PERSONAL FINANCIAL LITERACY IN MATHEMATICS TEACHER EDUCATION

by Austin Eatinger

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ABSTRACT

The concept and topic of Personal Financial Literacy (PFL) comes into the field of K-12 education as a relatively new discipline. This study investigates the question, what do pre-service educators know about Personal Financial Literacy? A project was developed to measure what pre-service educators know and how they mathematically calculate financial questions posed in the context of a personal financial literacy project filled with life simulated questions. Findings indicated a disconnect with conceptualizing applied mathematics in the context of finances and how to determine a procedural solution. Pre-service educators' understanding of PFL ideas were low, especially in the area of earning income and calculating monthly credit. The recommendation is to better prepare our preservice educators with guided practice, reinforcement of PFL standards in their education-based curriculum, and more feedback on pre-service educators' answers in PFL based learning. Informing our educators in PFL can impact the socioeconomic outlook for careers related to the pre-service K-12 industry.

Key Words: PFL, pre-service educators, financial literacy.

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Approved:

[Chairman, Thesis Committee]   [Date]

[Member, Thesis Committee]   [Date]

[Member, Thesis Committee]   [Date]

        [Department Head/Direct Supervisor]   [Date]

        [Dean, Academic College]   [Date]

        [Dean. Graduate School]   [Date]

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CHAPTER I INTRODUCTION

Financial Literacy is defined as, "the ability to use knowledge and skills to manage one's financial resources effectively for lifetime of financial security (Jumpstart Coalition, 1987, as cited in Hastings, 1987, ch 2. Para 1)." In order to assess financial literacy, measuring success and failure can be attributed to analyzing a current generational-age demographic and how they manage debt, consumption, and their overall contribution to Gross Domestic Product growth. With this insight, there can be financial education stratagems implemented for specific generations in how they perceive wealth in the current culture and what contributes to their personal financial literacy (PFL).

The argument for a need for PFL education is exemplified through some informative statistics found from Business Insider. One result found that Millennials between the ages of 25-42 own just under 5% of the U.S wealth as opposed to baby boomers who owned 21%, when they were in this age bracket (Business Insider, 2020, 2019). In addition, only 30% of Millennials have an emergency fund, and the average student debt is just under $29,800 for the graduating class of 2018 (Business Insider, 2020; 2019). 43% percent of Millennials have waited to have kids due to financial instability, and 58% have a credit card balance of just under $5,000 (Business Insider, 2020; 2019). These statistics reflect the current economic climate, and these numbers

would likely extend to most of the labor force and, more specifically, our educators. The statistics show an increasing wealth gap as time passes with little to no intervention.

From an overall experience, inflation has increased prices for consumer goods, and the cost of living for individuals today becomes limited and dependent on their income. Pre-service educators need resources to help them strategize what is best for their own and, arguably their students' current financial situation, as this may affect future generations' PFL knowledge based on interactions with the pre-service educators that went through a process of learning financial literacy.

Learning and implementing PFL could create a shift in the current financial climate, would affect current political and economic perceptions, and create an impact on future generational wealth. Wealth may not be a complete measure of success, but the knowledge passed forward can be reflected in an individual's spending, quality of life, and how their savings are grown. Therefore, teaching our future educators may leave a lasting effect on their economic outlook and the information they teach to students regarding PFL. Thus, there is a desire to incorporate PFL material in the mathematics training of pre-service teachers, especially in areas within the United States with PFL standards for the K-12 level such as the State of Texas.

Therefore, this investigation considered the following research question: What do K-12 preservice teachers and educators know about PFL? In order to acquire data that is sufficient to drive PFL standards forward in the curriculum, a project was developed surrounding PFL ideas and concepts. The implications of this project's implementation, should lend itself to ask further questions, find resolutions to implement PFL in teacher

education, and make recommendations for training teachers to be prepared for instruction of PFL content.

   To understand the need for PFL education, standards must be identified that define such a relevant topic. The Council for Economic Education (2013) published a set of voluntary National Standards for Financial Literacy. Within these standards, the council included six key elements of PFL: 1) earning income, 2) buying goods and services, 3) saving, 4) using credit, 5) financial investing, and 6) protecting and insuring (Lucy & Henning, 2018, p.21). Using this as a framework for project development, pre-service teacher knowledge was assessed through implementation of a PFL unit and project in a current preservice program.

CHAPTER II LITERATURE REVIEW

Communication and language are the building blocks to connecting ideas and concepts in education. The measure of successful communication is to be able to pass down such knowledge to make the community a better and more efficient environment. "When citizens lack the social literacy necessary to negotiate the various debates over personal and community rights and responsibilities, they risk susceptibility to distortion of information and usurpation of resources" (Lucey & Henning, 2018, p. 20). Therefore, understanding PFL and its key elements will help build not only conceptual understanding, but also the desire to know why such elements are needed for our current and future educators. Prior research in the field of financial literacy helps explore the needs, setbacks, and standards behind each key element through the studies conducted in this area. In this review of the literature, key concepts are defined, pragmatic examples explained, and achievable goals in each of the standards introduced by the Council for Economic Education will be provided. Findings and discussion from key research studies in the field will also be presented.

Scholarly contributor Thomas Lucy (2018) helped explain the need for PFL by defining perspectives on financial literacy. In one camp, financial literacy is seen through the lens of being fluent in numeracy and attaches the identity of capitalism and self-worth for the consumer (Lucy & Henning, 2018). In this definition, Lucy and Henning (2018)

found a misconception and see the drive behind PFL under the perspective that financial literacy is based on the welfare of the society at large and making financial decisions based on the people's needs. These authors find a reason behind the scope of teaching PFL and the impact it would have on the society and the betterment of helping others in different ways, such as generosity and business. This type of success focuses PFL ideas away from self and individuality and shows the compassion and unity behind PFL standards.

Way and Holden (2009) conducted an investigative report which addressed some looming questions about PFL, such as its current understandings, potential setbacks, and place in the pre-service teacher program. These authors sent a survey via online link to 82 institutions in five states and collected data from a sample of eight teacher educators and 11 teacher candidates. The study's results reported that more than 60% were not prepared in any sort of capacity to teach financial literacy and only 37.5% believed it was important to prepare such teaching candidates. Out of the six topics listed for feelings of competence, participants felt the most competent in the area of decision making and careers, with a competence level of 50% in subjective scoring, while the lowest competence indicated occurred under the area of insurance, risk management, and saving. "Relatively few teachers reported feeling very competent in any of the areas identified" (Way & Holden, 2009, p. 69). This shows that career focus and decision making have been identified as established areas in our society, but lacking knowledge in anything financially related to risk.

Another concern of the survey was that less than 13% of the study's participants felt qualified to utilize financial literacy standards, integrate financial literacy concepts, differentiate methods and content, and develop examples using case studies. Under the study, teacher candidates reported

> that they regularly paid their bills on time; however, none had calculated their net worth, attended a workplace presentation on a financial topic, taken out a home loan or refinanced a home loan, purchased mutual funds, created an estate plan, contributed to an IRA, nor purchased real estate (Lucy & Henning, 2018, p.25)

There is a difference in understanding the procedural routines found in financial literacy and understanding the broader conceptualization that leads to the outcome of a successful financially literate person. Lucy and Henning (2018) expressed that "teacher candidates possess confidence in basic instructional strategies, yet lack confidence in knowledge of financial literacy content and related standards" (Lucy& Henning, 2018, p.28).

The findings from Lucy and Henning (2018) were similar to an investigation by Way and Holden in 2009. Within their study, "teachers reported feeling least competent in the more specific areas of risk management and insurance, saving and investing, and financial responsibility, and decision-making" (p.69). The caveat to this report is the competence stemming from math teachers who came from a different educational background than other pre-service educators. "Math teachers do express more confidence in teaching savings and investment, which may reflect the relevance of some savings and

investment concepts (e.g., interest compounding) to mathematical competency" (Way & Holden, 2009, p. 70). This reflects the importance of the integration of mathematical topics into PFL, such as exponential growth and balancing multiple equations related to deficit and growth. "One striking conclusion of this study is that a majority of teachers recognize the need for personal finance education" (Way & Holden, 2009, p. 76).

Lucy and Henning 's (2018) study, mentioned previously, surveyed elementary teacher education programs within a large midwestern state. Both university faculty and pre-service educators in the related field of elementary teacher education filled out a survey related to financial literacy preparation. The survey included 26-32 questions related to topics such as demographics, perceived competence, and importance of financial literacy. What is limiting and yet interesting about their sample was the fact that, "all faculty respondents were Caucasian and married and had at least a master's degree or doctorate. Additionally, all the respondents, except one, had an academic appointment primarily in elementary education" (Lucy & Henning, 2018, p.165). This sample included 88% women. Despite the mastery of their related education field, it was reported that "they had at least three years of teaching experience K–12, and the majority (71%) reported that they had never taught any financial literacy during their K–12 teaching years" (Lucy & Henning, 2018, p.165). Within this research, student participants in the education program (ages 19-22) were asked who was responsible for their financial planning. Results concluded that 66% held their parents responsible and 69% had not managed their own finances, calculated their net worth, saved, invested, prepared for tax returns, used a budget, or purchased any kind of real estate (Lucy & Henning, 2018). The

findings from this study may indicate a setback due to the direct correlation of the willingness to educate elementary school pre-service educators and pre-service candidates having little to no understanding as adults.

Faculty members were also asked several questions in Lucy and Henning's (2018) study with regard to teaching several topics on finances such as decision making, career, money management, credit, risk, saving, and investing. Results show faculty members, overall, had very low feelings of competence to teach this content. If this study is true, the understanding of basic financial principles in the pre-service portion of a teacher education will help establish a more fluent teaching pedagogy, for pre-service educators, when PFL is integrated in the K-12 education system.

> The top five concerns expressed by the teachers relate to: whether they will have enough money for retirement, finding ways to supplement their income as a teacher, paying for their children's college education, knowing whether they are using the best strategies for investing their money, and knowing whether they are taking advantage of tax laws that may benefit them (Way & Holden, 2009, p. 71)

A possible solution to the problem here, evidenced in the study from Way and Holden (2009), shows that teacher knowledge of investment and retirement concepts increases after exposure to online or even face-to-face education experiences. When pre-service educators are simulating these financial concepts, then there is retention being built throughout this learning experience. After practicing financial problems, this builds competence in the subject area. The existing research indicates that there may be a potential to build buy-in to teaching, understanding, and implementing PFL education by

first exposure and distributing resources in the pre-service education programs. Findings reported more confidence in pre-service teachers in PFL, after experiencing both the opportunity to research for themselves and take a semester-long social studies course with general financial education (Lucy 2008; 2016, as cited in Lucy & Henning, 2018). One example for pushing for PFL is based on the survey results that 90% of educators felt that teachers need to be prepared to teach financial literacy as long as there was state-guided curricular standards (Lucy & Henning 2018).

> Financial literacy represents a basic life skill about which university faculty and preservice teachers express marginal amounts of teaching confidence and competence. We encourage further study into efforts to integrate financial education into teacher education curricula and strategies for improving the financial literacy of our teacher education faculty and children's teachers. (Lucy & Henning, 2018, p.171)

The conclusion of Lucy and Henning's (2018) study asserts that adding a potential semester-long or heavily integrated financial education course in the credential program could be a significant solution in these problems being addressed. Based on the findings from their research, PFL engagement has the benefit in contributing to preservice teaching pedagogy.

In conclusion to the overall review of the literature, "it is noteworthy that income sufficiency is a top concern for a rather large proportion (one-third or more) of the overall teacher population" (Way & Holden, 2009, p. 73). The driving force behind implementing PFL standards and collaborating with pre-service educators is to enable

and encourage educators to have a chance in this economy. The belief is that individuals will be able to do what they love and thrive financially while doing so. The knowledge learned through self-participation in PFL concepts can be directly related to the competency in teaching such standards. Although the benefits of PFL education are present within the literature base, gaps noted related to mathematical principles that pre-service educators would either not know or would know how to apply, in a financial situation. Thus, the PFL project implemented in this study aimed to add to the body of PFL literature in order to highlight conceptual and procedural applied mathematics problems to help pinpoint where pre-service educators and educators can improve.

Rationale for This Study

PFL has substantial case studies and surveys of current financial understandings. With this research there is still the need to address the relevance and placement of such coursework. The relevance of PFL can be seen in the great socio-economic gap between higher, middle class, and lower income individuals. When addressing social justice in the classroom, there is a deep drive to remove the obstacle that is in the way of each student learner. One way to do this is by leveling the playing field by teaching financial literacy standards in the classroom so that all future pre-service educators have the same knowledge and chance to build success in their finances. After all competence in anything builds confidence moving forward. The knowledge of PFL can decrease the socio-economic gap in the populous of a capitalist run economy. The material would not be dependent on what pre-service educators already know nor differentiate between socio-economic status.

One problem to address is the time and structure to fit in PFL. Due to high demand for test preparation, reading, writing, arithmetic, and mandated assessments, there is difficulty finding ample time to create space for learning outcomes in the fields of social studies or mathematics in PFL. One area that can be removed is the time it takes for testing and creating more of a project-based assessment. The time in class would be better utilized in the form of a Personal Financial Literacy Project. Something of this nature has been constructed by Dr. Meador and Dr. Matteson (2021). Description of the PFL project is beyond the scope of this paper and readers are encouraged to consult Meador and Matteson (2021).

Focusing on mathematics and PFL, the topics of instruction may address content ideas such as rates, proportions, and percentages being implemented in an applied way. Under Rule 111.6 of the Texas Administrative Code (2012) for teaching K-8th grade mathematics, personal financial literacy is addressed under several standards and has been adopted into teaching since September 2012. For example, in 4th grade, the standards read that

The student applies mathematical process standards to manage one's financial resources effectively for lifetime financial security. The student is expected to: (A) distinguish between fixed and variable expenses; (B) calculate profit in a given situation (C) compare the advantages and disadvantages of various savings options (D) describe how to allocate a weekly allowance among spending; saving, including for college; and sharing; and (E) describe the basic purpose of financial

institutions, including keeping money safe, borrowing money, and lending.

(Texas Education Agency, 2012)

Looking into sections (A) and (B) we see the need for algebra to be introduced, through modeling, analyzing graphs, and equations defining profit and its relation to income and expenses. This begins in 4th grade and will later be integrated through the middle and high school standards (Texas Education Agency 2012). Looking into category (D), one practical example includes spending at a restaurant and then adding tip plus tax using amounts such as 10,15, and 20%. These values are better understood conceptually as a portion of the original amount using the multiplication process. Ideas such as this are also present in the introduction into standards two and three in the National Standards of Financial Literacy entitled buying goods and services and saving (Lucy, T., & Henning, 2018, p.21).

Typically, buying goods such as food, gas, clothing, or even entertainment require a sales tax on top of the original amount and individuals need the mathematical knowledge to calculate this amount. In addition, any service purchase usually adds on a gratuity tip. This can be calculated using the mathematical concept of percentages in addition to principal amount. A 15% increase on a price tag worth forty dollars will be calculated by multiplying the principal amount of 40 to the number 1.15. This is an efficient way to help support and accurately calculate the purest tip an individual would like to leave someone. Understanding the hidden costs and fees is beneficial for budgeting accordingly as well. Rates, in the form of interest, are usually taught in grade six (TEA 2012). Interest in the context of PFL standards can be seen in saving, investing,

and using credit. Understanding that over time there will be an interest rate on your principal asset or liability can leave a pragmatic socio-economic impression. What is needed is the traditional overview of rates, such as growth and decay. Practical terms such as compound interest, sales tax, and percentage problems would benefit the welfare of anyone using wealth in their daily activities.

Algebra problem solving would be heavily needed for understanding PFL content when making future predictions based on trend lines and analyzing growth charts for investing and saving reasons. As for technology, the use of Microsoft Excel or other spreadsheet software, could be pertinent for organizing budgets and amortization tables for paying off debt such as credit cards, or car, student, and mortgage loans. Organizing a budget using Excel can be helpful to categorize and list out monthly expenses such as food, gas, insurance, shopping, and other extraneous items. Once an overall monthly total in expenses is defined, then one can compare to the income collected and find the difference in the two numbers see if any savings is being accumulated. Other ways technology is helpful is searching for compound interest calculators to show much a debt will need to paid in a certain amount of time or even the predicted investment an individual may have put in the stock market.

Needless to say, educators that specialize in the area of mathematics would be more inclined to help establish the standards outlined in Texas administrative code criteria. Way and Holden (2009) affirm this by stating, "Math teachers do express more confidence in teaching savings and investment, which may reflect the relevance of some savings and investment concepts (e.g. interest compounding) to mathematical

competency" (Way & Holden, 2009, p. 70). It can be argued that preservice teachers will first need to understand mathematical concepts behind the procedures introduced into PFL.

The fact that a disparity exists between teachers' perceived competence to teach personal finance subject matter and their competence to use a specific set of personal finance educational tools serves as a reminder of the importance of considering different kinds of teacher knowledge (i.e. subject matter pedagogy) in designing programs to nurture teacher development (Way & Holden, 2009, p. 71).

CHAPTER III CONCEPTUAL FRAMEWORK

The six principles as determined by the Council for Economic Education (2013) that will be investigated in the analysis of the research provided will first need to be defined and examined. Prior educators and researchers have developed examples of how these standards are used in studies, developed in surveys, and defined according to mathematics education purposes.

Earning Income

Earning income, defined by the Worcester Polytechnic Institute (WPI, 2023) "is any money an individual receives" (para 35). Collecting money earned can be from either passive or active work. The concept of earning income is different from expending any money, rather just the accumulation of money from a contracted obligation being fulfilled. This concept of focus is where personal financial literacy begins. Individuals need income to move forward with finances and make decisions based on what they have earned. "It is noteworthy that income sufficiency is a top concern for a rather large proportion (one-third or more) of the overall teacher population" (Way & Holden, 2009, p. 73). Specifically for future educators, the methods to establish knowledge in this area is to understand what jobs to look for and compare income based on the tax rate and benefits in the local area. This is practical for a pre-service teacher starting out and discovering that in one job they may pay more but the tax rate is higher, and therefore

takes less income home compared to another teaching job that pays lower yet has a lower tax rate.

Buying Goods and Services

Expensing is another way of understanding buying wants and needs in personal finances. A budget defined by WPI (2023) is "a plan for managing money, dividing up expected income and expenses among spending and saving options based on personal financial goals during a given time period (para 9)." In order to discern what is needed, a budget tracker is suggested for educators to visualize, measure, and track their spending habits. Categorizing food, housing, gas, entertainment, bills, and shopping is another way to help in contemplating the opportunity cost of what a pre-service teacher is choosing to spend based on their income, and the portion each category consumes in relation to income. PFL programs should put focus and effort into managing and tracking finances in order to provide sufficient competence.

Saving

From a mathematical position, saving is understood as income minus expenses, with the condition that income is greater than expenses. This can be understood from a business position in the sense that profit is equal to income minus expenses which leads to furthering a person's building of wealth and reducing risk. One big concept in savings is having three to six months of expenses in case of job loss, medical bills, or an average "rainy day" expense.

In a report, Totenhagen (2015) found that one of the interesting topics from young middle school to older high school pre-service educators was learning to track spending

and save money for future ambitions. According to Investopedia (2022) there are four common types of ways to hold savings: checking account, savings account, money market account, and certificates of deposits. These typically are low risk and low return on interest accumulation of the principal amount being stored away over time. Even with low returns, saving is foundationally what positions individuals for passive income, wealth, and asset management, such as financial investing.

The definition, according to WPI (2023) for savings is "the process of setting income aside for future spending" (para 52). Saving provides ready cash for emergencies, short-term goals, and funds for investing. In Totenhagen's (2015) study, a finance program was introduced to both middle school and high school pre-service educators and it taught budgeting and saving through a simulation. The simulation experience created an assigned family and income scenarios and pre-service educators had to make decisions based on the information provided (Totenhagen, 2015). This study showed that pre-service educators who went through the program had a direct correlation with demonstration of saving more and spending less on immediate gratification items.

Using Credit

Credit is the driving force behind borrowing money that an individual does not have immediate access too. Credit is viewed by a bank as who they can trust to lend money to with a specific interest attached to the principal amount over a period of time. This definition follows both WPI's (2023) and Investopedia's (2022) terms and definitions of financial literacy. The higher the credit, the more a bank is willing to trust lending, with a comparably favorable and lower interest rate on the loan for those with

greater scores. Higher credit also leads to more borrowing power for the desired

borrower. This standard helps teach the benefits and the strategies behind developing a

higher credit score. One key aspect for beginning credit managers is reading the terms

and services behind a credit card. A sample of college age pre-service educators who

went through the jump start coalition's PFL course "reported a significant increase in

young adults' self-reported responsible attitudes toward credit cards, with 81 % of the

participants specifically reporting that they would read the fine print on credit cards

before applying" (Totenhagen, 2015 p.174).

Financial Investing

Investing relates to the concepts of acquiring an asset that generates income

through either appreciation or periodic cash flow. This can be seen through residential

and commercial real estate, start-up business, and even an initial public offering in the

stock market. "In a survey of 710 teachers across the state of Ohio, Loibl (2008) asked

teachers to identify specific finance topics that were being covered in high school

financial literacy courses across the state" (Totenhagen, 2015, p.174). The outcome led to

51% of respondents wanting to learn more about stocks and bonds and 53% percent of

pre-service educators wanted to learn more about stock market information. The

definition of investing, according to Investopedia (2022), states that "investing is to grow

one's money over time. The expectation of a positive return in the form of income or

price appreciation with statistical significance is the core premise of investing" (para 4).

Another definition from WPI (2023) conveys investing as "setting aside money for future

income, benefit, or profit to meet long-term goals; using savings to earn a financial

return" (para 37). One of the most common investments is saving enough for a down payment on a first home that is beneficial in countering inflation and locking in a fixed interest rate and mortgage payment. An additional benefit is the value that the home may appreciate over time.

Protecting and Insuring

The concluding key element in the Economic Council guidelines follows protecting and insuring assets, liabilities, and life for beneficiaries and dependents. Insurance is crucial in the event of problematic accidents or even just peace of mind in covering risk. This may come in the form of car, home, rental, and life insurance. Protecting is also something to consider when assets have the risk of being targeted by lawsuits through an L.L.C or trust. Shopping for quotes in these areas is crucial and helps understand responsibility when an individual collects and owns more financial materials.

CHAPTER IV METHODOLOGY

The goal of this research project is to answer the question of what pre-service educators know about PFL. The approach to answering this question was the implementation of a PFL project developed by Meador and Matteson (2021) constructed specifically for pre-service educators taking a content course in mathematics. Through this project, pre-service teachers navigated through a simulated financial journey, where they begin to make decisions and traverse outcomes that may occur during in the course of a lifetime that relate to personal finances.

The project consists mainly of responses to quantitative questions involving scenarios that require the calculation of percentages, interest rates, tax deductions, and overall budgets. The project also contained qualitative response questions that helped inform the researcher on what pre-service teachers learned throughout the project. The reason for a mixture of both types of questions was to adequately discern what pre-service teachers know about PFL in the context of the six key principles of the Economic Council of Education. For example, in the first life scenario of the project, pre-service educators are given a wide variety of school districts from which to select a job and calculate annual salary, gross income, and net monthly income.

For methodological analysis of quantitative questions, pre-service educators reported answers and then were compared to the correct solution by a common use of the

percentage away from the actual answer formula. Another way shown is by comparing the correct value versus the subjects answer and intuitively one can see a great difference in the answer. Early in the project pre-service educators would calculate net income and then later would calculate a monthly car payment and what that was out of their overall budget. Instead of just comparing the final answer of overall budget, problems were analyzed for all parts leading up to the answer. This was done to see where the disconnect or miscalculation took place.

Participants

Participants, for this study were 14 pre-service educators enrolled in a mathematics content course for aspiring teachers. The mean age of the sample of pre-service educators was 29 years of age, which falls under the age of a millennial. A millennial is defined as anyone born between 1981 and 1996. Generation Z encompasses those born before 1996, while Generation X is anyone born between 1965 and 1980 (Dimock 2022). Specifically, two pre-service educators fell under the millennial generation category, eleven of the 14 pre-service educators were Generation Z, and the other fell under the generation x age range. Even though most pre-service educators were not classified as a millennial, the data suggests that participants' age was on the border of older Generation Z to younger millennial range. Age was the only demographic data collected for participants as part of this study.

Data Collection

Data collected came from the completed Personal Financial Literacy Project, where pre-service educators filled out a multitude of questions under the concepts of job

selection, income, savings, expenses, budgeting, and asset management. The concepts of the project that correlate to the principles of PFL standards would include earning income, buying goods and services, saving, using credit, financial investing, and protecting and insuring. Under the principle of earning income, pre-service educators were provided a table of job links embedded into the Word document that would give them the opportunity to research what would be the best job to select based on income and factors related to deductions such as taxes and retirement. After the sampled pre-service educators calculated their net monthly income, they would then select the desired job.

Buying goods and services was conducted through purchasing a car and home within the project. Pre-service educators were asked to find their desired car and home, and research current interest rates in order to calculate their expenses monthly and how much of that monthly expense is, in comparison to their income. The principle of saving was found under project questions regarding saving for the future. Pre-service educators were given a life simulation where they were instructed to save $100 monthly and had to choose where to allocate their funds based on a few options provided to them.

Pre-service educators were able to experience using credit to understand this financial principle by using interest rates on a credit card and calculating how much credit card debt costs monthly, based off of a given simulated amount. Financial investing was practiced through saving for the future and purchasing a home based on the given amount of their income. Participants decided if this was a wise investment with the amount in their budget remaining after paying the calculated mortgage. Finally, the

principle of protecting and insuring was utilized in this project through insurance deductions taken out of their job selection.

Upon completion of the project, pre-service educators submitted their work to the instructor of the course, where a research assistant identified the data and recorded submitted project answers under one Excel document. After receiving this excel sheet, the researcher then examined the results under each category of the standards listed in the Council of Economic Standards. Responses to questions were then compared to the correct answers on each given section. The results were determined by comparing pre-service educators' answers to not only the mean answer, but also the correct answer. Correct answers and pre-service educators' answers were compared using a percent difference formula. This equation was used for all quantitative portions of the project and was calculated by taking the difference of the correct answer and pre-service educators' answer and dividing it over the correct answer.

Excel was the best fit for analyzing the results in order to calculate compound interest, percentage increases, and loan payments. Rationale for using quantitative data on pre-service educators is to determine differences in results, compare individual scores to the mean sample, and to check if average answers were calculated correctly when given a calculation to perform in the project. Pre-service educators' impact answers at the end of this project helped convey pre-service teacher understanding prior to, during, or after project completion, as well as the possible transformative learning experience through completion of the project.

CHAPTER V RESULTS

For presentation of results, tables will be provided with the inclusion of only selected, noteworthy data or measures of central tendency calculated for the entire data set. Selected participant data was chosen based on emphasis in responding to the research question and the key PFL principles (Council for Economic Education, 2013). Pre-service teacher participants were deidentified, and a unique number was assigned to their project responses.

Data collected from the first section of the project that references job selection is listed in Table 1.

Table 1

El Paso/Houston Monthly Deductions

Participant	El Paso			Houston		
	Federal Taxes	Retirement Pre-tax	Insurance Pre-tax	Federal Taxes	Retirement Pre-tax	Insurance Pre-tax
10	$3,994	$3,539	$7,078	$4,241	$5,437	$6,524
13	$5,055.60	$29.49	$421.30	$5,436.90	$45.31	$453.08
Correct Answers	$442.71	$309.90	$619.79	$568.69	$568.69	$682.43

In the PFL project, the pre-service educators were to use a table embedded with

hyperlinks to school district jobs in selected districts in order to determine the exact

amount of income deductions such as retirement and income tax. Based on the

information provided, pre-service teachers were asked to then determine the exact

amount of those deductions given their research on base salaries as a first-year teacher in

the various districts provided. The data listed in table 1 above shows participants'

calculations in finding their annual salary, their gross monthly income, and their net

monthly income after deductions. The correct answers are listed in the last row so that

readers may compare the selected participants' answers and to show how they deviated

substantially from correct results.

Specific instructions in this portion of the project were given to pre-service

educators to deduct from a monthly gross income at either a 7, 10, 12, or 14% deduction,

and as shown, the selected pre-service teacher's answers were highly inaccurate. In order

to be successful in this section of the PFL project, participants would have to calculate

the monthly deductions using a general formula such as

$$Net\ income = gross\ monthly\ income\left(1 - \frac{percent\ deduction}{100}\right)$$

The percent differed for each job depending on what type of tax percent was taken out

from their salary. The selected participants above in Table 1 show a numerical value

much higher than what they were expected to calculate. Although data was collected for

several other districts (e.g., Amarillo and Dallas), due to a transfer of data from the

original submission documents to the main data spreadsheet, the El Paso and Houston

districts were the only data investigated, along with the overall job that pre-service

teachers chose. Table 2 shows the overall average of all answers submitted and the mean

percentage away from the correct answer when pre-service teachers calculated the

amount of tax, retirement, and insurance deducted when the percent of these deductions

of the income was known. Data from the mean in this table may be compared to the

correct answers provided in Table 1.

Table 2

Mean and Percentage for District Deduction Data

	El Paso			Houston		
	Federal Taxes	Retirement pre-tax	Insurance pre-tax	Federal taxes	Retirement pre-tax	Insurance pre-tax
Mean	$2,026.64	$506.90	$2,430.05	$2,170.39	$773.67	$2,238.40
Percent away from Correct	-357.78%	-63.57%	-292.08%	-281.65%	-36.04%	-228.00%

The project continued by asking pre-service educators to calculate gross and net

monthly income and how a year end raise would affect their income the following year.

The results for selected pre-service educators are reported below in Table 3.

Table 3

Raise Calculations Data

Participant	Gross Monthly	Net Monthly	5% Raise to Annual	Gross Monthly Increase	Net Monthly Increase
1	$4,106.08	$3,103.52	$4,311.38	$155.18	Increase
6	$4,106.08	$3,617.45	$51,736.65	$4,311.39	No affect

In order to see how each individuals' calculations were performed, a few calculations are highlighted below. Answers from selected pre-service educators are provided in order to highlight the vast difference in answers and understand the variation from the overall task. Next, these values were compared to the correct 5% raise calculations by using their selected salary, gross monthly, and net monthly income and multiplying by 1.05 to each answer. Then to show the percentage difference, a formula was used such as $Percent\ change = \frac{(correct\ answer - participant\ answer)}{correct\ answer} \cdot 100$ as shown in Table 4.

Table 4

Individual Difference by Percentage

Participant	Net	Gross	Salary
5	-47%	32%	17%
7	-167%	-24%	0%
14	-233%	-28%	0%

The results in Table 4 compare the individual calculations to what should be the correct answer. The percentage indicates how far off their answer was from the correct calculation of a five percent raise in annual, net, and gross monthly income. Nine out of the 14 pre-service educators were correct in their calculations for salary. However, incorrect answers increased when calculating gross and net raise increases, and in fact, some pre-service educators did not answer the question. Only one pre-service educator calculated the correct net increase, while only one pre-service educator correctly

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answered the gross income raise. It is important to note that gross monthly salary is the annual salary divided into 12 months and net monthly salary is after deductions. The results show that calculating both net and gross monthly salary was a task the overall sample of pre-service educators could not accomplish.

The topic that pre-service educators were asked to answer next was about saving for the future and car payments. Both topics revolved around interest formulas in order to calculate monthly car payments or evaluate a future savings goal. Within the project, participants were given two different hyperlinks in order to help solve the problems. These hyperlinks led to a website that provided a tool for calculating compound interest and information for taking out a car loan.

For the first part of this section of the project, participants needed to input their principal amount of savings, which was $4500 and input how old they would be once they graduated college to calculate the amount that would be in a savings account when interest is compounded. For example, if the participant was 24 years of age, when they graduate from college, as directed in the project, then they would input the number 24 in the time component of the compound interest formula. The final step was to change the interest to 6% annually and then the software, embedded in the link, calculated their overall earnings in that given timeframe. For the second part of this section of the project, the link provided help with navigating the price of the desired car and down payment on the car. After that, pre-service educators were given specific instructions to input interest rates and loan terms in the online calculation tool. Pre-service teachers were

given that the principal amount was $4,500 with 6% annual percentage rate. The function that works to calculate compound interest equates to,

$$f(t) = principal \left(1 + \frac{interest\ rate}{100}\right)^t$$ The variable t is measured in years from birth to 2021 and represents the amount of money accumulated given the time t. A table was constructed for each pre-service educators answer and what should be the actual answer based on their age to see why percentages are far from both the mean and each other's answers. Table 5 compares pre-service teachers 'answers of calculating compound interest to the correct answer. This was dependent on the age they input into the calculation and how far answers were from being correct.

Table 5

Participants Answers vs. Correct Way of Calculating

Participant	Birth Year	Money in 2021:	Actual Answer	Difference	Percentage
6	1991	$6,480.00	$25,845.71	$19,365.71	74.93%
7	1998	$241,030.42	$17,188.87	-$223,841.55	-1302.25%
13	1998	$6,210.00	$17,188.87	$10,978.87	63.87%

Analysis of this data reveals seven pre-service educators of the 14 sampled were within less than .10% away from the actual answer. Overall, this shows half of the pre-service educators can correctly calculate compound interest using a tool, while 10 out of the 14 pre-service educators can correctly calculate within 11% error from the correct target answer. The three selected pre-service educators in Table 5 showed why exactly the mean class answer was so far from the mean actual answer. One subject was 1300%

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away from the correct calculation while the other 2 pre-service educators were within 75% away from the correct calculation.

As directed in the projects, pre-service teachers may use the money from their savings account for use in purchases in future sections in the project. The first problem in which pre-service teachers could allocate these savings funds was as a down payment for a car loan. Table 6 shows the results below for selected pre-service educators for their savings calculation and car loan information.

Table 6

Future Savings and Car Payments

Birth Year	Cash in 2021	Price of Car	Down Payment	Loan Principle	Chase: Loan Principle
1974	$61,941	$38,595	$15,000	$23,595	$23,595
1991	$6,480	$21,444	$5,000	$16,444	$17,553.97
1998	$241,030.42	$9,965	$1,000	$8,965	$8,965

In the next phase of the PFL project, pre-service teachers were asked to select a car to purchase by finding the value of the car and the desired down payment so a loan can be calculated in order to pay a monthly expense on the newly acquired vehicle. Subjects calculated the loan principal by taking their desired price of car and subtracting it from desired down payment amount. Then, based on the loan principal, which all calculated correctly, pre-service educators then had to calculate monthly loans based off of three different lenders given a fixed rate. Chase had a 36-month loan at 6.75%, Ford Motor had 48 months at 4.75%, and Bank of America had 72 months at 5.99% interest. Pre-service educators were given the following instructions:

Your monthly payment is your principal divided by the number of months in your

loan term, and then multiplied by your interest rate. Next, multiply the monthly

payment by the loan term to determine the total amount paid. Record your

monthly payments and final amounts paid in the chart above. (Meador &

Matteson 2021)

Pre-service educators' results were recorded based on the car's principal amount,

monthly car payment, and the total for the car that the participant would be paying over

the entire loan amount. In order to check on the validity of results, a table was

constructed to measure accuracy. For comparisons, the formula based on the directions

given was converted to

$$Monthly\ payment = \frac{principal}{loan\ term}(interest\ rate)$$

The accumulation of the total paid from the loan would be calculated by the technology

provided to the pre-service teacher in a form of a link. Table 7 shows selected participant

answers and how far off they are from the correct answer for each individual bank they

signed a loan with.

Table 7

Car Monthly Percentage Away from Correct Answer

Participant	Chase	Ford	BOA
6	-11%	-10.07%	-23%
7	-57%	-40.81%	-51%
10	-533%	-353.84%	-465%

Note: BOA stands for Bank of America in Table 7.

Analyses showed that 10 out of 14 pre-service educators calculated the Chase payment correctly, eleven out of 14 pre-service educators accurately calculated the Ford payment, and five of the 14 pre-service educators accurately calculated the BOA payment. After participants calculated their monthly payments, pre-service educators were then asked which loan option they preferred and what percentage of their net monthly income this would be. Selected participants' answers are presented in Table 8 below.

Table 8

Preferred Car Loan/Budget

Participant	Preferred Car Loan	Percentage of Income
3	Ford	6.13%
10	Ford	99.50%

The mean monthly car loan, according to participants' calculations of monthly net income and car payments, was 20% of the pre-service educators' budget. Table 9 shows selected participants' calculations of their budgeted percentages in relation to their car payment and net income.

Table 9

Car Loan/Budget Percentage Comparison

Participant	Net monthly income	Car Payment	Participant's Percentage of Budget	Correct Percentage of Monthly Budget
1	$3,103.52	$726.21	23.40%	22%
5	$3,697.09	$210.81	7.60%	5%
12	$428	$625	20.41%	153%

In order to do this successfully, pre-service educators would create the following:

$$Car\ payment\ percent\ of\ budget = \frac{car\ payment}{monthly\ net\ income} \cdot 100$$

Since this problem's questions build off the prior information within the project, each category is important to discern where the calculation went wrong, from the final overall monthly budget. The problem may have been in calculating income, the car loan, or overall understanding of percentage as a ratio.

Based on the results above, calculations of their budget proportions were accurate for 11 out of the 14 subjects were within a 5% range of error. For the other three participants, errors would include conceptualizing the overall budget as a ratio. The ratio would include the car loan as the numerator and the monthly income would be the denominator. This would show that portion of a car payment is being allotted out of the overall budget. The next part of the PFL project was to find a desired home on any given home website and calculate home value, down payment, and mortgage given three lender options.

The mean home price was $156,000 given the 14 participants' answers. Answers indicate that most can evaluate a proper calculation of a loan principle, except for one participant. The loan principal is calculated by subtracting their desired down payment from the home price. Participants then had to assemble mortgages, but rather than calculating this themselves, they were given a link to a finance calculation tool to assist in this process by inputting the numbers in relation to their desired down payment and home price. For this we will not investigate their numbers to see any error since the goal is to show results manufactured by participants' mathematical procedural knowledge in order

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to answer questions about personal finance. What is important to note, is the preferred

loan per participant and their reasoning behind the selection. The reason to investigate the

qualitative responses is to highlight the understanding of measuring out the ratio of home

loan and their overall income to see if participants would realistically be able to live out

their financial endeavor of buying a home. The ratio in this process is to examine the

following equation:$percent\ of\ monthly\ budget = \frac{loan}{income}$.

Answers for selected pre-service educators are shown in Table 10.

Table 10

Preferred Home and Reason

Participant	Bank Chosen	Percent of Monthly Budget	Good Time to Buy a Home?
3	Chase has the lowest interest rate and fastest payment option.	56%	Yes, the sooner you buy a house the sooner it will be paid off.
10	Bank of America because the interest rate is low and the monthly payment is also low	251%	No, I barely make enough to pay for my car.
14	Chase cost less in the long run, even though it would be a chunk of my budget every month.	12%	I feel like buying a house at this time would be a better investment than paying for an apartment every month.

Out of the 14 pre-service educators sampled, not one participant selected Wells

Fargo as their home lender. For context, Wells Fargo offered a 6% interest with a 20-year

mortgage. Participants preferred either a 15-year loan with a 3% interest with Chase or a

traditional 30-year mortgage with a 5% interest with Bank of America. Four pre-service

educators chose Bank of America, while 10 chose Chase. The rationale for this choice stemmed from the mathematical point of view that less interest means more money not spent over the time of the loan. Only two considered a longer loan and the higher interest rate with BOA citing that it would either be a lower monthly payment and gives more ample time to save and pay the loan down with flexibility or they would not see themselves in the home for more than 5 years.

Table 11 was constructed to break down the correct calculation for their monthly mortgage to budget calculations. The mortgage is based on their bank loan choice and their net income below is used to divide the mortgage loan for their expected budget portion being paid into the mortgage loan.

Table 11

Calculations for Net Income to Mortgage Ratio

Participant	Monthly Loan	Net Income	Participant %	Correct %	Error
10	$8,271.24	$3,290	251%	251%	0%
12	$406.71	$428	13%	95%	82%
13	$11,787.44	$4,481	N/A	263%	NA

Ten pre-service educators out of the 14 were within 2% of the correct calculation for their budget. Based on the pre-service teachers calculated responses, the answer to whether or not now was the best time to purchase a home was a resounding yes, with three stating no and 11 stating yes based on the information. Pre-service educators 12 and 13 said it was a good time to buy, however participant 13 was unable to compute their monthly budget to a mortgage ratio and participant 12 was incorrect by 82%. Participant

8 had plenty of money in the budget but said no due to other factors not related to money and participant 10 said no due to calculating a 250% over budget ratio. Overall, several pre-service educators had struggled in different areas with either budget or discernment on a finite ratio that would be sufficient for their budget to purchase the desired home.

The final part of the PFL project was a simulation on credit card debt. Pre-service educators were given a scenario where they had to take a $3000 loan out on a credit card. The two options were Visa with a 25% interest rate and Mastercard with a 15% interest rate. Selected pre-service educators then filled in their results when calculating months to pay off debt, amount of interest paid, and final price paid in total and these amounts are shown in Table 12.

Table 12

Credit Card Calculations

Participant	Visa			Master Card		
	Months to Pay Off	Interest Paid	Final Amount Paid	Months to Pay Off	Interest Paid	Final Price
7	30	$750	$3,700	60	$450	$3,450
13	48	$56.85	$1,756.85	112	$29.76	$2,579.76

Pre-service educators overall had the correct answers dependent on the selected months to pay off debt and were provided a link to utilize in helping them calculate their payments. Participant 13 had a different answer despite the rest of the sample that selected the same amount of time to pay off debt. This may have resulted from incorrectly calculating interest into their monthly finance charge. Table 13 shows the decision of which card they selected, the percentage of monthly net income, and a

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problem that pre-service educators were required to solve for selected pre-service

teachers. Next month's bill in column five refers to the answer to the following question

by Meador and Matteson (2021): "With $575.34 as a balance, with $85 paid this month,

if this card has an annual percentage rate of 20% what is the finance charge on next

month's bill?"

Table 13

Credit Card Scenario

Participant	Card	Percent of Budget	Credit Problem	Next Month's Bill?
7	Mastercard	1%	$17	$102
8	Mastercard	1%	$40.19	$530.53
13	Visa	37%	$40.19	$535.15

Results showed that six pre-service educators selected Mastercard while eight

choose Visa. Overall pre-service educators had selected lower interest payments for cars

and houses. Though they were willing to choose higher interest on credit card, along with

the higher monthly payment, even if it meant more accumulation of debt. Table 14 was

constructed to compare selected pre-service teachers' answers to the correct answer.

Table 14

Credit Card Answers vs. Correct Answers

Participant	Participant Finance Charge	Next Bill	Percent Away on Charge	Percent Away From Next Bill
2	$98.07	$588.41	-1100%	-18%
10	$588.41	$588.41	-7102%	-18%

The mean finance charge was calculated to be $75 when the correct answer was

$8.17. The mean for next month's balance was calculated to be $490 when the correct

answer was $498.51. Overall, pre-service educators did well with perceiving the next

month's bill, however the results show only three pre-service educators understood the

increase in the finance charge for the next month.

The final part of the project had participants reflect and give replies to how this

PFL project impacted their overall understanding of personal finances. Table 15 displays

selected participant responses.

Table 15

Impact

Participant	Describe Project Impact:
1	I've never done a project like this and I think it was a good experience to have to see the different options there are.
2	Calculating all the expenses after my net income really shows me what I can and can't afford. Learning the difference between gross and net income helps me to see my real take home pay. I have learned the importance of budgeting and saving for the future.
3	I have learned that interest is getting so high each month as you pay off your debt. So, the best way to get a loan is to make sure you do a research and find the best credit card and with a low interest. Try to save money and pay off as fast as you can because the interest cost a lot.
4	It forced me into real life situations, and I had to make choices and do research that is vital in succeeding in life. The mathematics aspect helped me put into perspective how interest and percentages apply to my life now. I was also able to practice problem solving strategies such as guess and check.

The responses show an increased impact and understanding of the importance of percentages and interest. Also, the budget portion of the project showed to be helpful in understanding where their money is being spent and what is truly affordable, while also planning for the future. Even though many did not accurately calculate their true budget, they learned the importance and power of understanding compound interest and selecting the best rate on a loan. Participants also saw value in tracking a budget when expensing from their income stream. Overall participants' replies suggested they gained better understanding of PFL content through exposure provided to them.

CHAPTER VI DISCUSSION

After reviewing the results, the assertion made is that pre-service teachers know little about each given standard in regard to personal financial literacy. Participants struggled on concepts involving fractions and percentages. There are several pre-service educators in this project who, if a numerical problem is set in front of them, could solve a fraction or percentage problem. However, when the problem is applied and terms such as interest, deduction, and time are introduced, pre-service educators displayed a disconnect with the ability to approach the phrase and write out a procedural formula for the given question. With help of technology and embedded tools, participants were better equipped to solve compound interest problems and car loan payment problems. An example of this was found when pre-service educators in this study were asked to calculate the credit card new monthly payment after a portion is paid down. More than half of the pre-service educators did not answer this correctly. Then compared to calculating home loans in comparison to their overall budget, with the aid of technology, 10 of the 14 calculated correctly. Pre-service educators were asked about compound interest and to find the total amount accrued after a given amount of time passed with a return rate of 6% annually. Out of the 14 sampled, seven pre-service educators were within an accurate accrual amount. This a result of rationalizing and reasoning through exponential growth models. Pre-service educators without this context for an exponential growth problem would have

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a hard time problem solving a situation in which they were never given the proper tools to solve. Technology in the form of an online calculator was given to help assess their final amount of savings when their original principal amount accrued interest. This shows technology helps assist pre-service educators when given more complex PFL calculations to problem solve.

This PFL project can be considered a solution to fulfilling the need of what preservice educators must know for their financial benefit. 90% of educators felt that teachers need to be prepared to teach financial literacy, as long as there were state guided curricular standards (Lucy & Henning 2018). As stated previously in the literature review, Lucy and Henning (2018) deem financial literacy as a fundamental life skill and recognize faculty and preservice educators know little about the content. They encourage further investigative reports and brainstorming stratagems for improving PFL for future pre-service educators.

When looking through the final section of participant impact, the sample of participants had an overall consensus that they learned while they went through the PFL project and adapted to what they did not know. Pre-service educators also acknowledged the necessity of PFL knowledge for the future. The PFL project may not be considered the ultimate solution to learning all six principles of earning income, buying goods and services, saving, investing, credit, and tax and insurance. However, it can begin to provide understanding to pre-service educators' future projects. Based on knowledge of the PFL project, and can be augmented by more complex topics such as insurance. Insurance was a standard in this project that was only addressed as a fixed deduction

from gross monthly income. Other factors to consider, under the standard of insurance, include buying for home, life, car, and dependents' insurance plans. This would be an area to expand on to further deepen participants' understanding of basic insurance plans. A project can be developed revolving around the standard of insurance that would encourage researching multiple insurance plans, how to cover dependents, and making the right choice for a person's given life circumstances.

In regards to the age demographic, 11 of the 14 participants fell under the age bracket of Generation Z and one participant was classified as Generation X. There are some observable results found in the table from the outlier in the age sampled. The Generation X participant, is disclosed as participant 2 and it was notable that this participant was the only one to correctly calculate net income. This correlates to the longevity of career and having more exposure to balancing income after tax and retirement deductions as opposed to Generation Z participants who have not been as involved in the labor force due to age and in the near future will be the next dominant labor force. Participant 2 scored well on calculating a 5% raise calculation, monthly car payments, and how that affected overall budget compared to other participants. The only concern from participant 2 is managing credit with miscalculating finance charges on the monthly credit card statements by over 1100%. This was the highest miscalculation out of the other participants.

One key finding in the results was in analyzing all aspects of the participants' answers, which led to discover significant holes in participant learning. Topics included in the PFL project contained many tasks to resolve and pre-service educators' answers

would be calculated based on their previous findings. For example, pre-service educators were asked to calculate a car payment and how that affects their overall budget. Results were analyzed to take their answer from monthly car payment, net monthly income, and compared for how that payment affects their budget. Results showed that pre-service educators would still be wrong not only in the car payment part of their answer, but in the proceeding answer for overall budget as well, even if they had been correct on their car payment evaluation. The method in analyzing this type of data was to show holes in participant calculations for finding the correct car payment, monthly net income, and ability to determine how their car payment impacted their overall budget. The premise for this observation in participant data is to show how ratios were miscalculated and can be further introduced in future PFL projects. The ratio of a car payment expense out of the total income monthly was the target calculation that can be introduced in prior classes or re-enforced in PFL projects for pre-service educators.

Errors occurred in calculating exponents in relation to time and interest, calculating a raise, and in deductions in taxes. Pre-service educators overall showed a better understanding of salary and deductions in salary, but not in monthly gross and net income deductions. In support of this claim, nine out of the 14 subjects correctly calculated their salary's 5% raise. Only one participant correctly calculated the 5% increase in gross monthly income and one participant did so for net monthly income. Procedurally, nine out of 14 is not a high percentage to calculate an increase in income when a problem like this could be seen in elementary school. The problem lies in not knowing the proper mathematical procedure for the given problem. For example, in order

to calculate interest and then add it to the original value, a participant would need to recognize the value in conversions from a percentage to decimal. A 5% raise results in converting the percent to a decimal value of .05, then adding that to one, which totals to 1.05, or 105%. This 1.05 value would then be multiplied by the original principal in the problem. Any further 5% raise for future use would be related to exponential growth such as two years of 5% raises converted to 1.05 raised to the second power. From a conceptual standpoint, gross and net income can be differentiated by pre and post deductions from monthly income. However, only one pre-service teacher in the sample is able to comprehend this particular concept. This is more of a context and lack of knowledge issue than a mathematical procedure mishap.

This project shows the necessity behind researching and reevaluating the need for applied percentage increase problems, income and revenue story problems, exponential growth models, and applied interest scenarios. All of these may be experienced in a student's career of primary education; however, a child's understanding is not necessarily applied if they have no need for this until post-graduation. There is a need for PFL in both K-12 instruction and at the undergraduate level in order to formally integrate and embed the success of pre-service educators' ability to apply these problems in their own finances. Overall, there is much more to learn when it comes to holes in pre-service educators' learning and curriculum to be both developed and tested in order to build the foundation for PFL knowledge. However, this project illustrates the importance of how disconnected pre-service educators are from the real-world math application that will better their overall financial health and prosperous decisions.

CHAPTER VII IMPLICATIONS, LIMITATIONS, AND CONCLUSION

The overall implications of this project led to more questions than answers. Additional studies should be implemented in order to further the mission of PFL. For example, pre-service educators demonstrated multiple disconnects in various applicable math problems. This suggests a need for inclusion of mathematics curricula weaved into the K-12 education system. "We encourage further study into efforts to integrate financial education into teacher education curricula and strategies for improving the financial literacy of our teacher education faculty and children's teachers" (Lucy & Henning, 2018, p.171). This better navigates student-led problem solving and integration of feedback into pre-service educator work. This project helped pinpoint specifically where pre-service educator improvement might begin in leading to better financial maturity for when they graduate college.

Future studies can help with the limitations found in this project. One limitation in this study is the sample size of the study. The sample found in this project would not represent the behavior modeled by the current population of pre-service educators in the United States. Future researchers should conduct a new study where all pre-service educators from a university are asked to go through this specific project. This is to see if results are comparable, in order to more accurately make claims and assertions about a population size. Future studies can be conducted by having two groups where one is

applied a treatment to the project. Meaning one class can receive examples with explanations before asking pre-service educators to fill out the PFL project, and another class goes in with little to no instruction. Another study can require pre-service educators to fill out the project and then be asked several years down the road regarding the impact the project has and where they may have modeled the project in applicable ways throughout their life.

Other studies can be conducted where applied mathematics projects are given in a math course and compared to other non-math major classes to see if understanding of mathematic concepts is shown to be useful regarding applied financial analysis. "Math teachers do express more confidence in teaching savings and investment, which may reflect the relevance of some savings and investment concepts (e.g., interest compounding) to mathematical competency" (Way & Holden, 2009, p. 70). Another recommended study can be conducted on each generation to find out what they know about PFL. In this sample there was one participant from Generation X, while all other pre-service educators were Generation Z. Future projects, like the one created in this thesis can survey each age demographic to compare if knowledge and life experience have helped refine PFL knowledge. Overall, these participants help answer the questions raised from this project and help examine what limited the project from going further. There can be more improvements made to educate pre-service educators with applied mathematical problems from an early age and re-introduce these concepts in the undergraduate level credential programs for pre-service educators.

Participants were given a potential solution to their limited insight of PFL through the project literature simulation where they went through each of the six key standards of PFL. Proper resources such as technological or literature simulations that enforce decision making and mathematical calculations will help deepen further understanding. Pre-service educator impact answers from participants backs this claim. Overall, the comments on the pre-service educator impact section said they felt enlightened on the effect that loans and compound interest has on their budget and future investing opportunities. Reinforcement from knowledgeable educators will encourage an enriched pedagogy that can be passed to future pre-service educators and generations that will follow. This is done in order to better prepare them for the life lived filled with applied mathematics in their everyday personal financial world.

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