Comparing the Effectiveness of Retirement Planning Tools: A Study on Financial Illiteracy and Retirement Preparedness

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Abstract

This paper examines the issue of retirement preparedness among individuals, focusing on the impact of financial illiteracy on retirement planning. Despite the availability of education tools, many individuals lack the necessary knowledge to plan for retirement effectively. This study aims to compare the effectiveness of two commonly used retirement planning tools – financial calculators and reading retirement planning articles –in promoting action toward retirement planning among study participants, while also examining the emotional responses evoked by each treatment. Results indicated no meaningful statistical difference in the effectiveness of either tool in promoting action. However, a significant relationship was found between the financial calculator treatment and the likelihood of participants reporting negative emotions. Future research on the topic could explore different education methods and investigate the reasons why the financial calculator treatment elicited stronger negative emotions. Additionally, further analysis could be conducted to examine the results for different demographics. These findings have important implications for driving research on retirement preparedness forward, particularly for underrepresented groups who stand to benefit most from financial literacy knowledge.

KEYWORDS: (Retirement Preparedness, Financial Literacy, Retirement Planning Tools)

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED UNAUTHORIZED AID ON THIS THESIS

Signature

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Introduction

In the last 50 years, planning for retirement has undergone a significant transformation with the 401(k) replacing the traditional pension plan. This change has shifted the responsibility of retirement entirely to the individual who is retiring. There are advantages to this new system such as control over your risk tolerance and tax benefits. But there is one large problem with the change. People have very minimal knowledge of how to plan for retirement on their own. One-third of adults in their 50s have failed to develop any kind of plan for retirement savings at all (Lusardi and Mitchell, 2007a). This alarming statistic has led to considerable research into what is causing this lack of preparedness and what can be done to solve it.

Studies conducted on the topic of retirement planning have consistently identified financial illiteracy as a significant factor (Lusardi and Mitchell 2007a). Research has revealed that individuals often lack adequate understanding of the importance of early preparation for retirement as well as the necessary steps required to achieve it. This issue is particularly pronounced among demographics such as women, Hispanic and African Americans, and those with lower educational attainment (Lusardi and Mitchell, 2007a, 2007b). To address this issue, researchers have explored the potential of education programs as a solution. These studies have discovered a positive impact of these programs in promoting retirement planning and investment among individuals, particularly those with low levels of education and income. (Lusardi 2002, Lyons, Chang, and Scherpf 2006).

A recent survey conducted by Bank of America indicates that 62% of employers provide access to investment advisory services to their employees (2022). While prior studies have leveraged these employer-sponsored resources to prove the value of participation in retirement

planning, little research has been done on the most effective ways for this information to be absorbed. Since the initial financial illiteracy research, the focus has been on making the usefulness of literacy education known. Now that relationship has been established, there is an opportunity to research the optimization of these education resources. This paper will be addressing that opportunity by comparing the effectiveness of two commonly used retirement planning tools to determine which is more likely to spur action toward retirement planning in study participants.

After completing this study, it was found that there was no significant difference in the effectiveness of the two retirement planning tools, financial calculators and retirement planning articles, in promoting retirement preparedness. However, participants who completed the financial calculator tool were significantly more likely to report negative emotions after completion of the learning experience than those who read the article. This study lays the groundwork for future research in this area, such as exploring different education tools, investigating more on the influence of emotions, and examining how demographics approach retirement planning differently. By identifying both financial calculators and retirement planning articles as effective tools for retirement planning, progress toward widespread preparedness becomes increasingly possible.

Literature Review

Retirement Preparedness

Over the past two decades, extensive research has been conducted on retirement preparedness. After several studies around the world, three explanations for an individual's retirement planning, or a lack thereof, have persisted. First, and most significantly, a person's financial knowledge has the greatest positive relationship on participation in the stock market

(Van Rooij, Lusardi, and Alessie (2011), Lusardi and Mitchell (2007b)). Simply put, the more people understand the stock market the more likely they are to participate in it. This theory also extends beyond just the stock market into overall consideration for the steps necessary to be financially independent in retirement. Those who are financially literate are more likely to rely on formal methods of retirement planning such as retirement calculators, seminars, and financial experts, instead of their relatives or co-workers (Lusardi and Mitchell 2011). Lastly, it has been found that financial literacy has a strong impact on household wealth accumulation. Results from the study by Behrman et al (2012) suggest that investing in financial literacy could have large positive effects on household wealth accumulation. While these findings have significant implications for the importance of financial literacy for all individuals, minority groups that have traditionally missed out on the benefits described above have the most to gain from the from increasing their financial literacy (Lusardi and Mitchell 2007b).

Education Effectiveness

Using the findings of these studies, researchers have made significant efforts to address the issue of low financial literacy. Although work has been done to confirm the effectiveness of financial literacy education programs on retirement preparation, limited research has explored how to best deliver this information to those who need it most (Lusardi and Mitchell 2009; Bayer et al. 2009). One area of investigation has been to identify the most effective timing and context for financial literacy education. A concerning result from these studies found that the success of financial literacy programs can be short-lived, as students who completed a literacy program in high school reported the same level of literacy as those who had never taken the course, just one year after completing it (Mandell and Klein, 2009). Given that 21 states in the U.S. currently have personal finance requirements for high school students, this raises concerns about the effectiveness of such programs. However, the workplace has emerged as a promising

environment for promoting savings and 401(k) participation, with new employee orientation proving to be even more effective in providing teachable moments (Lusardi, Keller, and Keller, 2009; Amromin et al., 2010). Notably, these studies did not collect data on the demographics of the participants, leaving a gap in the literature on the impact of financial literacy programs on minority and low-income individuals.

Treatment

To address the gap in researching regarding the delivery of financial literacy education, the present study aims to investigate two common methods for providing retirement planning information. One of the methods studied is the use of financial calculators, which. Junare and Patel (2013) argue increases awareness of the required savings for retirement, allow testing of various "what if" scenarios, and provide additional information beyond that of a financial advisor. However, Dorman et al. (2018) and Turner (2010) express skepticism about the sole use of financial calculators as a retirement planning tool for individuals, recommending the integration of information provided by these calculators with resources from certified financial planners. Nevertheless, both Junare and Patel (2013) and Lusardi and Mitchell (2011) suggest that the use of financial calculators by individual investors results in higher financial literacy and overall financial independence in retirement. The use of financial calculators in this study will help detect any relationship between the use of these tools and participants' financial literacy, as well as any emotional response or action prompted by their use.

The second treatment method investigated in this study is the effectiveness of financial education resources in both written communication and website information. According to Ntalianis and Wise (2011), both written communication and website information are effective means of conveying financial education. Their study found that 61.5% of the respondents had previously accessed their retirement fund website and considered web-based educational

information highly informative. The study also showed that the most critical information found on the website pertained to expected return performance and potential risks of retirement fund offered investment options. Similarly, Loibl and Hira (2006) found that written communications contributed positively to the employee retirement savings knowledge and were best recalled by participants over any other educational resources. Although there is limited research on the direct impacts of reading website information on action towards retirement planning, the research presented above instills confidence that participants will be engaged in the learning experience by reading the information provided on the TIAA website.

Overall, the review of both treatment interventions instills confidence in the ability of these methods to impart some level of retirement preparedness knowledge to participants. The differences resulting from comparing the two treatments are intriguing and will be further examined in this study.

Emotions

One of the final points of interest that will be explored in this study is the influence emotions have on retirement planning and preparedness. Perik et al. (2018) investigated the role of emotions in long-term financial decision-making to better understand how individuals can be engaged in the retirement planning process. They found that older respondents reported more positive emotions compared to younger respondents. Moreover, individuals who perceived retirement planning as knowable rather than random were more likely to experience happiness with the planning process. Perik et al. (2018) also discussed what little analysis had been done on the topic of emotions and retirement planning, particularly when considering long-term behavior rather than just short-term emotions. Research conducted by Hastings and Mitchell (2020) touches on the influence of thinking in the short term. They found a negative association between impatience or present bias and the tendency to reduce stock market participation. This finding

suggests that those who are influenced by short-term gains or near-term spending satisfaction may be less likely to save for retirement. Another study completed by McKenzie and Liersch (2011) examined the effect of exponential growth bias, which is the misinterpretation of money growth. They found that this bias significantly influences the decision-making of US households. Strategies for reducing the impact of exponential growth bias include increasing awareness of the cost of waiting to save and showing the benefits of starting the savings and investing journey early. In a study by Mahdysiuk et al. (2020), participants completed a psychological preparedness for retirement questionnaire, which revealed the highest positive emotions among participants with medium levels of preparedness and lower positive emotions among those with high preparedness. This finding may be attributed to heightened awareness, anxiety over the future, and more active appraisal for their preparedness for the future.

Methodology

This study included employees of Colorado College whose ages ranged from 20 to 81 who have defined contribution 401(k) retirement plans through TIAA, the Teachers Insurance and Annuity Association of America. Participants were excluded from the study if they indicated participation in a retirement seminar with TIAA that took place in December 2022. The study included 64 respondents, 23 males, 41 females, and 1 non-binary individual. Furthermore, 50 respondents self-identified as White, 1 as Black and White, 6 as Asian, 4 as Latino, Latina, or Latinx, 1 as Indigenous, Native American, or Pacific Islander, and 2 as Other.

The study commenced by administering the first part of the survey with 23 questions, wherein the first five aimed to gather demographic data from the respondents. The subsequent questions assessed the participants' baseline financial literacy level, which was adapted from Lusardi and Mitchell's study that investigated the correlation between financial knowledge and

retirement planning (Lusardi and Mitchell 2007b). The complete list of questions from Part 1 of the survey can be found in Appendix A. In their study, Lusardi and Mitchell found the average score was 66%, which was lower than my study's average of 73% correct. A more detailed discussion on the findings can be found in Appendix B.

The study then proceeded to the treatment stage, wherein out of the 64 respondents who completed Part 1, only 50 continued to Part 2. This is due to participants leaving the survey after being directed to the learning portion and not continuing. These participants were randomly assigned to either of the two treatment groups. The first group received three articles from TIAA's website, which focused on determining their retirement budget, identifying the most suitable retirement accounts, and the impact of compounding interest on retirement investments. Links to the articles used can be found in Appendix C. The second group completed three financial calculators that aimed to recommend a monthly investment contribution based on age and retirement goals, determine their eligibility for certain IRA accounts based on age and income, and lastly a calculator used to help estimate their retirement budget. Details of the calculators used can be found in Appendix C.

Lastly, for the final stage of the study participants were given the opportunity to reflect on the influence of the learning experience. This section was aimed on gauge the impact of the learning experience on the participants' willingness to act towards retirement planning. The respondents were asked to rate their likelihood of performing eight different actions, including logging into their retirement accounts, and adjusting their contribution to those accounts. This portion was concentrated on measuring the potential impact the education had on participants' willingness to act towards planning for retirement. This section also included questions regarding the emotions the training may have provoked, their engagement with the material, and any

further feedback they may have. The results section will primarily focus on the analysis of this portion of the survey.

Participants were recruited to the study via a CC Staff Digest post as well as marketing directly to the Athletic Office and Career Center employees. This decision was made based on relationships and access to direct communications with those groups. All participants were offered a financial incentive of $10 to complete the study. Participants were offered their compensation as either an Amazon gift card or cash. To receive this compensation participants were required to provide either a name or email address. This data was collected separately from the rest of the survey results to maintain anonymity.

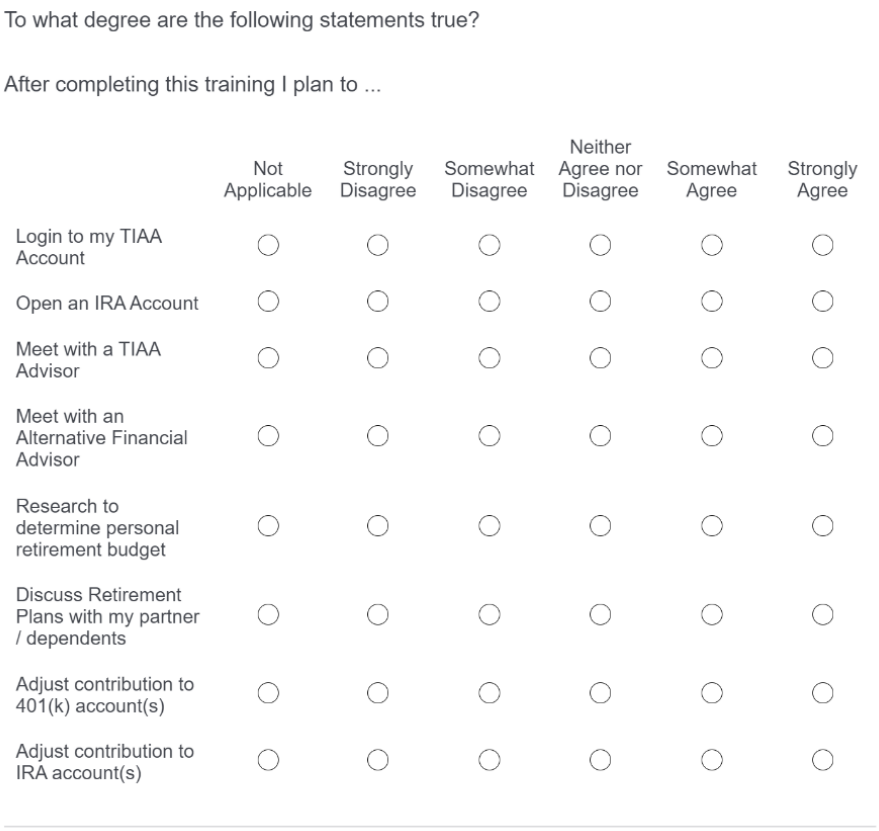
Results

This study comprises two main areas of analysis. The first involves examining the impact of the two treatment groups on participants' willingness to take action. Both treatment groups responded to the same question, shown in Figure 1, to measure their willingness to act.

Treatment Analysis

Figure 1

Action Question from Participant Survey



To what degree are the following statements true?

After completing this training I plan to ...

	Not Applicable	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
Login to my TIAA Account	○	○	○	○	○	○
Open an IRA Account	○	○	○	○	○	○
Meet with a TIAA Advisor	○	○	○	○	○	○
Meet with an Alternative Financial Advisor	○	○	○	○	○	○
Research to determine personal retirement budget	○	○	○	○	○	○
Discuss Retirement Plans with my partner / dependents	○	○	○	○	○	○
Adjust contribution to 401(k) account(s)	○	○	○	○	○	○
Adjust contribution to IRA account(s)	○	○	○	○	○	○

Treatment analysis was conducted to test the effectiveness of the treatments in promoting action from participants. An ordinary least squares (OLS) regression was employed to examine the impact of the treatment on the participants' willingness to act, with the responses to the question assigned a number from 1 to 5. The dependent variable was treated as continuous, and the OLS method was utilized, although an ordered probit model could have been used as an alternative method.

In this study, the model was run with each of the action items serving as dependent variables on the left-hand side and the treatment (calculator vs. article) as the independent

variable. The model also included seven control variables, with explanations for each variable provided below:

$$\text{Loginagree1} = \beta_0 + \beta_1\text{treatment} + \beta_2\text{gender} + \beta_3\text{Age} + \beta_4\text{race} + \beta_5\text{education} + \beta_6\text{salary} + \beta_7\text{engage} + \beta_8\text{litscore} + \varepsilon$$

- Loginagree1 represents the participants' agreement to log in to their retirement account.
- Treatment is a dummy variable representing the independent variable for the learning treatment the participant received – either the financial calculators or the articles.
- Gender is a set of dummy variables indicating the gender of the respondent, with female as the reference group.
- Age is a continuous variable measuring the age of respondents.
- Race1 is a set of dummy variables indicating the race/ethnicity of the respondent, with white as the reference group.
- Education is an ordered variable with the categories of 1=High School Education, 2 = Bachelor's Degree, 3 = Master's Degree, 4 = Doctorate Degree.
- Salary is a continuous variable measuring the income of the respondent in dollars.
- Engage is treated as continuous variable with the response of how engaged the respondents were in the training on a scale from 1 to 7, with 1 being not at all to 7 being very engaged.
- Litscore is a continuous variable that represents the number of questions the respondent answered correctly on the literacy test taken before the treatment.

The regression model described above was used for all eight action opportunities. The number of observations included in each model varied from 30 to 42, depending on how many responses were dropped from the "Not Applicable" selection. The action item with the highest opt-out rate was opening an IRA account, which could be assumed to be a good thing, as most participants already have the account and do not need to open a new one.

Table 1 presents the results for the OLS regression, which seeks to explain the factors that influence the likelihood of an individual agreeing to act toward retirement planning. The table is structured to compare the impact of each treatment, with all other variables held constant, on each action item.

Table 1 – Regression Results

VARIABLES	(1) Login	(2) OpenIra	(3) TiaaMeet	(4) OtherMeet	(5) Research	(6) Discuss	(7) Adj401	(8) AdjIra
Treatment = Article = 0 Calc = 1	-0.53	0.76	0.46	0.08	-0.80**	0.49	-0.05	0.10
	(0.35)	(0.63)	(0.38)	(0.48)	(0.29)	(0.54)	(0.45)	(0.53)
Gender = Female = 1 Male = 2	-0.96**	0.25	-0.08	-0.44	-1.07***	-0.07	0.47	0.10
	(0.37)	(0.46)	(0.36)	(0.49)	(0.36)	(0.48)	(0.51)	(0.58)
Age	-0.01	-0.01	0.03	-0.02	-0.00	0.02	0.03	0.03
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
race1 = 1 = White	-0.11	0.75	0.26	1.18**	0.43	0.59	-0.07	0.25
	(0.41)	(0.49)	(0.54)	(0.52)	(0.35)	(0.55)	(0.54)	(0.62)
Educ= 2, Bachelor's	1.01	1.23	0.81	1.29	1.02	-0.75	0.97	0.32
	(1.17)	(1.02)	(1.07)	(1.12)	(0.94)	(0.57)	(1.06)	(1.05)
Educ = 3, Master's	1.19	1.25	1.06	1.08	1.24	0.18	1.36	0.45
	(1.12)	(1.04)	(1.01)	(1.12)	(1.01)	(0.65)	(1.08)	(1.06)
Educ = 4, PhD	2.06	-0.07	1.08	1.09	1.68	0.51	1.96	1.32
	(1.24)	(1.30)	(0.94)	(1.19)	(1.02)	(0.53)	(1.16)	(1.16)
salary	0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.00**	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
engaged	0.42***	0.45**	0.42***	0.18	0.27**	0.30	0.28*	0.10
	(0.09)	(0.18)	(0.14)	(0.14)	(0.10)	(0.18)	(0.15)	(0.16)
litscore	-0.10	-0.27**	-0.14	-0.12	0.07	-0.08	-0.03	0.05
	(0.07)	(0.13)	(0.11)	(0.10)	(0.07)	(0.10)	(0.09)	(0.14)
Constant	2.02	1.49	0.20	2.27	1.24	2.43	0.68	1.14
	(1.28)	(1.58)	(1.76)	(1.84)	(1.64)	(1.71)	(1.78)	(2.05)
Observations	39	30	42	40	42	34	35	37
R-squared	0.52	0.35	0.41	0.22	0.54	0.36	0.33	0.20

Note: Standard Errors are in parentheses. *p<0.10 **p<0.05 ***p<0.01

The OLS results indicate that a one-unit increase in the independent variable results in a change in the dependent variable, or action item, by the reported coefficient, while holding all other variables constant. For instance, the coefficient of the treatment variable, which compares participants who completed the financial calculator versus those who read the article, is -0.53, meaning that completing the calculator reduces the likelihood of participants logging into their TIAA account. However, it should be noted that the constant variable may be influenced by the article treatment, which is represented by zero in the model.

Although the regression line predicts only 20 to 54% of the actual data, some significant relationships can still be observed. The ability to predict the probability of participants moving from strongly disagreeing to strongly agreeing may not be as reliable as expected, but the results presented in this paper, combined with further research on a more representative participant pool, are promising for drawing more definitive conclusions in the future.

Regression Post Estimations

Multicollinearity

To assess the validity of the regression analysis, a multicollinearity test was conducted to determine whether any of the independent variables were correlated with each other. The results of the correlation matrix are presented in Table 2.

Table 2 – Multicollinearity Test Results

	logina~1	treatm~t	gender	Age	race1	educat~n	salary	engaged	litscore
loginagree1	1.0000								
treatment	-0.3615	1.0000							
gender	-0.2317	0.0313	1.0000						
Age	0.1013	0.0399	-0.1321	1.0000					
race1	0.1228	-0.3036	0.1158	0.4439	1.0000				
education	0.2146	0.0107	0.0905	-0.1636	-0.0925	1.0000			
salary	0.1851	-0.1826	0.2000	0.6128	0.4453	0.0296	1.0000		
engaged	0.4920	-0.2891	0.1452	0.3324	0.3836	-0.1608	0.3404	1.0000	
litscore	-0.0625	0.1278	0.1243	0.3283	0.3298	0.1071	0.3421	0.1218	1.0000

Two variables are considered to have high correlation if the correlation coefficient is above 0.8 or 0.9. Fortunately, there are no immediate concerns for multicollinearity among these variables. To further confirm this finding, a variance inflation factor (VIF) test was conducted. Multicollinearity is indicated by a VIF score over 10 or a 1/VIF value smaller than 0.1. The largest VIF score observed was 5.8, and the lowest was 0.186, indicating that there are no major concerns for correlation among the independent variables, and thus the analysis can proceed.

Omitted Variable Testing

The next analysis conducted on the model was the omitted variable test, aimed at determining if any significant variables were left out of the regression model. The test was conducted for each dependent variable tested in the regression. In all cases, the null hypothesis could not be rejected, indicating that there is no evidence of omitted variables in the model.

Heteroskedasticity Testing

The final test used to evaluate the model was the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. This test was performed to determine whether the model exhibits constant variance. Heteroskedasticity can arise when the variance of the residuals is not consistent across all values of the independent variables, which violates a key assumption of regression analysis. To test for heteroskedasticity, each variable was analyzed and no evidence of heteroskedasticity was found. This indicates that the model's errors have constant variance, making it a reliable tool for making accurate predictions and drawing relevant conclusions. With the model passing all tests, we can conclude that it is robust and that the regression coefficients can be interpreted with greater confidence.

Further Action Analysis

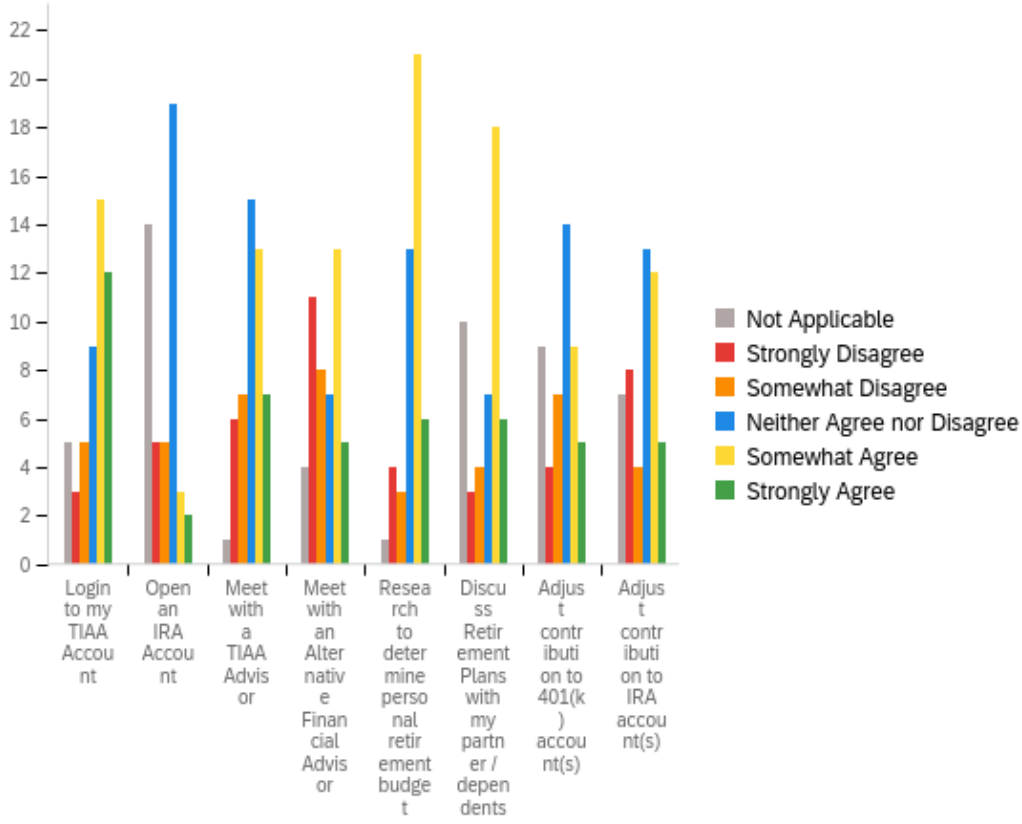
In addition to the statistical analysis presented earlier in this section, further analysis can be conducted on the meaning of the results obtained from the action question. Figure 2 below illustrates the responses of participants to the action question, showing the number of individuals who agree or disagreed to take specific actions. Notably, 14 participants expressed a willingness to adjust their contribution to their 401(k) accounts, while 17 participants agreed to adjust their contribution to their IRA accounts. While the degree of these adjustments was not specified and there is no guarantee that participants will follow through, it is worth noting that 33 individuals expressed a willingness to take real steps towards their retirement planning due to their participation in this study.

Other significant categories of agreement include meeting with a financial advisor, researching personal retirement budgets, and discussing retirement plans with partners or dependents. Of the two financial advisor categories, 38 participants expressed their desire to meet with a financial advisor. The value of this decision was discussed in the literature review by Lusardi and Mitchell in their 2011 study that found successful retirement planners tended to engage in formal financial planning rather than relying solely on friends and family. Similarly, the categories of researching personal retirement budgets and discussing plans with partners or dependents received a high level of agreement, with 27 and 24 agreeing respondents, respectively. These results are unsurprising given the lack of retirement planning observed among many households, as outlined in the introduction of this paper.

While it is impossible to guarantee that participants will follow through with their indicated intentions, these results suggest that the study may have encouraged individuals to take meaningful steps towards their retirement planning.

Figure 2 –

Participant Responses to Action Question



Note: X-Axis represents action choices for participants that were presented in Figure 1. Y-Axis represents the number of respondents for each corresponding answer choice.

Gender Interaction Regression

Another area the study aimed to investigate is whether the effects of the financial calculator treatment on retirement preparedness differed across different groups of participants, particularly those who historically have lower levels of retirement preparedness. To explore this question, an interaction regression was conducted. Only the gender variable was found to have a significant interaction effect with the treatment, and thus, the following equation was used for the analysis:

$$\text{Open\_ira1} = \beta_0 + \beta_1\text{treatment} + \beta_2\text{gender} + \beta_3\text{treatment*gender} + \beta_4\text{Age} + \beta_5\text{race} + \beta_6\text{education} + \beta_7\text{salary} + \beta_8\text{engage} + \beta_9\text{litscore} + \varepsilon$$

This model is identical to the previous regression model, except for the addition of the interaction term between the treatment and gender. The results of this interaction regression are presented in Table 3.

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Table 3 – *Interaction Regression Results*

VARIABLES	(1) Login	(2) OpenIra	(3) TiaaMeet	(4) OtherMeet	(5) Research	(6) Discuss	(7) Adj401	(8) AdjIra
treatment = Article = 0 Calc = 1	-0.53	1.21*	0.81*	0.41	-0.85**	0.93	0.24	0.21
	(0.50)	(0.67)	(0.47)	(0.67)	(0.40)	(0.59)	(0.60)	(0.67)
Gender = Female = 1 Male = 2	-0.95	1.24	0.46	0.12	-1.15**	0.45	0.90	0.27
	(0.56)	(0.73)	(0.56)	(0.80)	(0.48)	(0.65)	(0.72)	(0.79)
treatment#gender = 1#Male	-0.02	-1.55*	-1.02	-1.01	0.15	-1.19	-0.75	-0.31
	(0.74)	(0.86)	(0.72)	(1.01)	(0.62)	(0.88)	(0.89)	(1.02)
Educ= 2, Bachelor's	1.01	1.26	0.90	1.40	1.01	-0.59	0.90	0.34
	(0.76)	(0.92)	(0.78)	(1.09)	(0.67)	(1.00)	(1.05)	(1.12)
Educ = 3, Master's	1.19	1.23	1.11	1.15	1.23*	0.25	1.28	0.47
	(0.76)	(0.93)	(0.79)	(1.10)	(0.67)	(1.08)	(1.03)	(1.08)
Educ = 4, PhD	2.06**	0.04	1.06	1.16	1.69**	0.54	1.79	1.30
	(0.86)	(1.27)	(0.90)	(1.34)	(0.77)	(1.07)	(1.20)	(1.24)
Age	-0.01	-0.00	0.04*	-0.01	-0.01	0.02	0.03	0.04
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
race1 = 1 = White	-0.10	0.76	0.36	1.27*	0.42	0.78	-0.04	0.27
	(0.50)	(0.61)	(0.48)	(0.66)	(0.41)	(0.57)	(0.58)	(0.66)
salary	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00**	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
engaged	0.42***	0.46**	0.39***	0.16	0.27**	0.30*	0.26*	0.09
	(0.12)	(0.16)	(0.12)	(0.18)	(0.10)	(0.15)	(0.14)	(0.17)
litscore	-0.10	-0.29*	-0.16*	-0.15	0.07	-0.11	-0.04	0.04
	(0.09)	(0.15)	(0.09)	(0.13)	(0.08)	(0.11)	(0.11)	(0.15)
Constant	2.02	1.42	0.21	2.22	1.24	2.35	0.79	1.15
	(1.23)	(1.38)	(1.28)	(1.79)	(1.09)	(1.83)	(1.59)	(1.85)
Observations	39	30	42	40	42	34	35	37
R-squared	0.52	0.45	0.45	0.24	0.54	0.40	0.35	0.20

Note: Standard Errors are in parentheses. *p<0.10 **p<0.05 ***p<0.01

Table 3 indicates that the interaction term between the treatment and gender is statistically significant in predicting the likelihood of opening an IRA account. Specifically, the coefficient of the treatment*gender variable suggests that, compared to female participants who received the financial calculator treatment, male participants who received the same treatment are less likely to open an IRA account. This finding provides evidence for the importance of considering the potential differences in treatment effects across different participant groups in retirement preparedness programs.

Emotional Response Analysis

The emotional response conveyed by participants of the study is another important piece of analysis to be included in the results of this study. To test for the emotions present, participants were asked to express which emotions they felt after completing the learning experience. They were given the choice of 13 emotions, 8 of which were negative, and 5 which were positive. To analyze the results of this question, a dummy variable was created where 1 equals stronger positive emotions from a participant after completing the learning experience and 0 indicating stronger negative emotions. Next, a logistic regression model was run with the following equation:

$$\text{Log (emotions)} = \beta_0 + \beta_1 \text{treatment} + \beta_2 \text{gender} + \beta_3 \text{Age} + \beta_4 \text{race} + \beta_5 \text{education} + \beta_6 \text{salary} + \beta_7 \text{engage} + \beta_8 \text{litscore} + \varepsilon$$

The results from this regression are presented in Table 4 below.

Table 4 – Logistic Model Results

VARIABLES	(1) odds ratio
emotion	
treatment 0= Article 1= Calc	0.121**
	(0.121)
Gender = Female = 1 Male = 2	0.299
	(0.321)
Age	0.947
	(0.0445)
race1 = 1 = White	7.197
	(8.873)
Educ = 2, Bachelor's	32.60*
	(63.12)
Educ = 3 Master's	15.06
	(26.16)
Educ = 4 PhD	15.42
	(30.32)
Salary	1.000
	(1.34e-05)
engaged	1.508
	(0.488)
litscore	0.902
	(0.220)
Constant	0.140
	(0.420)
Observations	43

Note: Standard Errors are in parentheses. *p<0.10 **p<0.05 ***p<0.01

The results of the logistic regression model presented in Table 4 can be interpreted using the odds ratios. When the odds ratio is less than 1, it suggests that the respondent was more likely to report negative emotions than positive ones. One statistically significant finding of the model was related to the treatment received by the participants. Since the coefficient for the treatment variable is less than 1, this indicates that those who received the calculator treatment were more likely to report negative emotions over positive ones. A possible explanation for this result could

be that the calculator provided a more personalized experience, which may have made the retirement planning process feel more real and eye-opening for the participant which may have resulted in stronger emotions of fear or anxiety.

Age Interaction Analysis

In addition to the statistically significant variance in emotions between the two treatment groups, an additional analysis was conducted using an interaction term for the treatment assigned to the participant and the participant's age. This analysis was motivated by Perik et al.'s study (2018), which found a positive relationship between age and positive emotions. The purpose of this interaction analysis was to investigate whether this relationship was influenced by the treatment received by the participant.

The results of the logistic regression model with the interaction term can be seen in the table below.

Table 5 – Logistic Interaction Model

VARIABLES	(1) odds ratio
emotion	
Treatment 0 = Article 1= Calc	160.9
	(596.1)
Age	1.042
	(0.0911)
treatment#c.Age= 1#Age	0.835*
	(0.0814)
Gender = Female = 1 Male = 2	0.244
	(0.266)
Age	-
race1 = 1 = White	11.25*
	(16.14)
Educ = 2, Bachelor's	275.3*
	(845.8)
Educ = 3, Master's	188.7*
	(533.8)
Educ = 4 PhD	199.1*
	(605.8)
Salary	1.000
	(1.57e-05)
engaged	1.524
	(0.577)
litscore	0.863
	(0.250)
Constant	0.000240
	(0.00126)
Observations	43

Note: Standard Errors are in parentheses. *p<0.10 **p<0.05 ***p<0.01

The table shows that the interaction term between age and treatment is statistically significant. Interestingly, the results suggest that older participants assigned to the calculator treatment were more likely to experience negative emotions compared to those assigned to the article treatment.

It is worth noting that while the results of the original model were not statistically significant, both models found conflicting results to that of Perik et al. (2018) , suggesting that older participants were more likely to experience negative emotions than positive emotions.

Overall, the analysis suggests that the calculator treatment may have had a negative emotional impact on older participants, which should be taken into consideration when designing retirement education programs.

Further Emotions Analysis

In addition to the statistical analysis of the emotions felt during the study, there is a lot of interesting analysis that can be drawn from the emotion results. First, is the number of positive responses reported by participants. All five of the emotions categorized as positive (Interested, Attentive, Excited, Proud, and Inspired) had the highest count of agreement (indicating moderately or higher). While it was difficult to find much research on the emotions provoked by retirement planning, it was still anticipated that the negative emotions would be most prevalent in most participants. I am pleasantly hopeful for these respondents and their positive reaction to retirement planning. One limitation that may have influenced the concentration of negative emotions is the number of negative options presented to the respondent being nearly double that of the positive emotions. Because of this it is likely the negative emotions were more dispersed among the different choices making them seem less prevalent. Additionally, after looking through the results by each respondent it became clear that many participants reported having felt both positive and negative emotions very strongly making it more difficult to draw any clear conclusions about the type of emotions one treatment might have evoked over another. Overall, the presence of strong emotions both ways is another testament to the engagement of participants in both treatments.

Discussion

At the beginning of this research, the objectives of the study were to compare the effectiveness of two learning methods for promoting financial literacy and retirement preparedness among participants. Furthermore, the study aimed to explore whether there were differences in the preferred learning method among groups historically known to have lower financial literacy levels. Additionally, the study sought to investigate if emotional responses evoked by the learning method influenced a respondent's willingness to act towards retirement preparedness. The findings presented in the previous section revealed minimal statistically significant results to answer these research questions. The study was confined by a small sample size and lack of diversity among participants, making it difficult to draw significant conclusions from the data. Despite the limited statistical significance of the results, the study still yields meaningful outcomes. Notably, 33 of the 50 participants indicated a willingness to adjust their contribution to their 401(k) or IRA account, indicating the potential impact of both forms of retirement planning tools. Moreover, these positive actions were observed after a brief exposure of just 10-15 minutes to financial articles or calculators, highlighting the practical effectiveness of the education methods. Lastly, while emotions associated with retirement preparedness were not overwhelmingly negative, participants using the financial calculator treatment may have experienced more negative responses due to its personal nature. This example highlights the potential influence of personal versus impersonal learning methods on participants' experiences.

The results of the study suggest that both financial articles and calculators are effective methods for promoting retirement preparedness among participants. Despite limited statistical significance, the study demonstrates that a brief exposure to these tools can have a positive impact on participants' willingness to adjust their contributions to retirement accounts. This

finding is encouraging, as it suggests that even small interventions can promote retirement preparedness. Additionally, the study suggests that emotional responses may differ based on the type of learning method used. Participants who used the financial calculator tool reported more negative emotions, likely due to the personal nature of the tool. This finding suggests that the emotional impact of learning methods should be considered when designing financial education programs. Overall, this study provides valuable insights into the effectiveness of different retirement planning tools and highlights the importance of considering emotional responses when designing financial education programs.

As have been previously mentioned, several limitations were encountered during this study that could be addressed in future research. Firstly, the study did not include a control condition with no treatment at all, which could have been informative in evaluating the impact of the retirement planning tools. Future studies should include a control group to better isolate the effects of the interventions. Secondly, the results to the action question make have been influenced by the improper terminology for the retirement plan used by participants. The question referred to the account as a 401(k) but due to the college being a nonprofit, the retirement plans are 403(b) retirement accounts. Moreover, the study's findings may have been impacted by the fact that participants were recruited solely from one organization, which had a higher concentration of highly educated individuals. This leads into the third limitation, the lack of diversity among participants in the study. Future research should aim to recruit a more diverse sample of participants, such as those from races/ethnicities, educational backgrounds, and income levels. By doing this, it would enable more comprehensive analysis of how various demographic groups approach retirement planning differently.

In conclusion, this study sheds light on retirement planning tools, yet its limitations highlight the need for further investigation to enhance the generalizability of the results. As retirement planning becomes increasingly important, research in this field must continue to advance. The present findings carry important implications for future research on retirement preparedness, especially for underrepresented groups who can benefit significantly from financial literacy knowledge. Therefore, further investigation is crucial to expand the knowledge and understanding of effective retirement planning tools to improve financial security in the future.

Appendix A

Question	Possible Responses
What is your gender?	Male Female Non-Binary Prefer not to say
What is your age?	Slider Scale from 18-100
What is your race? Select all that apply	Black White Latino, Latina, Latinx Indigenous, Native American, Pacific Islander Asian Other Prefer not to say
What is the highest level of school you have completed, or the highest degree received?	High School Graduate Some College but No Degree Associate's Degree Bachelor's Degree Master's Degree Professional School Degree Doctorate Degree Prefer not to say
What is your total household income during the past 12 months?	Slider Scale from $0 to $150,000
How would you assess your understanding of economics?	On a 7-point scale; 1 means very low understanding and 7 means very high understanding
Did any of the companies you have previously worked for offer financial education programs (for example retirement seminars)	Yes No CC is the first company I have worked for I don't know

Have you attended any retirement seminars?	Yes No I don't know
How much have you (/ and your partner) thought about retirement?	None at all A little A moderate amount A lot A great deal
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 I don't know
Suppose you had $100 in your savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?	More than $200 Exactly $200 Less than $200 I don't know
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, exactly the same as, or less than today with the money in this account?	More than today Exactly the same as today Less than today I don't know
Assume a friend inherits $10,000 and his sibling inherits $10,000 but 3 years from now. Who is richer today because of the inheritance?	My friend His Sibling They are equally rich I don't know
Suppose that in the year 2025, your income has doubled, and the prices of all goods have doubled too. In 2025, will you be able to buy	Buy more than today Buy the same as today Buy less than today

more, the same, or less than today with your income?	I don’t know
Which of the following statements describes the main function of the stock market?	The stock market helps to predict stock earnings The stock market results in an increase in the price of stocks The stock market brings people who want to buy stocks together with those who want to sell stocks None of the Above I don’t know
Which of the following statements is correct?	Once one invests in a mutual fund, one cannot withdraw the money in the first year Mutual funds can invest in several assets, for example, invest in both stocks and bonds Mutual funds pay a guaranteed rate of return which depends on their past performance None of the above I don't know
Consider a long period of time (e.g., 10 or 20 years) which asset normally gives the highest return?	Savings Accounts Bonds Stocks I don’t know
Normally, which asset displays the highest fluctuations over time?	Savings Accounts Bonds Stocks I don’t know
Stocks are normally riskier than bonds.	True False I don’t know

If the interest rate falls, what should happen to bond prices?	Rise Fall Stay the same I don't know
Buying a company stock usually provides a safer return than a stock mutual fund	True False I don't know
When an investor spreads his money among different assets, does the risk of losing money.	Increase Decrease Stay the Same I don't know

Appendix B

Articles

https://www.tiaa.org/public/learn/retirement-planning-and-beyond/how-much-to-save-for-retirement

https://www.tiaa.org/public/learn/retirement-planning-and-beyond/which-ira-is-right-for-me

https://www.tiaa.org/public/learn/personal-finance-101/investing-101/compounding

Calculator

https://www.tiaa.org/public/retire/retirement-advisor

https://www.tiaa.org/public/tools-calculators/ira-contribution-eligibility

https://my.tiaa.org/public/publictools/targetincome/annuityEstimator

Appendix C

Question	Possible Responses
Did you complete all tasks in the training?	Yes No Other: ___
Have you ever reviewed the retirement resources provided by TIAA?	Yes No Unsure
Do you currently have the log in for your retirement account through TIAA?	Yes No Unsure
How would you assess the effectiveness of the financial education training just completed?	On a 7-point scale; 1 means very ineffective 7 means very effective
To what degree did you feel each of the following emotions while completing that exercise? Emotions asked about in the question: Interested, Frustrated, Excited, Upset, Confused, Guilty, Scared, Hostile, Proud, Ashamed, Inspired, Attentive, and Afraid	Responses: Very slightly or not at all A little Moderately Quite a bit Extremely
To what degree are the following statements true? After completing this training, I plan to…	Not Applicable Strongly Disagree Somewhat Disagree Neither Agree nor Disagree Somewhat Agree Strongly Agree
If none of the above, please explain why.	Short Response
How engaged were you in the training you just completed?	On a 7-point scale; 1 means very unengaged 7 means very engaged

Would you like access to additional resources from TIAA?	Yes No
Any feedback (comments, questions, or concerns) on the training or study?	Short Answer
How would you like to receive your $10 compensation?	Amazon Gift Card (will need to provide Email Address to Fulfill) Cash Pickup at Worner 2/15 and 2/16 from 1-3pm

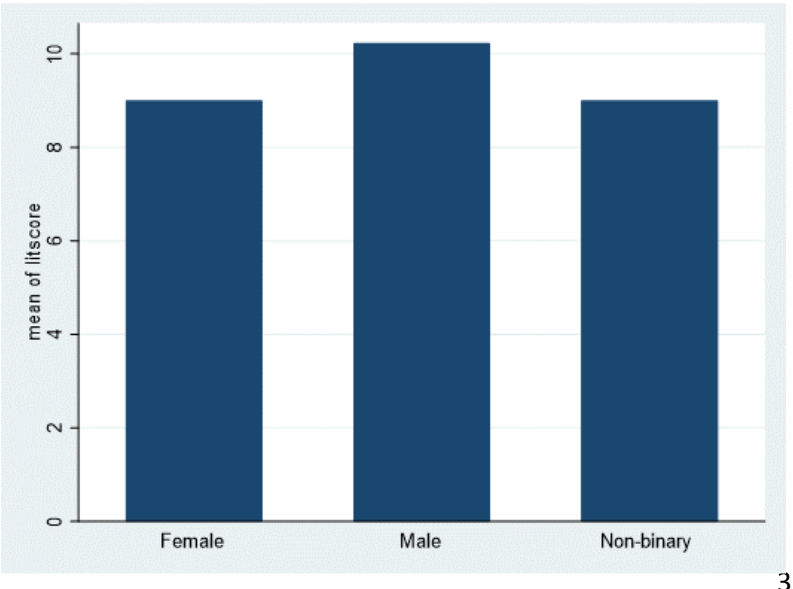
Appendix D

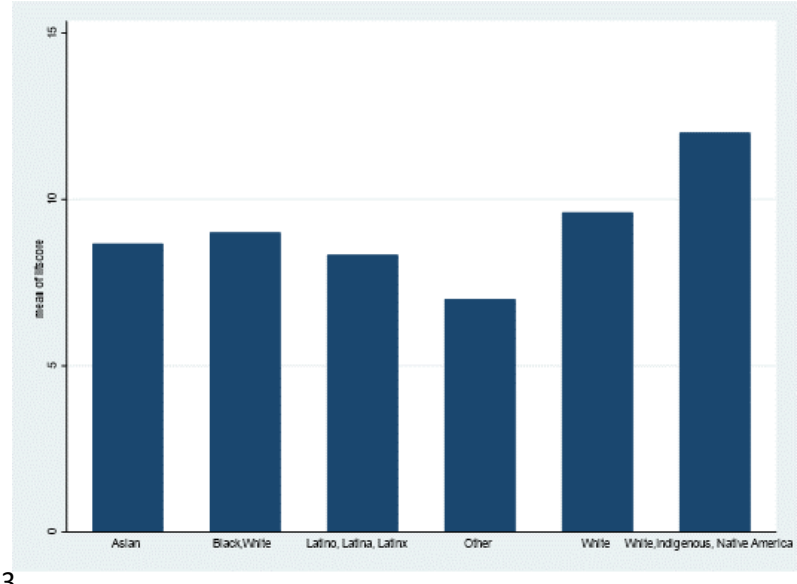
Financial Literacy Analysis

One additional area of analysis for this study is the financial literacy survey participants took before completing the treatment. There were two purposes for including the literacy test in the study. The first was to be able to use it as a control variable for the main regression to make sure all possible influences were accounted for. The second was to compare the results with that of Lusardi and Mitchel who created and ran the survey over 15 years ago. I was curious to see how participants faired in the survey particularly with the access to learning resources being so readily available now. The literacy test included 13 questions. Of the 60 participants who completed the literacy test, the average score was 73% with 3 participants scoring 100% and 7 scoring less than 50% including one individual scoring 31%. The first level of analysis completed on this data is looking at any trends that can be observed between the various independent variables and a respondents score on the literacy test.

Visual Results

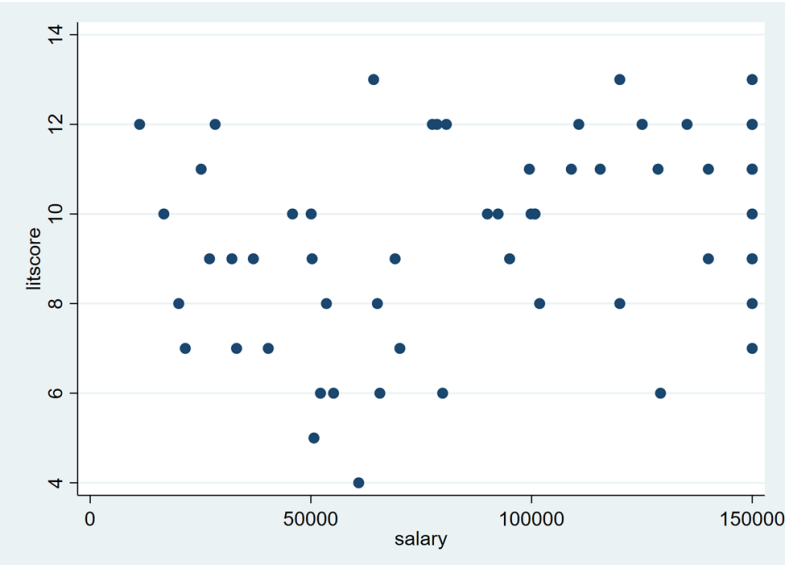
First, the demographics of the respondents. The first graph on the left reports the average score for each gender. Men averaged a score of 78% at just over 10 of the 13 correct. Whereas

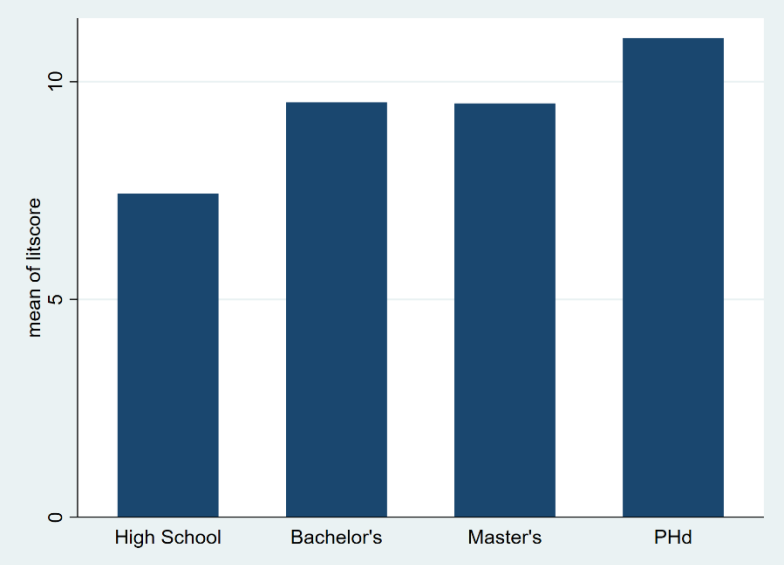




women and non-binary averaged a 9/13 or 71% correct. The graph on the right reports the race of the participants. Only one individual accounted for the White, Indigenous, Native American, Pacific Islander but they reported a 12/13. The next highest category was white at 9.8 or 75% correct. The next highest was Black at 9/13 or 71% followed by Asian at 8.5 or 65%. Finally, Latino, Latina, Latinx at 64% and other at 8 or 62%. While the results of the race analysis did not include many participants outside of White, the results of the scores are consistent with that of Lusardi and Mitchel. More details will be provided on the two studies below.

The next section for analysis includes the salary and education of participants. The salary is represented using a scatterplot given the continuous nature of the responses unlike our other variables. The graph of salary below shows there is very little correlation between the salary of participants and their scores on the literacy test. One reason for this lack of relationship may be described by the next variable in the analysis.

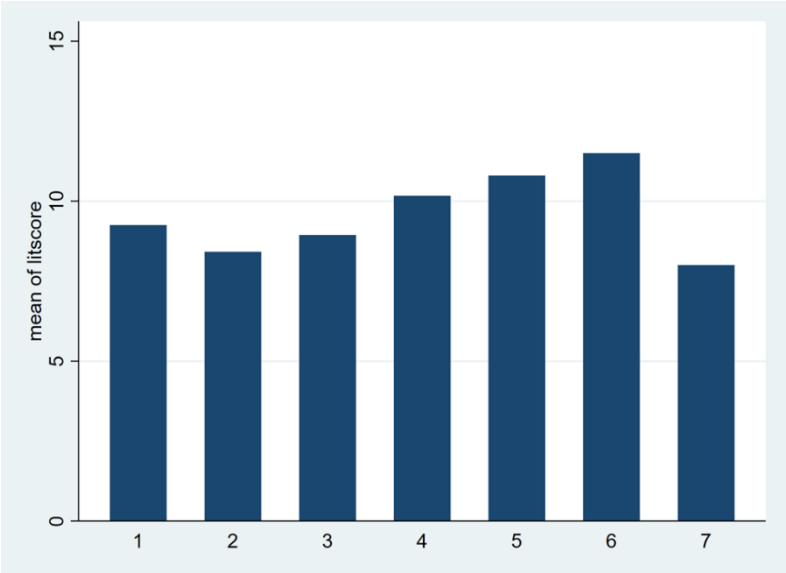


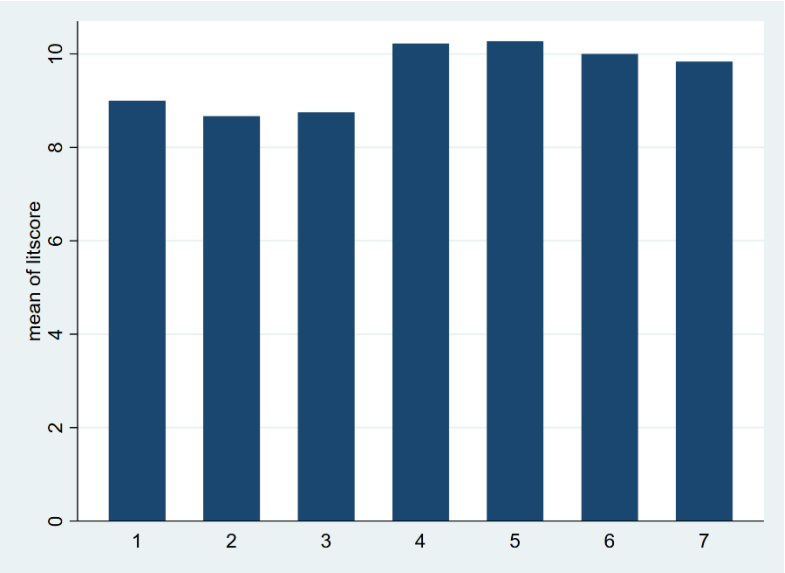


The right graph shows the literacy scores for varying levels of education received. Here you can see the range of scores is 2 or 16% with high school being an 8.5 or 65% and those with

doctorate degrees with a score of 10.63 or 81%. It is worth noting that due to the nature of where this research took place the population of the study includes a higher concentration of highly educated individuals, especially those with Doctorate degrees, than the rest of the population. Drawing these results back to the results of the salary analysis, it is highly likely that even those with lower salaries are still very highly educated increasing the spread of knowledge across all salary levels.

The last two graphs to be discussed for the analysis of the literacy test is the respondents understanding of economics and engagement in the study. The first graph provides the results for individuals responses to the question “How would you assess your understanding of economics?” The answers range from 1 meaning very low understanding to 7 meaning very high understanding. Coincidentally, those that ranked themselves as having the highest level of understanding underperformed the rest of the group, including those who ranked their understanding of economics at a 1. This concept was touched on in the literature review as Lusardi and Mitchell also observed a similar phenomenon in which those who believed to have a strong understanding significantly underperformed.





The second graph is also a self-reported scale question where participants were asked to rank their engagement in the study. Again, this is graded as 1 meaning very unengaged and 7 being very engaged. The graph shows us that those who reported particularly low levels of engagement were more likely to perform poorly on the financial literacy test. Whereas those that reported average to high levels of engagement finished with similar results. These results are important to the study as they help give a better understanding of not only the effectiveness of the communication or of the high likelihood of a lack of agreement towards action like we tested in the previous analysis.

Overall, the analysis of the financial literacy survey provided insights into the demographics, education level, understanding of economics, and engagement of the study participants, and their scores on the survey. While there were some interesting trends observed, such as the underperformance of those who believed to have a strong understanding of economics, the results were consistent with previous studies and provided valuable context for the main regression analysis.

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