982	0.4616
WKS2Q13	17	24	0.7083	0.4705	0	57	0	*
WKS2Q14	9	24	0.375	0.4945	10	57	0.1754	0.3837
WKS2Q15	14	24	0.5833	0.5036	9	57	0.1579	0.3679

WKS2Q2	20	24	0.8333	0.3807	31	57	0.5439	0.5025
WKS2Q3	17	24	0.7083	0.4643	20	57	0.3509	0.4815
WKS2Q4	14	24	0.5833	0.5036	4	57	0.0702	0.2577
WKS2Q5	18	24	0.75	0.4423	14	57	0.2456	0.4343
WKS2Q6	19	24	0.7917	0.4149	28	57	0.4912	0.5044
WKS2Q7	10	24	0.4167	0.5036	10	57	0.1754	0.3837
WKS2Q8	19	24	0.7917	0.4149	14	57	0.2456	0.4343
WKS2Q9	20	24	0.8333	0.3807	26	57	0.4561	0.5025
WKS3Q1	20	21	0.9524	0.2182	32	57	0.5614	0.5006
WKS3Q10	12	21	0.5714	0.5071	11	57	0.193	0.3981
WKS3Q2	19	21	0.9048	0.3008	13	57	0.2281	0.4233
WKS3Q3	16	21	0.7619	0.4364	12	57	0.2105	0.4113
WKS3Q4	19	21	0.9048	0.3008	30	57	0.5263	0.5037
WKS3Q5	8	21	0.381	0.4976	12	57	0.2105	0.4113
WKS3Q6	11	21	0.5238	0.5118	0	57	0	0
WKS3Q7	8	21	0.381	0.4976	8	57	0.1404	0.3504
WKS3Q8	15	21	0.7143	0.4629	15	57	0.2632	0.4443
WKS3Q9	15	21	0.7143	0.4629	26	57	0.4561	0.5025

We now describe key features of the success percent increases by week and by the four objectives (Basic Knowledge, Terminology, Greeks, Practical Use) summarized in Figure 1 (Figure 1a By Question by Objective and Figure 4b by Questions by Week). It is evident from Figure 1 that the percentage correct increases each week and by each objective from pre- to post-workshops. The biggest increases in post-success proportions for questions based on Figure 1a apply to the workshop objectives centered around the “Greeks” for options and “Terminology” with post-success proportions around 70% and to a lesser extent on the objectives related to “Basic Knowledge” and “Practical Use” with post success proportions around 62% and 65% respectively. Likewise, the biggest increases in post-success proportions for questions based on Figure 1b apply to questions from weeks 2 and 3 with success proportions of around 68% for both weeks and about 62% for week 1.

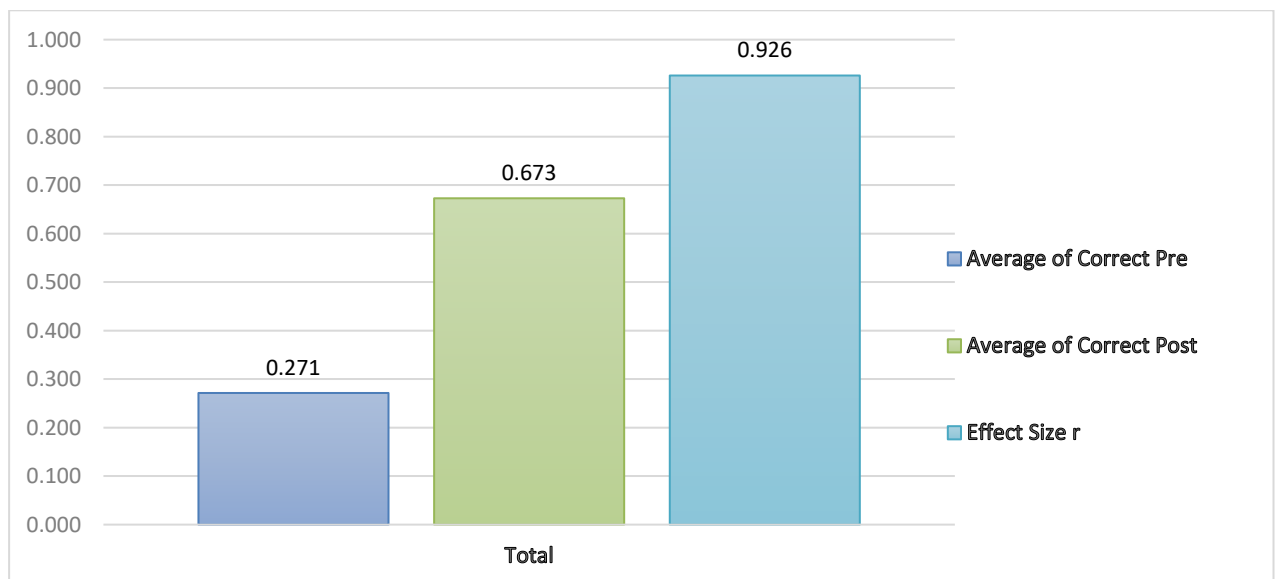


Figure 1: Statistics for multiple choice quiz Questions responses

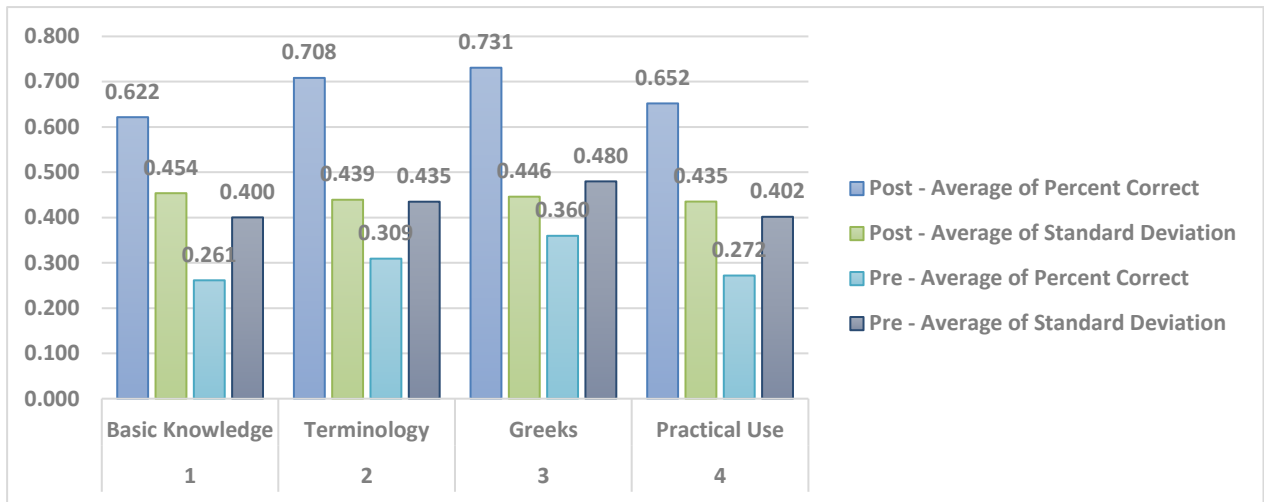


Figure 1a: Statistics for Multiple choice quiz Questions by Objective Type

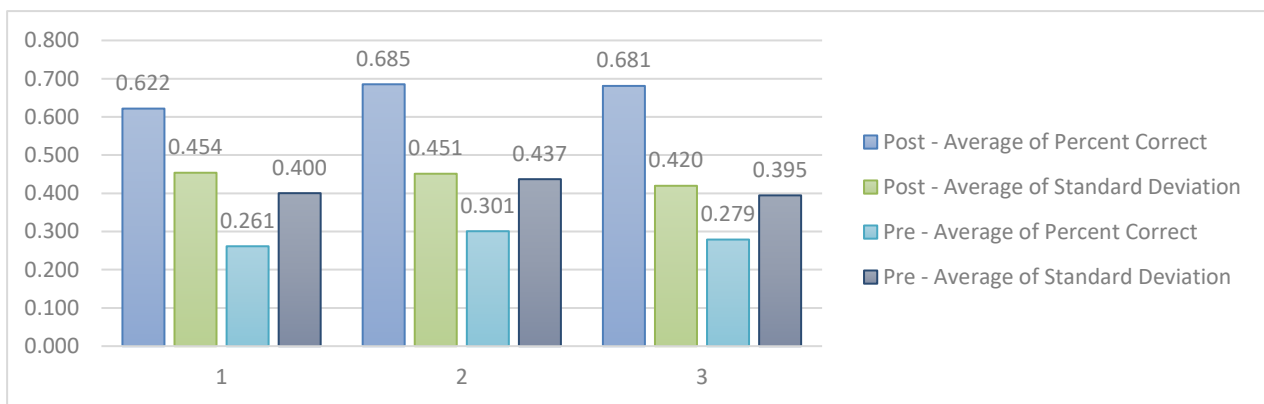


Figure 1b: Statistics for multiple choice quiz Questions by Week

It is also apparent from Figure 1 that standard deviations or variability are comparable from pre- to post-quiz survey questions. This means that while the percentage of correct increases from pre-to post-quiz questions, the variability does not change much. For instance, the variability or standard deviations by objective and by week for pre and post are very comparable. Specifically, with reference to Table 3, we see that the standard deviations for pre and post are both around 40% although the percentages of correct certainly are much higher for post than for pre-quiz question responses. We establish that the increase in proportions is statistically significant using significance tests for matched or paired pre-and post-quiz question responses in the next section using the Wilcoxon ranked sign test, a non-parametric procedure adopted since the response is not continuous and therefore not a normal random variable (taking values either “correct” or “incorrect”) and so a matched or paired t-test cannot be used.

Quiz assessment inferential analysis of paired pre- and post-success percentages

In this section, we conduct inferential analysis for differences in pre- and post-success percentages by each question for post and pre-quiz scores with student responses as matched or paired data on each question response pre- and post-quiz. Since the pre- and post-binomial values of “Correct or 1” and “Incorrect or 0,” are not independent, we cannot use a z-test for proportions which requires independence. Likewise, since the responses are binomial denoted as either “Correct or 1” or “Incorrect or 0” which is not continuous and therefore not a normal random variable we cannot use the standard paired t-test. Instead, we use a non-parametric test for matched responses toward an analysis of the success percentages or proportions for each question. We use the Wilcoxon Signed Rank Test. Recall that since the values of “Correct or 1,” or “Incorrect or 0,” are binary, the averages for correctness (0 or 1) are proportions.

This means that the hypotheses that we apply individually on each of the questions $Q_1 \dots Q_{35}$ are as follows:

H_0 : success proportion post quiz for question $Q_i =$ success proportion pre-quiz for question Q_i
 H_a : success proportion post quiz for question $Q_i >$ success proportion pre-quiz for question Q_i

We summarize the key features of the Wilcoxon Signed Rank test for matched proportions:

- A z-test for the comparison of proportions correct (pre- and post) cannot be used because of dependence
- A matched t-test of pre and post-values (correct =1, incorrect =0) cannot be used because these are discrete values, and are not even approximately normal
- A signed rank Wilcoxon test for matched pre- and post-values of “Correct=1” and “Incorrect =0” for averages, and therefore proportions was implemented in SAS
- Since all sample sizes were large, ($N \geq 20$ in all instances) SAS provided approximations to the corresponding Wilcoxon statistics, W , with z-statistics

We present a summary of the Wilcoxon z-tests including z-statistic, p-value, and the effect size for each question, $Q_1 \dots Q_{35}$ in Table 5. Recent trends in educational research have seen the move away from straightforward p-values to include meta-analysis such as including effect sizes.

Table 4: Matched or Paired non-parametric Wilcoxon ranked signed test results for proportions of success by question

Question	N	df	Correct Pre	Correct Post	z Wilcoxon	p-value (z)	Effect Size r
WKS1Q1	37	36	0.54054	0.81081	2.72655	0.0032**	0.448242^
WKS1Q10	37	36	0.59459	0.78378	1.56152	0.0592	0.256713
WKS1Q2	37	36	0.18919	0.91892	5.26889	<.0001**	0.8662^^
WKS1Q3	37	36	0.08108	0.62162	4.45889	<.0001**	0.733037^^
WKS1Q4	37	36	0.18919	0.7027	3.4889	<.0001**	0.573572^^
WKS1Q5	37	36	0.21622	0.81081	4.83152	<.0001**	0.794298^^
WKS1Q6	37	36	0.24324	0.51351	2.0395	0.0207*	0.335292^
WKS1Q8	37	36	0.16216	0.48649	3.12139	0.0009**	0.513153^^
WKS1Q9	35	34	0.05714	0.31429	2.51807	0.0059**	0.425631^
WKS2Q1	24	23	0.375	0.70833	2.06843	0.0193*	0.422216^
WKS2Q11	23	22	0.52174	0.6087	0.40211	0.3438	0.083847
WKS2Q12	23	22	0.43478	0.69565	1.45381	0.073	0.30314^
WKS2Q13	23	22	0.21739	0.65217	2.72655	0.0032**	0.568525^^
WKS2Q14	23	22	0.08696	0.3913	2.06419	0.0195*	0.430413^
WKS2Q15	23	22	0.21739	0.52174	1.56152	0.0592	0.3256^
WKS2Q2	24	23	0.5	0.83333	2.30085	0.0107*	0.469659^
WKS2Q4	23	22	0.08696	0.6087	3.54008	0.0002**	0.738158^^
WKS2Q5	24	23	0.16667	0.79167	4.01201	<.0001**	0.818949^^
WKS2Q6	23	22	0.30435	0.82609	3.12139	0.0009**	0.650855^^
WKS2Q8	23	22	0.31818	0.81818	2.92905	0.0017**	0.610749^^
WKS3Q10	20	19	0.15	0.55	2.66061	0.0039**	0.59493^^
WKS3Q3	21	20	0.15	0.8	3.71902	0.0001**	0.811556^^
WKS3Q4	21	20	0.55	0.9	2.41814	0.0078**	0.527682^^
WKS3Q1	21	20	0.45	0.95	2.72655	0.0032**	0.594982^^
WKS3Q8	21	20	0.25	0.7	2.28352	0.0112*	0.498304^

* denotes significant at 5% level, ** denotes significant at 1% level or low

^ denotes moderate effect, ^^denotes strong effect

In Table 4 in addition to p-values for the non-parametric test to compare matched success proportions on each pre- and post-quiz question we also provide the *r-effect* which is related to the Cohen's D effect and in many ways is comparable to a correlation type measure. The interpretation values for r commonly in published literature and on the internet are:

- a) Small effect if $0.1 \leq r < 0.3$
 b) Medium effect if $0.3 \leq r < 0.5$
 c) Strong effect if $r \geq 0.5$

For the matched Wilcoxon test the *effect-size r* is calculated using the following formula:

$$r = \frac{z}{\sqrt{N}}$$

Where z = the Wilcoxon z-value, and

N is the sample size for that question (N being the number of responses for which we have post and pre-responses for that student on that question.)

Table 5: Matched or Paired non-parametric Wilcoxon ranked signed test results for proportions of success by all 35 questions combined

Question	N	Df	Correct Pre	Correct Post	z Wilcoxon	p-value (z)	Effect Size r
35 Combined	700	699	0.27143	0.67286	24.5	1.00E-13	0.926013

The actual student-paired question data used for this non-parametric Wilcoxon test is not shown in the interest of space but is summarized in Table 5 below. As can be seen from Table 5 the majority of questions have strong effects ($r \geq 0.5$) associated with the and/or low p-values (≤ 0.01). For instance, for WKS1Q2 (Week 1, Question #2), the p-value ($<.0001$) and *r-effect* (0.8662) suggest significant improvement between pre- and post-workshop results. Similarly, for WKS2Q5 (Week 2, Question #5), the p-value ($<.0001$) and *r-effect* (0.818949) suggest significant improvement in participant performance on question number 5 due to the workshop held in week 2. There are a few exceptions, e.g., WKS1Q10 has a p-value just above 0.05 and an *r-effect* of 0.25, and WKS2Q11 which has a p-value close to 0.3 and an *r-effect* close to 0.

We also carry out the Wilcoxon matched or paired test for proportions post and pre for all questions and not concerning question number (not concerning the questions Q_1, \dots, Q_{35} as variables). This means each student's response on each question (pre and post) was tabulated (without identifying the actual question number) and the Wilcoxon pairwise test for proportions was conducted on those combined 700 post and pre-responses. In this scenario, every matched pre and post, by student and by the question was used, and not separated by question and so the appropriate inferential hypotheses for this matched test for proportions are:

H_0 : The average proportion of success on post-quiz questions = average proportion of success on pre-quiz questions

H_a : The average proportion of success on post-quiz questions > average proportion of success on pre-quiz questions

Statistics for paired analysis of multiple-choice quiz questions responses are detailed as follows

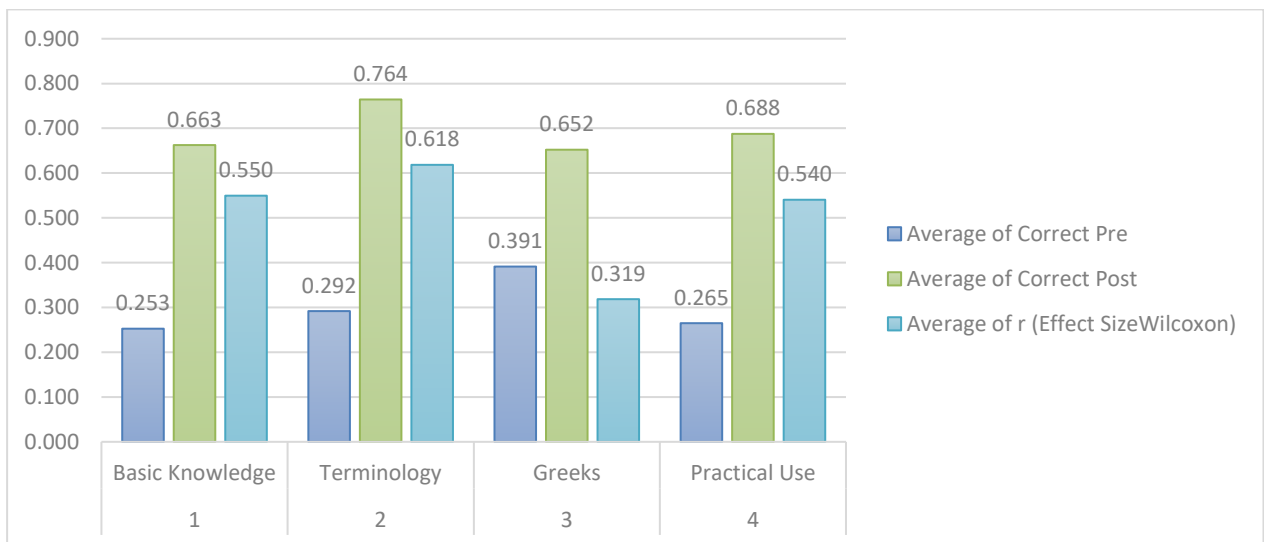


Figure 2a: Statistics for paired analysis for multiple-choice questions by objective

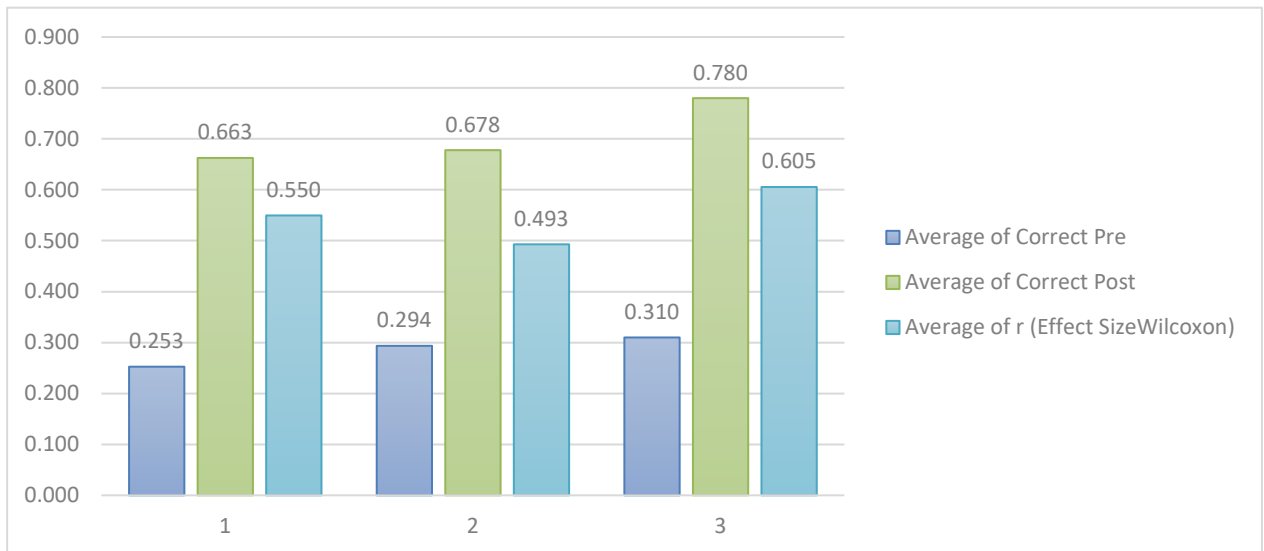


Figure 2b: Statistics for paired analysis for multiple-choice questions by Week

The results are shown below and summarized in Table 5. The effect of the options workshops is strong with $r = 0.92601$ and the p -value is close to 0. The effect sizes (r) for questions by objective and for questions by week are summarized in Figure 2. We see the effect of the workshop is strong for the objectives “Basic knowledge”, “Terminology” and “Practical use” with effect sizes all greater than 0.5 and a small effect for the “Greeks objective” with an effect size of 0.31. The workshop effect by week is strong for Weeks 1 and 3 with r -effects larger than 0.5 and moderate effect size for week 2, with r just under 0.5.

Conclusion

Lack of adequate financial literacy in colleges is well-documented and among the many reasons postulated, a general lack of interest and curiosity among school/college students is quite evident. Furthermore, the traditional techniques and courses offered are not too effective in addressing the problem. This paper provides a unique outcome-based co-curricular experiential pedagogical tool to supplement the traditional techniques to enhance interest in investing and financial matters and overall financial literacy. A series of weekly workshops on financial options was offered at a four-year open-access public college. At the outset, the interest level among students, faculty, and staff of the college to enhance their knowledge and skills in options trading increased significantly. They looked at this event as an opportunity to learn more about the less common mode of investing. All workshops were free of any enrollment cost to them.

Based on the results of pre- and post-workshops surveys and quizzes this paper finds a *significant increase in interest and knowledge among participants*. The study also finds that the significant improvement is spread over the entire period that the workshops were offered. Quiz results demonstrate improvement in participant interest and financial literacy every week. Future studies will further dissect and focus on the reasons and specific topics that can be emphasized during similar workshops.

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Appendix

An Outline of Topics Covered in Workshops

a) Introduction

- i) Historical Background
- ii) Uses of options
 - Hedging. Insurance against price fluctuations
 - Speculation. Profit from direction, volatility and/or time decay
- iii) Basic introduction to the Black-Scholes model

b) Fundamental Concepts

- i) Definition. Options as contracts
 - Types of options. Calls and Puts
- ii) Strike price
- iii) Expiration date
- iv) Basics of options profitability (buyers vs sellers (writers))
- v) Option premium. Bid and ask
- vi) In the Money (ITM), Out of the Money (OTM), At the Money (ATM)
- vii) Exercise and assignment
- viii) Intrinsic and extrinsic value
- ix) Time decay
- x) Implied Volatility
- xi) Greeks. Delta Δ , Gamma Γ , Theta θ , Vega V , Rho ρ .

c) Strategies

- i) Concepts. Max gain, max loss, break even, margin requirements, portfolio margin, nominal value, margin call.
- ii) Put. Short, cashed-secured short, long, credit (or short) put spread, debit (or long) put spread
- iii) Call. Short, long, covered call, credit (or short) call spread, debit (or long) call spread

d) Hands-on Practice

- i) Creating a paper account
- ii) Selecting stock/ETF symbol
- iii) Selecting option from option chain
- iv) Placing the trade
- v) Managing the trade
- vi) Book-keeping

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