

***Behavioral Models for
Prosperity: A Statistical
Assessment of Savings and
Behavioral Change***

by **William M. Lapp, Ph.D.**

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EARN Research Brief

eARN
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INTRODUCTION

EARN's scientific survey was analyzed using SPSS and Mplus statistical modeling programs to develop a theoretically driven model of how the program works and subsequently use the model to gauge clients' progression toward prosperity. A reliability analysis was performed for each of three sets of questions to insure that high quality answers were obtained regarding clients' relationship to money in terms of their: (a) knowledge of their finances, (b) self-efficacy with respect to handling finances, and (c) financial problems. A structural equation model was then computed based on 487 respondents to develop the theoretical model behind EARN's training; namely, "Savers" – EARN clients – would learn more about their financial situation, become empowered to do something about it through EARN's program and thereby reduce their financial problems. Savings and debt were added as

intervening variables between self-efficacy and problems because they are two of the main mechanisms EARN teaches its participants to use in their quest for greater prosperity. Happiness with one's financial situation and perceived financial stress were mutually and reciprocally affected by financial problems and financial self-efficacy in the model. Once the model was confirmed, a longitudinal analysis was performed to determine if changes in Savers' knowledge about their savings and their ability to confidently affect their financial well-being also translated into a reduction in financial problems and thereby reduced stresses related to these problems and increased happiness with their financial situation.

FINANCIAL KNOWLEDGE

As shown in Table 1, three items formed a reliable factor of financial knowledge that was found for a sample of 487 respondents who were asked, "How much do you know about the following topics: (a) investing your savings, (b) your credit rating, and (c) finding and buying insurance." Respondents rated their knowledge of these three financial questions based on a five-category scale: "Nothing," "Very little," "Some," "A fair amount" or "A lot". Their responses were subsequently coded on a scale from zero to four for purposes of the making the analysis possible with today's software; albeit, the categorical nature of these numerical designations was retained in the details of one exploratory factor analyses as well as in the structural equation models used to develop the theoretical model and to test the effectiveness of EARN's program. The "internal consistency"¹ of this set of questions was

¹ Internal consistency is the extent to which people answer all of the questions in a similar manner –

found to be acceptable, as well as the corrected item-total correlation of each item with the sum of the other two items.

Table 1

Reliability Statistics for the Financial Knowledge Questions

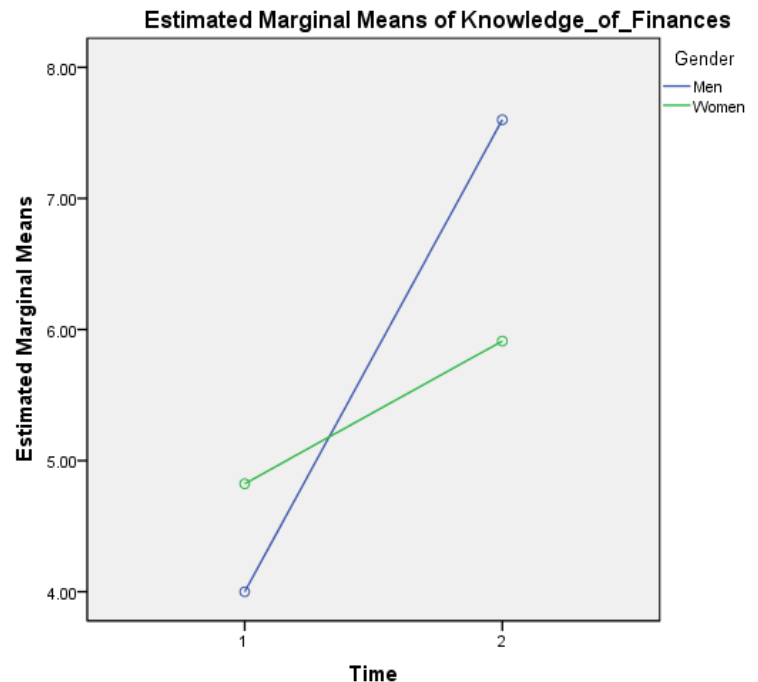
Item	Corrected Item-Total Correlation	Alpha (α) if Deleted
Credit Rating	0.58	0.75
Investing your savings	0.65	0.66
Finding and Buying Insurance	0.62	0.69
Overall Coefficient Alpha = 0.78		

A longitudinal analysis of the Savers' possible changes in knowledge about their financial circumstances was conducted using a mixed design analysis of variance for factors of the time of observation (before vs. one year after their participation) and the between subjects factor of gender. Fifty-four clients who rated their knowledge at intake and again after a year in the program exhibited a significant increase in their knowledge over time, $F(1, 52) = 25.56, p < 0.001$. As shown in Figure 1, the gender of the clients (12 men and 42 women) also interacted with this change over time – men started out knowing less than women but wound up knowing more, $F(1, 52) = 7.34, p < 0.01$, though both men and women knew more than when they started.

coefficient *alpha* (α : Cronbach, 1951) above 0.70 is the usual threshold for reliable factors.

Figure 1

Knowledge of Clients' Own Finances Increased After a Year in the Program



FINANCIAL SELF-EFFICACY

Self-efficacy is a construct that has been shown to be one of the best predictors of successful performance across behavioral domains, genders and age groups (Bandura, 1994, 1997, 2008). EARN's scientific survey contains three critical questions regarding financial self-efficacy that were prefaced by the instruction, "Thinking about *the last 12 months*, how much do you agree with the following: (a) I was good at planning for my financial future, (b) I was satisfied with my financial situation, and (c) I was able to save money." Their responses were subsequently coded from zero to three for purposes of analysis and once again a

reliability analysis was computed for all 485 respondents, while changes in financial self-efficacy were examined for fifty-four respondents whose data was tracked over the year they participated in the program.

Table 2 shows that the items tapped into a reliable factor of financial self-efficacy because the Corrected Item-Total Correlation of each item with the sum of the other items exceeded the 0.34 threshold² and the coefficient *alpha* (α) showed a sufficient degree of internal consistency.

Table 2
Reliability Statistics for the Financial Self-Efficacy Questions

Item	Corrected Item-Total Correlation	<i>Alpha</i> (α) if Deleted
I was good at planning for my financial future	0.67	0.68
I was satisfied with my financial situation	0.68	0.67
I was able to save money	0.56	0.80
Overall Coefficient <i>Alpha</i> = 0.79		

EVIDENCE OF TWO CORRELATED FACTORS

An exploratory factor analysis of the classical type in which Likert-style ratings are treated as continuous variables was performed to satisfy the notion that an unsupervised process could detect the underlying structure of the latent variables in the

² This threshold is based on the idea that indicators which belong to the same overall construct should share at least 10% of the variance with the larger set after removing variation due to itself.

general covariance space. The analysis employed the method of maximum likelihood for extraction and oblique minimum rotation³ to see if these questions were tapping into distinct aspects of the respondent's financial lives, rather than simply belonging to a general set of reflections about finances. Using the usual criterion of an eigenvalue of one,⁴ two correlated factors were extracted, $r(485) = 0.19$, $p < 0.05$, thereby lending evidence to the notion that two somewhat distinct dimensions of people's thoughts about their finances were assessed.

In an exploratory factor analysis, both factors are allowed to load on all of the items and the assignment of items to factors is based on the relative weight of the factor loadings. Table 3 shows that the first factor loaded most highly on the first three items, and the second factor loaded most heavily on the second three items. As you might expect, the first three items are the ones previously developed to represent financial self-efficacy and the second set of questions were the ones developed to represent financial knowledge, so the factors were labeled accordingly.

³ Maximum likelihood is one of the more elegant factor analytic procedures and is preferred over principal components analysis due to its estimation of error variance and the possibility of assessing the actual correlation between factors rather than forcing an orthogonal solution. Oblique minimum rotation to "simple structure" was used because it is one of the most balanced ways of correcting for arbitrary beginning points in the extraction procedure (See Gorsuch, 1983, 1990).

⁴ "Kaiser's little jiffy" was used because the eigenvalue tells us how much more variance the set of items predicts above and beyond a single item.

Table 3

Two Factors that Corresponded to the Notions of Financial Self-Efficacy and Financial Knowledge Were Extracted in An Exploratory Factor Analysis

Item	<i>Financial Self-Efficacy</i>	<i>Financial Knowledge</i>
I was good at planning for my financial future	0.80	0.14
I was satisfied with my financial situation	0.82	0.07
I was able to save money	0.64	0.21
Investing your savings	0.27	0.80
Finding and Buying Insurance	0.15	0.77
Credit Rating	0.04	0.65

A more analytic exploratory factor analysis was performed using Mplus (See: Muthén & Muthén, 1998 – 2010, p. 45) that incorporated the ordered categorical nature of the factor indicators (i.e., the Likert-style ratings of the items) and allowed us to compare one and two factor solutions on a statistical basis. The robust weighted least squares method was used for estimating the initial factor loadings, a solution that was then rotated to simple structure via geomin oblique rotation to produce an optimal solution involving correlated factors.⁵ The

⁵ At times, some researchers will argue that they used Principal Components with Varimax rotation because they wanted to maximally distinguish between the factors by providing an orthogonal (independent, uncorrelated, 90 degree related) set of factors. The more reasonable position is to first of all use a method of extraction that leads to a proper estimate of measurement error and then measures the correlation between the factors (See Gorsuch, 1983) – if the factors

null hypothesis in this case is that the items all belong to a single factor concerning reflections about finances while the alternative hypothesis is that the two sets of questions are tapping into distinct aspects of the Savers' financial lives. The one factor solution turned out to be inadequate on several levels: (a) The chi-square test that the single factor model did not fit the data was highly significant and the model was thereby disproven, $\chi^2(9) = 521.61, p < 0.0001^6$; (b) the Comparative Fit Index was inadequate (CFI = 0.73); and the Tucker Lewis Index of fit was inadequate (TLI = 0.56). The two factor solution was accepted for just the opposite reasons: (a) the chi-square criterion of fit was nowhere near the usual $p < 0.05$ level of significance, $\chi^2(4) = 2.49, p = 0.65$; (b) the Comparative Fit Index was nearly perfect (CFI = 0.99); and, (c) the Tucker Lewis Index was also nearly perfect (TLI = 0.99). Table 4 lists the more accurate factor loadings of each factor on each item to the right of the factor loadings obtained with the classical method; in all cases, the factor loadings were higher on the corresponding factor and lower on the other factor. The correlations between factors, $r(495) = 0.15, p < 0.05$ was also lower when

are truly uncorrelated, then the estimate will equal zero. Otherwise, the analysis forces the variables to lay on a "Procrustean Bed;" Procrustes was a mythological innkeeper in ancient Greece who had a bed that fit everybody because if your body was too long, he would saw off your legs to the appropriate length, too short and he would stretch you!

⁶ The traditional probability levels are reported to keep good form and in this case it says that the difference between the one factor model and the data would be unlikely to be observed by chance less than one time in ten thousand. Actually, the χ^2 value would be unlikely to have been observed by chance less than one in a million times.

the categorical nature of the responses was incorporated into the analysis.

Table 4

Factor Loadings for the Classical Factor Analysis are Listed to the Left of the Colon and the Ones that Incorporated the Categorical Nature of the Responses are Listed to the Right of the Colon

Item	<i>Financial Self-Efficacy</i>	<i>Financial Knowledge</i>
I was good at planning for my financial future	0.80 : 0.90	0.14 : 0.01
I was satisfied with my financial situation	0.82 : 0.84	0.07 : -0.06
I was able to save money	0.64 : 0.67	0.21 : 0.12
Investing your savings	0.27 : 0.14	0.80 : 0.81
Finding and Buying Insurance	0.15 : -0.01	0.77 : 0.78
Credit Rating	0.04 : -.008	0.65 : 0.73

Three items from the EARN scientific survey also formed a reliable set of questions surrounding the matter of financial problems. The Item-Total correlations exceeded the required limit and the coefficient *alpha* (α) showed that the set of items was internally consistent.

Table 5

Reliability of the Financial Problems Factor

Item	Corrected Item-Total Correlation	<i>Alpha</i> (α) if Deleted
Problems paying for Utility Bills	0.63	0.58
Problems paying for housing	0.60	0.61
Bouncing a check	0.47	0.77
Overall Coefficient <i>Alpha</i> = 0.74		

To help systematize our thinking about how the EARN program might be helping to change the way people relate to money, a structural equation model was built based on the power of the full set of data from 487 respondents. A structural equation model with latent variables (factors) was constructed for the three overall constructs that were incorporated into the structured interview: (a) financial self-efficacy, (b) financial knowledge and (c) financial problems. Each of these latent variables was hypothesized to predict responses to specific questions and these “factor loadings” are all shown in Table 4 where it can be seen that all of these coefficients were sizable and highly significant. In addition, it was hypothesized that financial knowledge would predict financial self-efficacy which in turn would predict a decrease in financial problems. A couple of other features were added to the model as potential factors that could fuel or quell financial problems; namely, debt and savings. It was further hypothesized that financial problems will predict an increase in stressfulness of people’s finances and reduction of happiness with their finances. Figure 1 shows that many of the hypothesized relationships proved to be significant and in the predicted direction. The overall fit of the model was excellent with respect to the two best

global fit indexes: the Comparative Fit Index (CFI = 0.98) and the Tucker-Lewis Index (TLI = 0.97) both exceeding the required thresholds for well fitting models⁷

Table 6

Measurement Model for the Larger Structural Equation Model Showing the Factor Loading of Each Item on Its Respective Factor

Factor	Item	Factor Loading
Financial Knowledge	Investing your savings	1.00
	Credit Rating	0.54***
	Finding and Buying Insurance	0.52***
Financial Self-Efficacy	I was satisfied with my financial situation	1.00
	I was good at planning for my financial future	0.57***
	I was able to save money	0.47***
Financial Problems	Problems paying for Utility Bills	1.00
	Problems paying for housing	0.94***
	Bouncing a check	0.56***

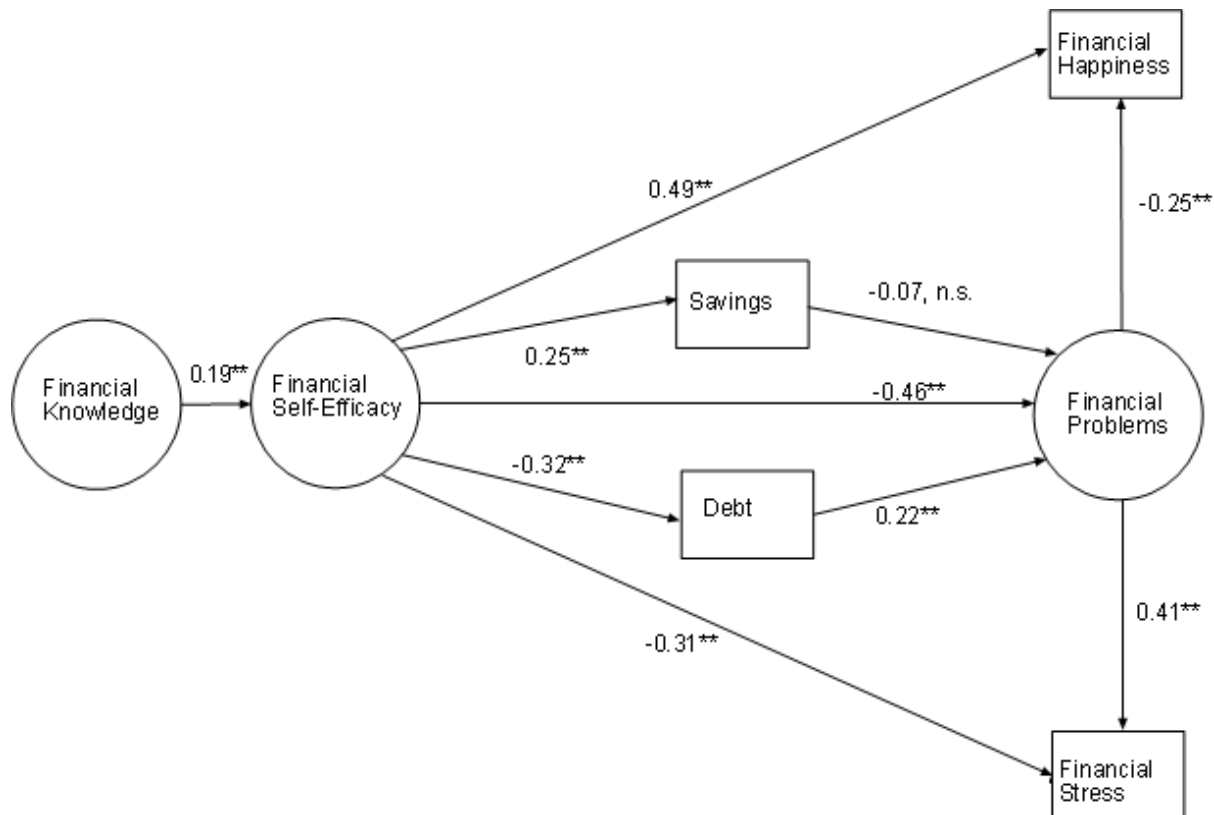
ordered categorical variables (See: Kamanou, 2006; Muthén, 1984; Muthén & Kaplan, 1985; Joreskog & Moustaki, 2001). The same rationale that led to the demonstrated advantage to incorporating the categorical nature of the responses in the exploratory factors analyses applies here as well. Item-Response Theory analyses have shown that Likert-style ratings are generally not normal and the psychological distances between the numbers varies when one and the same scale is applied to different items (Fox & Bond, 2007). In the present analysis, the responses to the items were declared as ordered categorical variables and theta parameterization was used in conjunction with the robust weighted least squares to test the model (See: Muthén & Muthén, 1998 - 2010).

As is standard practice, the scale for each latent variable was established by setting the first factor loading to one and estimating the other loadings relative to this standard. In addition to developing the model through a conceptually driven process, special care was taken with respect to computing it because a special feature of Mplus software was used to incorporate the numerical properties of

⁷ Hu and Bentler (1998, 1999) established on an empirical basis that the fit statistics for well fitting models were 0.95 for the Comparative Fit Index and 0.97 for the Tucker Lewis Index.

Figure 2

A Cognitive-Emotional-Behavioral Model of Financial Life



** $p < .0001$

This model is useful by itself because it may help us to make progress in the search for the sources of the wealth-health connection (an important issue of social inequality/social justice)⁸ and other matters involving people's relationship with money. We adapted the model for the present report to obtain

⁸ Health and illness may fall to the right of these equations, though certainly it could resonate back the other way with catastrophic health events and chronic debilitating illnesses.

longitudinal evidence for the success of the program by testing for changes over time among the people who were surveyed twice: (a) when they entered the program and (b) after completing a year. In this analysis, rather than using the latent variable approach we used manifest variables because there were not yet enough respondents to perform a stable latent variable solution. A longitudinal path analysis model (also known as a "panel analysis") was computed in which we were able to preserve the categorical nature of the sum of the scores for each factor and thereby not

making the all too common mistake of presuming equal intervals between the ordered categorical scores (see: Fox & Bond, 2007).

The focus of interest in longitudinal analyses is on change – this property is incorporated into the model by taking the autoregressive effect of the same variables over time. For example, financial knowledge at baseline is used to predict financial knowledge at one year and the same is done for all of the other variables in the model. Table 7 contains a complete list of all of the autoregressive effects that were incorporated into the model.⁹ Scores were formed for the financial knowledge, self-efficacy and problems factors by adding up the scores across the three items that make up each of the latent variables in the previous model.

Table 7.

Autoregressive Effects that were Taken Into Consideration

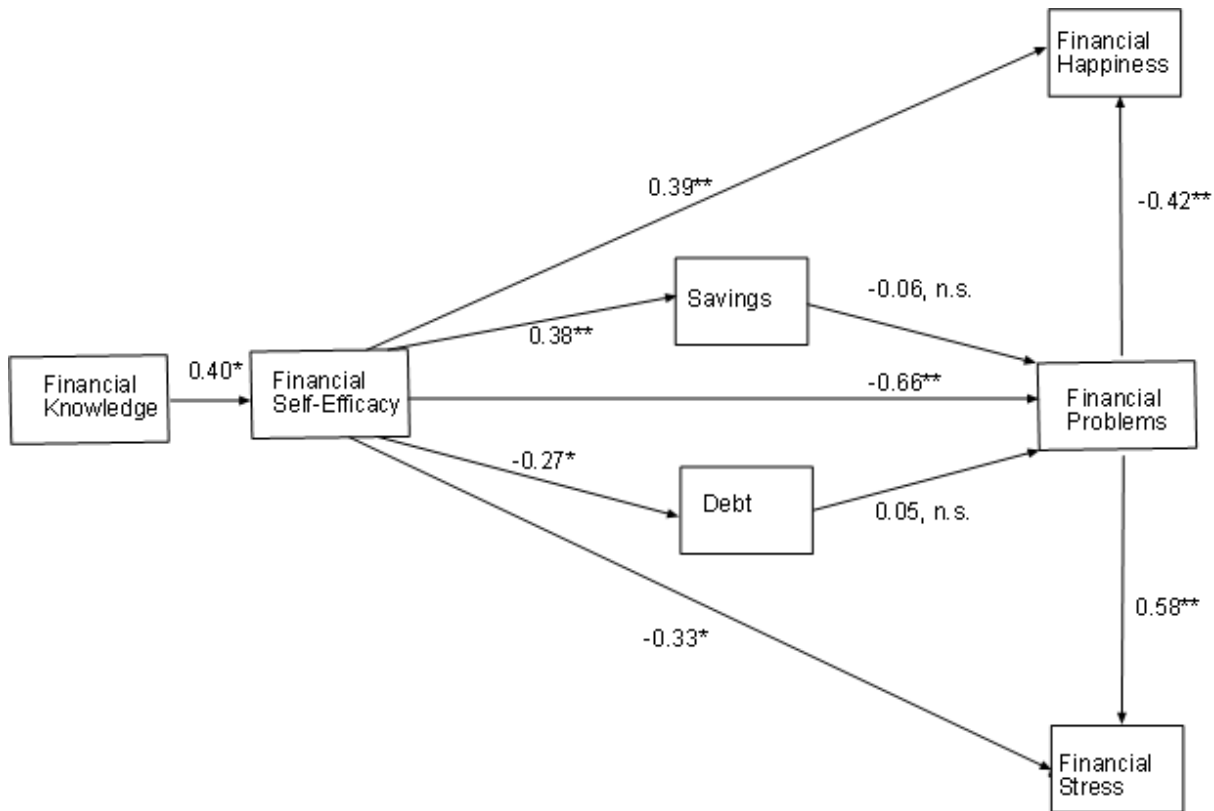
Variable	β
Financial Knowledge	0.46**
Financial Self Efficacy	0.45**
Financial Problems	0.60**
Savings	0.40*
Debt	0.36*
Financial Stress	0.10
Financial Happiness	0.16

⁹ Beta (β) coefficients range from -1.00 to +1.00, with zero indicating no relationship, -1.00 indicating a one to one negative relationship and +1.00 indicating a perfect positive relationship. Typically, β coefficients fall somewhere in between zero and either -1.00 and +1.00 and represent the magnitude of the change you can expect in the dependent variable based on a unit change in the independent/predictor variable.

As expected, the autoregressive effects of each of the factor summary score variables at baseline on their counterpart a year later were highly, but not perfectly related. The “imperfection” in these predictions is actually a good thing, because it indicates that some sort of change occurred among the Savers after they participated in the program. The greatest areas of change were observed in the emotional arenas and in terms of debt and savings. Figure 3 shows the baseline model, which does not differ in its major details from the latent variable model that was confirmed with the larger sample, suggesting that it is possible to use the path analysis with manifest variables to achieve roughly the same outcome. The model fit to a high degree of specificity, as evidenced by the non-significant chi-square for assessing the fit of the model to the data, $\chi^2(10) = 12.41, p = 0.26$, and both the Comparative Fit Index (CFI = 0.98) and the Tucker Lewis Index (TLI = 0.97). Most of the same paths were significant, or non-significant as in the case of savings predicting a decrease in financial problems; i.e., one of the core principles taught to the Savers during their participation.

Figure 3

The Path Analysis with the Smaller Sample Showed the Same Pattern at Baseline



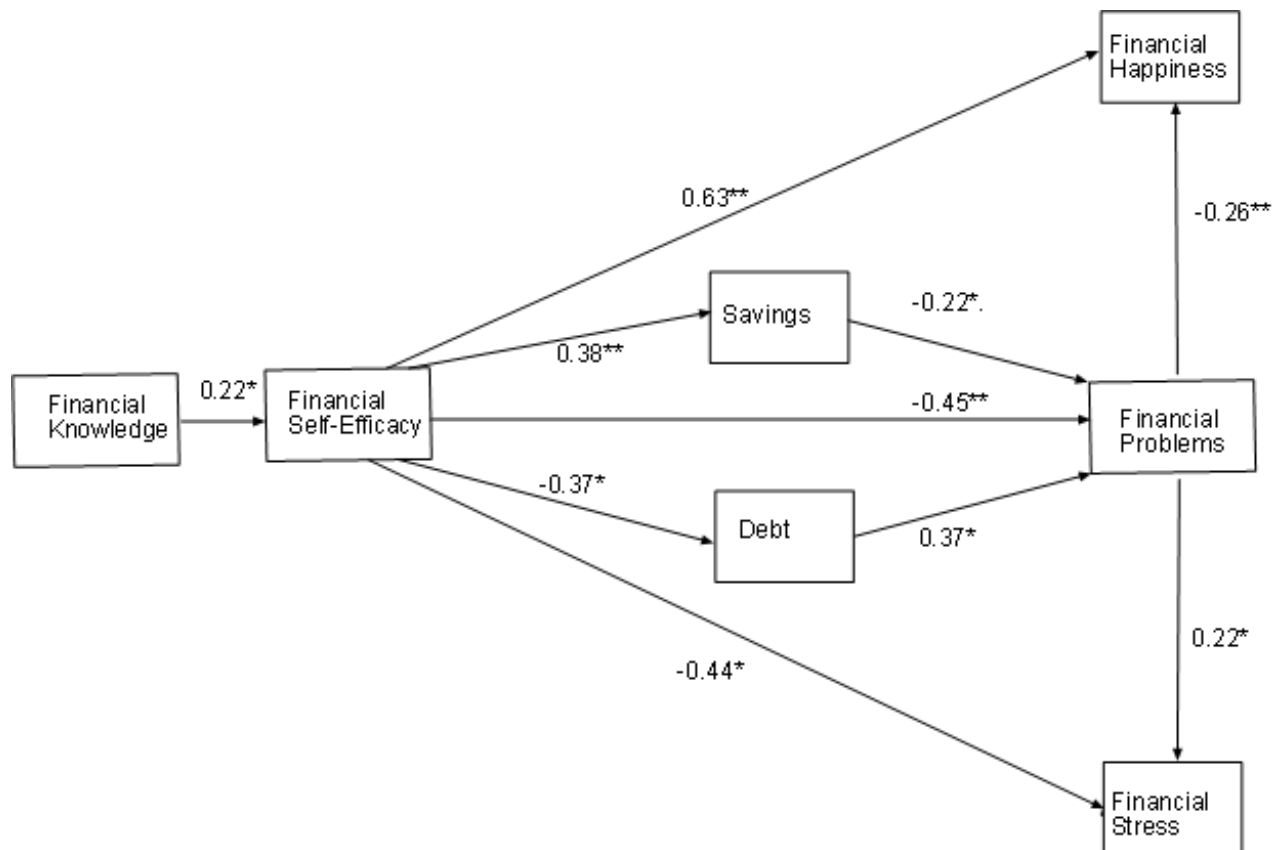
* $p < 0.05$
 ** $p < .01$

Figure 4 shows that after controlling for measurements taken at baseline, the same dynamics were at work, but with one interesting change: Savings predicted a decrease in financial problems. Another difference is that the paths from financial problems to happiness and stress were reduced in magnitude, whereas, the paths from financial self-efficacy to predict an increase in happiness and a decrease in stress became stronger. The model was once again not significantly different from the data by the chi-square criterion, $\chi^2(61) = 63.11, p = 0.40$, and fit

rather well as evidenced by the Comparative Fit Index (CFI = 0.99) and the Tucker Lewis Index (TLI = 0.98).

Figure 4

The Dynamics of the Model Persisted and Savings Became Significant



* $p < 0.05$
** $p < .01$

SUMMARY AND CONCLUSIONS

A Cognitive-Behavioral-Emotional model of financial life was developed during the present investigation that fit the data collected for a large number of people on a small set of variables, making this model a highly powerful one from a statistical perspective. The model has potential for being useful in other domains, but was applied here to ascertain the effectiveness of the EARN Savers program for improving the financial lives of individuals. After taking baseline measurements

into account, the same dynamics were observed after a year of participation in the EARN Savers program, but improvements were seen in the strengthening of healthy relationships to money; e.g., self-efficacy's effect of reducing debt, financial problems and finance related stress while increasing savings and financial happiness. Decreases in unhealthy relationships between financial problems and its impact on decreasing financial happiness and increasing financial stress were also observed. In conclusion, we now have an

assessment tool that works very well and the EARN program accomplished what it was designed to do: increase prosperity for low income people.

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ABOUT THE AUTHOR

Dr. William Lapp, PhD joined EARN as the Research Manager in 2010 to advance the cause of helping low- and middle-income people achieve economic prosperity by conducting research on evidence-based best practices in the financial industry. Dr. Lapp has diversity of experience evaluating pro-social initiatives such as the Friends for Youth Mentoring program in Redwood City, CA; sober living houses in Berkeley and Sacramento; programs for helping homeless people in the Haight-Ashbury district; and the Treatment on Demand program in the City and County of San Francisco (sponsored by the National Institute of Health).

Dr. Lapp's Bay Area experience includes working as a Biostatistician for the Public Health Institute in the East Bay, where among many other things he studied predictors of longevity; Senior Scientist at Ischemia Research and Education Foundation, finding ways to advance cardiac and other cardiovascular surgeries; Researcher/Analyst at Stanford University Medical School, examining treatments for Alzheimer's disease and late-life depression; and a two-year NIDA Sponsored Postdoctoral Fellowship at UCSF's Langley Porter Psychiatric Institute.

Dr. Lapp worked for 10 years as a Research Scientist at the New York State Research Institute on Addictions (RIA) in Buffalo, New York. He started at RIA during his last year of graduate school in the Department of Psychology at the State University of New York at Buffalo, where he studied Cognitive Psychology under one of the world's foremost Gestalt Theorists, James R. Pomerantz, Ph.D. In the process of learning about

artificial intelligence models of perception, memory, language and thought, Dr. Lapp opened up his mind to the formal science of multivariate statistics, thereby discovering interesting ways to look for coherent patterns within nests of complex information. The clinically and theoretically oriented researchers at RIA invited him to join them in the search for models of addiction and effective treatments. There, he helped to develop psychological tests that have been broadly used in Addiction Medicine for decades, studied social interactions and cognitive-emotional reactions of people in a simulated bar setting, and conducted his own psychopharmacological research on the effects of alcohol on attention, creativity and the perception of time.

Dr. Lapp's research has been mentioned in the London Times. He has been interviewed by BBC Radio Scotland, asked to deliver an invited address on innovations in statistical analysis at the annual conference of the American Psychological Association, and received an Outstanding Research Award from the New York State Office of Alcoholism and Substance Abuse Services.

ABOUT EARN

EARN, the nation's leading provider of microsavings, is an award-winning California non-profit that gives low-income workers the power to create economic prosperity for generations to come. Since 2001, EARN has helped tens of thousands of low-wage families through innovative financial products including matched savings accounts, checking accounts for the unbanked, micro-loans, and money management coaching. EARN's powerful combination of lasting assets and financial know-how enables families to build wealth and achieve

life-changing goals such as saving for college, purchasing first homes, or starting small businesses.

The EARN Research Institute evaluates the impact of EARN's work and publishes original data, sharing lessons learned and best practices. EARN uses this unique grounding in rigorous research and direct service experience to transform the financial services landscape and to champion effective public policies. EARN's ultimate vision is that millions of well-informed, low-income American families will achieve financial success through proven strategies, fair public policy, and their own hard work.

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