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The effect of risk literacy and visual aids on portfolio choices among professional financial planners

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Abstract

Financial planners and their clients come together regularly to discuss financial decisions, which are inherently risky. Yet, financial planning research has not explored the impact of risk literacy (i.e., objective numeracy)—the ability to understand and interpret probabilistic trade-offs—and graph literacy on client-planner decision-making quality. This study uses an experimental design to test financial planners' risk literacy and their ability to select the most resilient portfolio based on whether they were given probabilistic information and a visual representation or only probabilistic information. Results indicate that visual representation do help financial planners determine the appropriate choice, but risk literacy does not. Implications for financial planners and future research in this area are discussed.

Keywords: Financial planners; Risk literacy; Decision-making; Client communication; Experimental design

1. Risk literacy among professional financial planners

Making risky choices is central to professional financial planning. The majority of financial decisions involve some risk. Professional financial planners create financial plans and present financial information to help clients make financial decisions in the presence of risk. Research from the field of judgment and decision-making highlight the importance of the concept known as risk literacy, which is defined as "the ability to accurately interpret and act on information

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about risk" and is a synonym for statistical numeracy (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012, p. 26). In the same way previous studies point out the need for risk literacy in the medical profession so doctors can better assist patients in making medical decisions involving risk (e.g., surgeries, new treatments, or new drugs), is the need for risk literacy is also in financial planning. Compared with the average consumer, professional financial planners are educated in risk and deal with probabilistic outcomes on a regular basis (e.g., chance of disability, Monte Carlo simulation results of adequacy of retirement funds, etc.). This suggests professional financial planners may possess a higher level of risk literacy.

Understanding the risk literacy of financial planners is a critical step in the development of the financial planning profession because financial planners help clients make better financial decisions. Financial planners that go through the Certified Financial Planner (CFP) certification process are required to learn about risk. For example financial knowledge topics, including D22, D23, and E34, specifically address risk in the areas of insurance and investments. In addition, CFP professionals learn the seven-step financial planning process, which inherently includes the discussion of risk with clients, reflecting the steps found with the Skilled Decision theory framework.

Another aspect of risk literacy and enhancing understanding of risks stems from visual representations of risk. Previous research in financial literacy indicates visual representation of financial concepts allows for better processing of financial information (Kothakota & Kiss, 2020). Specifically, groups that have historically underperformed on financial literacy showed a much larger increase in financial literacy when the literacy concept is explained visually. Properly formatted visualizations may assist financial planners and their clients in understanding portfolio risk. Most visualization practice in the financial services industry have been applied to more complex concepts, such as bond duration and convexity or accounting analytics (Rodriguez & Kaczmarek, 2016).

Moreover, a growing body of literature suggests that while there is an expectation professionals who deal with risk on a regular basis have a high degree of risk literacy, this is not always the case. Other professions, such as surgeons and senior-level police officers (Garcia-Retamero, Cokely, Wicki, & Joeris, 2016; Garcia-Retamero & Dhami, 2013), do not always exhibit high risk literacy. Subsequently, an objective of this study is to extend the risk literacy research to a new profession by examining the risk literacy of professional financial planners (hereafter referred to as financial planners for convenience). The research question is: Does risk literacy and visual representation of a risk-related scenario help financial planners to select an appropriate portfolio?

2. Literature review

Risk literacy can be defined as "the ability to accurately interpret and act on information about risk" (Cokely et al., 2012, p. 26) and has a well-researched history in judgment and decision-making (Lurtz & Heckman, 2018). Risk literacy is separate and distinct from similar constructs such as: subjective numeracy, risk perception, and financial literacy. Subjective numeracy is how a person feels about numerical information and their perception of their ability to use or understand numerical information (Gamliel, Kreiner, & Garcia-Retamero,

2016). Risk perception is also subjective and relates to one's ability to accurately understand the risks associated with a behavior or an event (Roszkowski & Davey, 2010). Financial literacy has both an objective and subjective component as it is a combination of knowledge (objective) and perceived ability to apply one's knowledge (subjective; Huston, 2010). Risk literacy is a solely objective measure of statistical numeracy. Objective numeracy can be related to numeric skills, including basic arithmetic and statistics (Garcia-Retamero & Galesic, 2010; Gamliel et al., 2016). Risk literacy in this investigation is the statistical, objective numeracy and will be referred to as risk literacy throughout the remainder of the study. As an example, testing individual risk literacy may involve calculating the probability of an event occurring, such as how often a die loaded to land on "6" should happen on a given number of rolls.

Ongoing work by researchers involved in the development of risk literacy measures have proposed a framework known as Skilled Decision Theory (see Cokely, Feltz, Ghazal, Allan, Petrova, & Garcia-Retamero, in press). The theory highlights visual aids and risk literacy as the two constructs that, "support skilled decision making both directly and indirectly through metacognitive effects" (p. 34). This theory details what individuals need (e.g., visual aids and risk literacy) to make skilled decisions and how those constructs impact the way in which individuals deliberate, build confidence, comprehend, and feel (affect) when making decisions (Cokely et al., in press). The literature review focuses on risk literacy, visual aids, and the studies that have applied these important constructs to financial planning.

2.1. Risk literacy

Risk literacy has been used to investigate the ways professionals understand probabilities and how they then, in turn, help others to understand or work with that information (e.g., surgeons and how they engage with clients when making surgical decisions; Garcia-Retamero, Cokely, Wicki, & Hanson, 2014). A few studies have been published looking at risk literacy and financial planning topics. These studies have found that higher risk literacy is linked to better insurance decision-making, higher net worth, a desire for shared financial decision-making, and lower risk tolerance (Campara, Paraboni, da Costa, Saurin, & Lopes, 2017; Garcia-Retamero & Galesic, 2013; Petrova, van der Pligt, & Garcia-Retamero, 2014; Smith, McArdle, & Willis, 2010).

2.2. Visualization and visual aids

Visualization is a wide and growing field encompassing studies that investigate the impact of data visualization and constructs such as spatial ability and graph literacy. Spatial ability refers to one's capability to form mental representations and/or manipulate these representations of objects in one's mind (Hegarty & Kozhevnikov, 1999). Studies of visual-spatial skill and numerical skill find a positive correlation between visual-spatial ability and numerical ability (Hegarty & Kozhevnikov, 1999; Tosto et al., 2014). Graph literacy is the ability to understand information that has been presented graphically and make decisions or draw conclusions based on that information (Okan, Galesic, Garcia-Retamero, 2016; Shah &

Freedman, 2011) and has been linked to higher levels of education (Galesic & Garcia-Retamero, 2011). Data visualization is the field of study provides insight into just how information can be presented to enhance understanding (Knaflic, 2015).

Research on the usefulness of visual aids in financial planning, such as mind-mapping and the Happiness Risk/Reward Pyramid, have assisted financial planners and their clients to better communicate about decisions across all seven steps of the personal financial planning process (Rouillier, 2011; Van Zutphen, 2010). A powerful visual aid used by financial advisors, coaches and therapists to help clients connect with their future and plan over a life span takes a tape-measure that the client cuts and manipulates to represent the life that they have yet to live (Klontz, Kahler, & Klontz, 2016). Narrowing the focus to just portfolio risk, a study using FinVis, built to help financial planning clients visualize portfolio decisions—found that individuals using the software (1) improved decision-making, (2) increased learning and reduced ambiguity, and (3) increased confidence in understating of the financial decisions they were making (Rudolph, Savikhin, & Ebert, 2009). These results are similar to the results from Garcia-Retamero, Cokely, Wicki, & Joeris, (2016) who found that low-numerate surgeons when provided with an icon describing the risks associated with a surgery were not only more accurate choosing the correct assessment of risk, but also spent more time making decisions. This literature points to how visual aids can increase confidence, understanding, and impact resulting decision quality.

3. Theoretical framework

Skilled Decision Theory details the decision-making process through which "novices" or non-experts and experts travel through to arrive at a well-informed or skilled decision (Cokely et al., in press). The theory was developed based on numerous previous studies of how average individuals as well as experts process and arrive at a decision, and what can be done to influence arrival at a "skilled decision," across a wide range of contexts (e.g., surgery, insurance, or precautionary health) (Cokely et al., in press). As such, the theory organizes the decision-making process linearly.

The decision-maker begins the decision process with a certain amount of risk literacy and/or the use of visual aids (Fig. 1). Visual aids may range in type or style but are tools that help individuals understand probabilities, percentages, and proportions. Other constructs include deliberation, confidence, comprehension, and affect, each having a relationship with the use of visual aids and risk literacy. The deliberation construct is thinking about the problem at hand. Both indiosyncratic risk literacy and visual aids/tools may help or hinder individual understanding of the problem. Confidence follows deliberation. The confidence construct is related to one's confidence in one's knowledge and one's confidence in their ability to carry out any subsequent behavior related to the decision. Confidence is influenced by visual aids and risk literacy. Comprehension is the next construct and it is also influenced by visual aids and risk literacy. Visual aids and one's level of risk literacy impact comprehension; high-risk literacy and use of a visual aid would make comprehending a risky decision easier as opposed to low risk literacy and no visual aid. Affect, which pertains to how

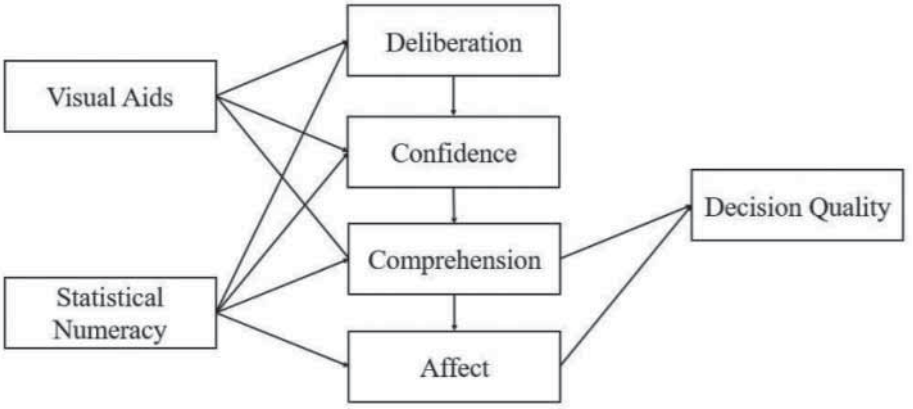

Fig. 1. Skilled decision-making theory (Cokely, Feltz, Ghazal, Allan, Petrova, & Garcia-Retamero, in press).

"good" or "not good" a person feels about their decision-making ability is only influenced by risk literacy. The final construct, decision quality, is related to comprehension and affect. Essentially, the best decisions are the ones we understand and that we feel good about.

Moreover, Skilled Decision Theory is an appropriate theory for investigating risk literacy and decision-making in financial planners. The theory organizes how both expert and non-experts make decisions. Financial planners can be considered "expert" decision-makers. It is their job to help "non-expert" decision-makers (i.e., clients) to arrive at quality financial decisions. Expert decision-makers are assumed to use this decision-making process even if they do not work with another individual.

The study posits that within the financial planning process, financial planners and clients are regularly going through the decision-making process outlined by Skilled Decision Theory. The financial planning process (Appendix 1) promotes ongoing dialogue—deliberation between the client and the practitioner. Scenario planning, like going over a market crash or likelihood of taking an early retirement, includes steps two through four of the financial planning process, which takes clients to a point where they are willing to implement (Step 5). Furthermore, this could be interpreted as evidence that the client and the planner have, at the same time, inadvertently moved through Skilled Decision Theory, where they become confident, they understand (i.e., comprehension), and they feel good (i.e., affect) about moving forward to implementation.

The current study did not test for the constructs that are ultimately related to decision quality (i.e., comprehension and affect), rather it focused solely on visual aids and risk literacy. Previous investigative work on risk literacy in other professions also focused solely on visual aids and risk literacy, and used Skilled Decision Theory as a theoretical framework (Garcia-Retamero et al., 2016; Garcia-Retamero & Dhami, 2013). Moreover, even without a direct theoretical connection from visual aids and risk literacy to decision quality, it is assumed that investigating the impact these two constructs alone still provide insight into decision-making ability and needs of financial planners as a first step. Furthermore, CFP Board registered financial planning education programs place an emphasis on risk literacy and often use visual aids in teaching materials. This additional, formalized education may assist CFP professionals to deliberate, build confidence, gain comprehension and handle affect by way of the seven-step financial planning process.

Utilizing Skilled Decision Theory as a framework and previous literature as motivation for this study, five hypotheses were developed:

Hypothesis 1: Financial planners who are Certified Financial Planner (CFP) professionals will have higher risk literacy than financial planners lacking the CFP designation.

Hypothesis 2: Use of a visual aid will be positively associated with having selected the correct risk portfolio.

Hypothesis 3: Risk literacy will be positively associated with having selected the correct risk portfolio without use of a visual aid.

4. Method

4.1. Sample

To gather data for this study, a 79-item survey was emailed to 106 U.S.-based financial planners via three sources: (1) an advisor-only forum (advisorheads.com), (2) a list-serve created and maintained by a popular financial planning practitioner-blogger, and (3) personal emails to financial planners. Personal emails were limited in number, six emails in total. Advisors from all three sources received the same email explaining the project and inviting them to complete the questionnaire. Participants were not incentivized to participate, but participation was made simpler by only requiring them to click on the link provided to them in the invitation email. The computer-based questionnaire was administered in English and included basic demographic characteristics, firm characteristics, professional qualifications, financial literacy, and risk literacy. Response rate from the forum, Listserv, and personal emails combined totaled 65%. Of those completed, less than 5% had missing items and those that had missing items were deleted (Fowler, 1995). All told, 69 completed surveys were part of the research sample.

4.2. Experimental design and dependent variable

The experimental design of the current study is based on the work by Garcia-Retamero et al. (2016) who studied surgeons. The current design is similar in the following ways: (1) both tested risk literacy scores; (2) an almost identical icon array was used as a visual representation of the risk; (3) both tested the accuracy in answering a probability question; and (4) both were asked a question related to their domain of expertise. However, the studies were dissimilar in the type of risk presented. Negative outcomes in surgery are death or other complications, whereas portfolio risk is not directly related to death. Also, the question posed to the surgeons had known probabilities, whereas the type of market events posed to the financial planners in the current study are less precise (Taleb, 2004).

Financial planners were randomly assigned to one of two survey instruments. One group received only written probabilistic information and the other received written probabilistic

Fig. 2. Portfolio selection icon.

information plus a visual aid. Using the given information, participants were asked a specific question about the likelihood of failure for a portfolio given conditions similar to the Great Recession, a time period resulting in prolonged capital market decline. The text-only format asked the participant to calculate which of the two portfolios would be more resilient given the proposed market conditions:

> You have a client who is fearful of another Great Recession affecting their portfolio. Based upon the fact-finding you have done you have narrowed the possible portfolio strategies to two. The first portfolio strategy is an asset allocation that is based upon an investment management strategy you have been using for years, while the second is based upon a newer investment strategy. You stress test the portfolios using 100 simulations. Portfolios using the first strategy failed the client's goals 27 times. Compared with the first portfolio, the new strategy resulted in seven fewer failures. Which portfolio strategy do you use?

In the second condition, the respondent was given the same question, but the success and failure of the portfolios was also represented by a visual aid comprised of an icon array (Fig. 2). As such, the condition being applied in this study was the presence, or lack thereof, of the icon array. The outcome of interest or dependent variable was the correct choice of portfolio given the situation. This was identified as the portfolio failing the fewest number of times.

For the purposes of this study, if the respondent were in the non-visual aid condition, they were coded as "0." If they were in the visual aid condition, they were coded as 1. If the respondent chose the correct portfolio, they were coded as 1 for correct answer, and 0 if they chose incorrectly.

4.3. Independent variable of interests

Risk literacy was measured using the Berlin Numeracy Test (BNT; Cokely et al., 2012). The BNT is a psychometrically valid survey, which measures risk literacy and has been used

on various populations (www.riskliteracy.org). This test has been used in over 15 countries and has been shown to be both valid and reliable (Cokely et al., in press; Schwartz, Woloshin, Black, & Welch, 1997). Previous work differentiated risk literacy as a unique predictor of ability to understand and work with probabilities even after controlling for intellectual ability and numerical literacy (Låg, Bauger, Lindberg, & Friborg, 2014). The BNT has since become the strongest predictor of an individual's ability to assess and understand everyday risk (Cokely et al., 2012).

All seven questions were asked in this survey, as used in the more comprehensive risk literacy tests. The analysis only used the four asked on the pen and paper BNT. This more closely aligns with other studies of surgeons (Garcia-Retamero, 2016) and the general population (Cokely et al., 2012). This measure is scored as a 0–3 variable based upon the number of correct responses. Categories were collapsed with scores of 0 and 1 = *low* numeracy, 2 and 3 = *moderate* numeracy, and 4 = *high* numeracy.

The CFP certification was a self-reported measure. Participants indicated whether or not they held the certification. Thus, a binary variable of CFP certification was used. If an individual held the CFP certification, they were coded as a 1, and if not, they were coded as 0. No other demographic variables were used in the final regression.

4.4. Demographic variables

Table 1 outlines demographic variable descriptive statistics according to treatment. Demographic characteristics included gender, CFP certification, title, compensation method, firm type, education, personal income, and specialty. Compensation structures included: (1) assets under management (AUM), (2) AUM fees and flat fees, (3) combination of salary, profit share, and commission, (4) commission and AUM fees, (5) hourly and flat fees, (6) hourly, (7) flat, and (8) AUM fees. Firm types included: (1) commercial bank advisor, (2) independent B/D affiliations, (3) independent registered investment advisor (RIA) of varying sizes, (4) brokerage firms, and (5) wire-houses. Professional qualifications included education and professional specialties, such as financial planning and investment management, financial planning only, or life planning.

5. Analyses

Descriptive analysis was conducted using R, in conjunction with the IDE Exploratory.io. Univariate and bivariate tests were conducted using R in conjunction with RStudio. Regression was conducted using R and RStudio, including the "tidy" packages (Wickham, 2018).

First, to determine if the group presented with the visual aid was similar to the group presented without a visual, a *t*-test across risk literacy levels by condition was conducted. To investigate whether or not a visual representation of portfolio risk increased accuracy in assessing and selecting the most resilient portfolio, parametric bootstrap logistic regression was conducted. Both parametric and non-parametric bootstrap analyses were run and produced similar results.

Table 1 Descriptive statistics of sample

Variable	Descriptives - Visual (n = 69)		
		Visual percent	No visual percent
Gender			
	Male	97.50%	91.30%
	Female	2.50%	4.35%
	Rather not say	0.00%	4.35%
Certified Financial Planner (CFP)?			
	Yes	50.00%	53.62%
	No	50.00%	46.38%
Title			
	Junior Financial Advisor	3.50%	13.04%
	Assistant Financial Advisor	3.50%	4.35%
	Broker/Financial Advisor	32.14%	26.09%
	Senior Advisor/Firm Owner	46.43%	47.83%
	Senior Financial Advisor	14.29%	8.70%
Compensation method			
	AUM fees and flat fees	10.71%	17.39%
	AUM fees only	10.71%	4.35%
	Combination of salary, profit share, and commission	10.71%	17.39%
	Commission and AUM fees	46.43%	30.43%
	Hourly and flat fees	7.14%	0.00%
	Hourly, flat fees, and AUM fees	14.29%	26.09%
Advisor channel			
	Commercial Bank Advisor	3.57%	5.88%
	Independent B/D affiliation, large (>15)	3.57%	3.92%
	Independent B/D affiliation, small (<10)	17.86%	21.57%
	Independent RIA, large	10.71%	7.84%
	Independent RIA, medium	10.71%	7.84%
	Independent RIA, small	28.57%	33.33%
	Large Regional Brokerage Firm	21.43%	11.76%
	Large wire-house	3.57%	7.84%
Higher education			
	Masters	28.57%	30.43%
	PhD, Masters	7.14%	4.35%
	PhD	3.57%	4.35%
	No higher education/chose not to respond	60.71%	60.87%
Income			
	$0–$20,000	7.14%	4.35%
	$20,001–$50,000	3.57%	13.04%
	$50,001–$100,000	17.86%	17.39%
	$100,001–$200,000	21.43%	21.74%
	$200,001–$300,000	17.86%	30.43%
	$300,001–$400,000	7.14%	4.35%
	$400,001–$500,000	7.14%	0.00%
	$500,001–$600,000	3.57%	0.00%
	$600,001–$700,000	3.57%	3.92%
	$900,001–$1,000,000	0.00%	4.35%
	$1,000,001–$1,500,000	3.57%	0.00%

(continued on next page)

Table 1 (Continued)

Variable		Descriptives - Visual (n = 69)	
		Visual percent	No visual percent
Specialty			
	Financial planning and investment management	96.43%	95.65%
	Financial planning only	3.57%	0.00%
	Life planning	0.00%	4.35%

Note: AUM = Assets under management; B/D = Broker-dealer; RIA = Registered Investment Advisor.

Therefore, parametric bootstrap was used in this study. Parametric bootstrap provides narrower confidence intervals and more power than non-parametric bootstrap (Adjei & Karim, 2016). Bootstrap logistic regressions have been used in social science and the medical field to estimate a population by resampling the observations (Fitrianto & Cing, 2014).The independent variables included whether or not the participant was a CFP certificant and the financial planners' BNT score. The dependent variable was whether or not the financial planner selected the most resilient portfolio. Given the small sample size, a bootstrap logistic regression was also conducted.

To obtain robustness with respect to logistic regression, the observations were resampled at random specific intervals (Fitrianto & Cing, 2014). In this case, at each iteration 10% of observations were resampled, for a total of four iterations. The more iterations, the higher the standard error and model specification is more difficult as the number of iterations increases. The suggested number of iterations is calculated by taking the number of observations in the sample and dividing by the minimum variable requirement for the type of regression used, which in this case is 18. Five iterations are the maximum number of resamples recommended (Fitrianto & Cing, 2014).

6. Results

In terms of risk literacy, most participants had moderately high risk literacy. The mean risk literacy score for financial planners was 2.20 (SD = 0.99). The Cronbach's α for the BNT was .79. The following groups were compared with see if they contained similar profiles: (1) CFP status and (2) risk literacy. Crosstab information (Table 2) indicated 44.44% of non-CFP holders had "low" risk literacy compared with 21.43% of CFP holders. One-third (33%) of non-CFP holders had "medium" risk literacy, compared with 50% of CFP certificants. Those respondents in the "high" group were 22.23% for non-CFP holders and 28.57% for CFP holders.

A χ^2 test of CFP certificant status and choosing the correct portfolio was conducted. Results indicated that choosing the correct portfolio was not significantly different and independent of whether the participant was a CFP certificant or not. Results in Table 3 indicate a p-value of 0.16.

Of participants who received the portfolio information with no visual, 64% of participants chose the correct portfolio (Table 4). For participants who received the portfolio information and a visual representation, 87% chose the correct portfolio. A χ^2 test was conducted

Table 2 Cross-tab of risk literacy by Certified Financial Planner (CFP) status

Risk literacy level	Non-CFP	CFP
Low	44.44%	21.43%
Moderate	33.32%	50.00%
High	22.23%	28.57%
Total	100.00%	100.00%

indicating a significant difference ($p = .016$) and having the visual aid increased accuracy. A robustness check using a t test for the percentages was also conducted, confirming the results of using the count data from the χ^2-test.

6.1. Bootstrap logistic regression

Parametric bootstrap logistic regression results are presented in Table 5. Results indicated that participants in the group that saw the visual representation had 2.45 times ($p = .03$) greater odds of choosing the correct portfolio. Holding a CFP certificate ($p = .25$) nor possessing numeracy ($p = .29$) were significant in selecting the correct portfolio. Moreover, these results do not support Hypothesis 1 and 3, but does provide support for Hypothesis 2. Visually presented information had a significant and positive impact on correct portfolio selection.

Univariate models were run with each independent variable in the full model. Results are similar to the multivariate model and are contained within Tables 6, 7, and 8. Whether or not a participant was a CFP certificant was not significant as it relates to selecting the correct portfolio ($p = .26$). Numeracy was also not significant in the univariate model ($p = .35$) as it relates to selecting the correct portfolio. Whether the participant received a visual aid was significant ($p = .02$) and had 2.65 greater odds of choosing the correct portfolio.

7. Discussion

The research question was: Does risk literacy and visual representation of a risk-related scenario help financial planners to select an appropriate portfolio strategy? In short, risk literacy did not impact appropriate portfolio strategy, but visual representation did. To

Table 3 χ^2 test of participants' risk literacy on whether they were a Certified Financial Planner (CPF) certificant

χ^2	Degree of freedom	p-Value
6.65	4	0.16

Significance levels $*p < .10$, $**p < .05$, $***p < .01$.

Table 4 χ^2 test of participants' risk portfolio on condition

χ^2	Degree of freedom	*p*-Value	Effect size
5.84	1	0.016**	0.19

Significance levels *$p < .10$, **$p < .05$, ***$p < .01$.

investigate this question, the study measured risk literacy using the BNT and an experimental design, which consisted of a randomly assigned visual aid component.

High risk literacy may be related to the unique nature of financial planners' work, as it is inherently involved with discussing, understanding, and measuring risk. The study suggests those planners who further their education and obtain the CFP certification have higher risk literacy scores. The type of work, education, and use of the seven-step process may be related to higher levels of risk literacy among those who hold a CFP certification. On the other hand, it is also important to recognize that this finding may also be a selection effect, and those with higher risk literacy scores opt-in to obtaining CFP certification.

Selecting the correct portfolio was not linked to risk literacy, education, or professional certification as demonstrated by the logistic regression. This may be due to a small sample size, the convenience nature of the sample, or a commonality of industry training (e.g., Series 7, 63 and/or 65 exam). Unlike Garcia-Retamero et al. (2016), this study found that risk literacy was not linked to the likelihood of choosing the appropriate portfolio strategy, which could be an artifact of testing risk literacy in financial planners. Said another way, a reason for investigating risk literacy in financial planners was to examine how risk literacy in financial planners may be different from that of other professionals (e.g., surgeons or high-level police officers). Financial planners, by way of their training on portfolio selection, may still be able to select the right portfolio regardless of risk literacy. Another possible reason for this finding is that risk literacy and the knowledge needed to select the correct portfolio are not one in the same as originally thought by the researchers. Lastly, it is important to remember that this group, as a whole, was very risk literate. Therefore, the sample may not have enough variation to detect the importance of risk literacy.

Although these findings differ from previous work in this area, it can be argued that the findings in this study still support the new theoretical framework of Skilled Decision Theory (Cokely et al., in press). Financial planners may ultimately choose to become financial planners not only due to their natural ability to understand risk, but also due to their education and training. Either way, financial planners' higher levels of risk literacy cannot be ignored

Table 5 Results for bootstrap logistic regression on portfolio selection ($n = 69$)

Variable	Coefficient	*SE*	*p*	OR	Lower CI	Upper CI
Intercept	1.01	0.54	0.62	—	—	—
Certified Financial Planner (CFP)	−0.38	0.42	0.25	0.61	0.26	1.42
Risk literacy	0.02	0.20	0.29	1.17	0.87	1.58
Visual aid	0.94	0.39	0.029**	2.45	1.28	5.04

Source: Four resampling intervals. CFP = Certified Financial Planner; OR = Odds Ratio; CI = confidence interval. Significance levels *$p < .10$, **$p < .05$, ***$p < .01$.

Table 6 Results for bootstrap logistic regression of Certified Financial Planner (CFP) status on portfolio selection (n = 69)

Variable	Coefficient	*SE*	*p*	Or	Lower CI	Upper CI
Intercept	1.09	0.25	<0.01***	—	—	—
CFP	0.46	0.41	0.26	1.58	−0.34	1.25

Source: Four resampling intervals. CFP = Certified Financial Planner; OR = Odds Ratio; CI = confidence interval. Significance levels *$p < .10$, **$p < .05$, ***$p < .01$.

and the use of visual aids, which was the only significant predictor of the correct portfolio selection, does demonstrate the importance of visual aids for risk decisions—perhaps even in high risk literacy populations.

7.1. Implications

This study demonstrates visual icons help individuals at all levels of risk literacy to improve their decision-making. Financial planners, even CFP certificants, may want to test themselves and then take pro-active steps to become better at interpreting and explaining risk information. Financial planning programs registered with the CFP Board may wish to start adding a component of visual aid literacy to their curriculums. Larger regulatory financial institutions, like the Security and Exchange Commission (SEC) as well as Financial Industry Regulatory Authority (FINRA), may want to request that financial planners, in addition to measuring client's risk tolerance, also display risk-reward tradeoffs in a visual format.

Financial planners, especially those acting as fiduciaries, can consider using visual techniques in their workflow process. This information will not only help the financial planner to assess what they should be discussing when they discuss risks with clients, but also how they explain recommendations and actions taken as it relates to risk. Investing in financial software that utilizes visual best practices may also be advantageous. Displaying information graphically during reviews and illustrating portfolio stress tests via charts may be useful in helping clients comprehend what advisors are attempting to communicate.

7.2. Limitations

There are limitations inherent in this study. First, the sample is small and has less power than it would have if the sample were larger. This has implications for the results and a

Table 7 Results for bootstrap logistic regression of risk literacy on portfolio selection (n = 69)

Variable	Coefficient	*SE*	*p*	OR	Lower CI	Upper CI
Intercept	0.65	0.7	0.36	—	—	—
Risk literacy	0.13	0.14	0.35	1.14	−0.15	0.41

Source: Four resampling intervals. CFP = Certified Financial Planner; OR = Odds Ratio; CI = confidence interval. Significance levels *$p < .10$, **$p < .05$, ***$p < .01$.

Table 8 Results for bootstrap logistic regression of visual aid on portfolio selection (n = 69)

Variable	Coefficient	*SE*	*p*	OR	Lower CI	Upper CI
Intercept	0.83	0.26	<0.01***	—	—	—
Visual aid	0.97	0.41	0.02**	2.65	1.18	4.21

Source: Four resampling intervals. Significance levels *$p < .10$, **$p < .05$, ***$p < .01$.

more robust sample may have different conclusions. Bootstrap logistic regression can increase standard errors, but this was limited by limiting the number of iterations. However the sample mirrors the population of financial planning advisors in two key ways. Participants in the study were mostly male (94.12%) with high incomes, which are consistent traits of financial planners based on recent industry research (Tharp, Lurtz, Melitz, Ammerman, & Kitces, in press). This could have had an impact on the insignificance of risk literacy, resulting in different findings than past research. However, this may also point to the fact that financial planners possibly have received more education geared toward understanding and interacting with probabilities (i.e., risk literacy) than the general population.

Overall, 30.43% of the sample scored low on the risk literacy assessment. Financial planners' style of work, deliberating, and working with the client to understand risk, may also drive up risk literacy scores. Financial planners may, in general, have higher risk literacy than some other professional groups due to the way their education and the practice of financial planning, is conducted. However, as this was administered online, with no time limit, the participants could have answered using online calculators or internet searches. In addition, this was a convenience sample drawn from willing participants through Listservs and email lists known by the researchers. While most financial planners will choose portfolios based upon a variety of factors, the portfolio selection task in this study was simple, constrained, and narrowly defined.

7.3. Future research directions

To our knowledge, this study is the first of its kind in financial planning research. Findings suggest that further exploration with a larger, more diverse sample may result in different findings that could reflect previous work conducted with other populations. Testing other types of visual aids utilizing the same probabilistic information could lead to a better understanding of best practices for visual aid use. It would also be helpful to uncover how, if at all, risk literacy does increase or change as financial planners grow in their careers and position. The same could be said for clients of financial planners: Does working with a financial planner increase risk literacy skill? Finally, future research would also be enhanced by measuring the other constructs of Skilled Decision Theory.

7.4. Conclusion

Literature from judgment and decision-making highlights the importance of risk literacy and visual aids in making decisions. This study (1) compares risk literacy levels of financial

planners to previously published studies of risk literacy levels and (2) replicates the study by Garcia-Retamero et al. (2016) that investigated risk literacy and the effect of visual aids among surgeons. This study contributes to the literature by (1) investigating risk literacy levels among financial planners, and (2) examining the effect of visual aids on portfolio choices among financial planners. The findings provide support for skilled decision-making theory (Cokely et al., in press) as well as previous work conducted by Garcia-Retamero et al. (2016) and Kothakota & Kiss (2020), which suggest the use of visual aids in financial planning is useful and potentially necessary. Not all visual aids are created equally, however, and a poorly constructed visual, like a simple verbatim task description, may not help in explaining risks to clients. While this study only investigated the use of an icon array, the direct application to understanding portfolio failure risk is something financial planners address every day.

In summary, financial planners help clients make appropriate financial decisions that involve risk and the need to interpret probability appropriately. While most financial planners in this study scored moderate or high in risk literacy, the combination of a visual aid and written probabilistic information versus only written probabilistic information significantly helped planners choose the appropriate portfolio strategy.

Appendix 1

The seven-step financial planning process

1. Understanding the Client's Personal and Financial Circumstances
2. Identifying and Selecting Goals
3. Analyzing the Client's Current Course of Action and Potential Alternative Courses of Action
4. Developing the Financial Planning Recommendation(s)
5. Presenting the Financial Planning Recommendation(s)
6. Implementing the Financial Planning Recommendation(s)
7. Monitoring Progress and Updating

Adapted from the CFP Board of Standards (www.cfp.net)

Berlin numeracy test traditional paper and pencil format

Instructions: Please answer the questions below. Do not use a calculator but feel free use the space available for notes (i.e., scratch paper).

1. Imagine we are throwing a five-sided die 50 times. On average, out of these 50 throws how many times would this five-sided die show an odd number (1, 3, or 5)?
2. Out of 1,000 people in a small town 500 are members of a choir. Out of these 500 members in the choir 100 are men. Out of the 500 inhabitants that are not in the choir 300 are men. What is the probability that a randomly drawn man is a member of the choir? _____ % (please indicate the probability in percentage)
3. Imagine we are throwing a loaded die (6 sides). The probability that the die shows a 6

is twice as high as the probability of each of the other numbers. On average, out of these 70 throws, how many times would the die show the number 6? _____

4. In a forest 20% of mushrooms are red, 50% brown, and 30% white. A red mushroom is poisonous with a probability of 20%. A mushroom that is not red is poisonous with probability of 5%. What is the probability that a poisonous mushroom in the forest is red? _____%

Scoring = Count total number of correct answers.
Correct answers: 1 = 30; 2 = 25; 3 = 20; 4 = 50.

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