WAMC Lab Template

Math Concept(s): Future Value
Source / Text: Financial Algebra (new book: 2-7; old book: 3-7)
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The following documents are at the end of this lab:

- Lab Instructions / Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

- Classroom setting: access to technology (chromebook, desmos, graphing calculators) as needed.
- Students will be asked to identify what is the most important factor to growing wealth for the future: time, periodic investment (students need to discuss and define this term) or growth rate. The will unpack the formula and work together to understand how to use and apply it. Students will be responsible for their own learning and practice, but then work together in triads to develop a group belief on the most important factor. They will create spreadsheets and graphs, which they will interpret in context. Students will create a poster or PowerPoint presentation sharing their findings with the class and a financial advisor. The financial advisor will help determine the most articulate and accurate presentation for a reward (shhh—that's a surprise to the kids) and also share some of her/his thoughts on financial planning, the time value of money, and managing growth investments.

Lab Plan

Lab Title: I'm gonna be rich!

Prerequisite skills:
Prior knowledge of compound interest, arithmetic operations, exponents, use of a calculator, previously developed rubric for presentations, PowerPoint, spreadsheets

Lab objective:

- Calculate the future value of periodic deposit investment
- Graph the future value of function
- Interpret the graph of a future value function

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*
Mathematics K–12 Learning Standards:
Seeing Structure in Expressions A-SSE
Interpret the structure of expressions

1. Interpret expressions that represent a quantity in terms of its context.★
a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P*(1+*r*)^n *as the product of P and a factor not depending on P.*

Interpreting Functions F-IF
Understand the concept of a function and use function notation
1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).
2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
Analyze functions using different representations
7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Linear, Quadratic, and Exponential Models F-LE
Interpret expressions for functions in terms of the situation they model
5. Interpret the parameters in a linear or exponential function in terms of a context.

Standards for Mathematical Practice:
Practice 1: Make sense of problems and persevere in solving them.
Practice 2: Reason abstractly and quantitatively.
Practice 3: Construct viable arguments and critique the reasoning of others.
Practice 4: Model with mathematics.
Practice 5: Use appropriate tools strategically.
Practice 6: Attend to precision.
Practice 7: Look for and make use of structure
Practice 8: Look for and express regularity in repeated reasoning.

Washington English Language Arts Standards (Common Core State Standards) - Science and Technology Literacy Standards (Grades 11-12):

- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Educational Technology:

- 3.d Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

- ☐ Global Awareness
- ☒ Financial/Economic/Business/Entrepreneurial Literacy
- ☐ Civic Literacy
- ☐ Health/Safety Literacy
- ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION

Creativity and Innovation
- ☐ Think Creatively
- ☐ Work Creatively with Others
- ☐ Implement Innovations

Critical Thinking and Problem Solving
- ☒ Reason Effectively
- ☐ Use Systems Thinking
- ☐ Make Judgments and Decisions
- ☒ Solve Problems

Communication and Collaboration
- ☒ Communicate Clearly
- ☒ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
- ☐ Access and Evaluate Information
- ☐ Use and manage Information

Media Literacy
- ☐ Analyze Media
- ☐ Create Media Products

Information, Communications and Technology (ICT Literacy)
- ☒ Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability
- ☒ Adapt to Change
- ☐ Be Flexible

Initiative and Self-Direction
- ☐ Manage Goals and Time
- ☐ Work Independently
- ☐ Be Self-Directed Learners

Social and Cross-Cultural
- ☒ Interact Effectively with Others
- ☐ Work Effectively in Diverse Teams

Productivity and Accountability
- ☒ Manage Projects
- ☒ Produce Results

Leadership and Responsibility
- ☐ Guide and Lead Others
- ☒ Be Responsible to Others

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Calculators, Chromebooks, poster paper/materials, envelopes with variable info

Set-Up Required:

- Organize the "luck of the draw" slips into appropriate envelopes; have poster materials and space available for groups to work. Contact guest speaker, facilitate needs as requested

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Please see highlighted skills above

Cooperative Learning:

- Students will work in large groups and triads

Expectations:

Students are expected to be good team members (positive and supportive language, respectful interactions, focused and on-task, supportive of each other, communicate professionally, seek out support within and beyond the team as needed) as well as self-directed learners to complete their own responsibilities as defined by the group.

Timeline: 3(ish) days + 1 day (guest speaker if possible)

- Day 1: Introduce the concept, have students make a prediction, create triads and explore the formula
- Day 2: Calculations and spreadsheets, group discovery
- Day 3: Posters/presentations
- Day 4: Guest speaker (financial advisory) addressing the time-value of money, the power of investing, and the reality of finding the interest rates we used

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Time-value of money, reality of finding investments with appropriate growth rates, feasibility of consistent period contributions (could those contributions change with life events?), learning the language of personal investing and finding an advisor whom you can trust

Career Applications

- Business, Personal Finance, Investing, Wealth Management, Banking

Optional or Extension Activities

- Compare/Contrast other methods of compounding interest on investments
- Students could tie into a mutual fund lesson and do research on realistic growth rates for mutual funds instead of being given arbitrary rates. Students could interview people in their life, asking when they hope to retire and how much money the predict will be needed. A future value calculation could be completed to determine if they will reach that goal using a current market growth rate on mutual funds.

I'm Gonna Be Rich!
Exploring Future Value

Name:
Date:
Period:
Triad Partners (Doubles Partner if needed):

Making Predictions:

- Everyone wants to be rich, right? What do you believe is the most important factor to developing monetary wealth: time, rate of growth, or periodic investment.

- What do those terms mean to you?
  - Time:
  - Rate of growth?
  - Periodic investment?

- Share and compare your ideas with an elbow partner. Do you need to change your definitions or need clarification?

- Take your paper with you to the location in the room that represents time, rate of growth, or periodic investment. Share with the others in that location why you chose this factor. Take some notes on what others share—you might be sharing your large group's ideas with others!

- Number off so we create triads (one person in the group represents one of the three factors). Discuss what your large groups shared about the factor you chose. Have a discussion in your triad about the reasoning from your large groups. Take some notes! You might want to change your mind on the most important factor.

Unpacking the formula:

- Time to take a look at our future value formula in our triads. Please turn to p110. In your groups define each variable. Be prepared for a thumb check regarding what each variable represents and to share out with the class what you discussed.

B: P:

r: t: n:

- What do you notice about the formula? How is it different/similar to other formulas we have used? Why are there two 1's and why don't they cancel? Can we treat this as a function? If so, what would be the input?

- How can I "attack" this formula and make my calculator make sense of the order of operations? Can you "chunk" this formula into smaller, less overwhelming steps?

- Can I skip some of the parenthesis? Do I need more?

Formula Practice:

- Let's explore an application:
    - Tanner can budget $175 each month to contribute to a mutual fund that is expected to grow on average 7% annually. How much money will he have in the fund if he invests for 15 years? Do you have enough information to complete this problem? Assumptions to be made?

Testing our predictions:

- Time for luck of the draw—select a slip of paper from the envelope labeled with your preferred factor. Complete the calculations described and organize your findings in a spreadsheet. Create a graph (what will be x, what will be y?). Share your findings. Combine your data and display it graphically. Write a brief summary of what your findings (shared google document would be a great idea) are telling you about time, rate, and investment amount. Remember to be independent learners and good teammates when appropriate.

- What do you believe to be the most important factor impacting future growth of investments? Did you change your mind or confirm your original prediction? Be prepared to explain…

Presentation mode:

- You will now create a poster or PowerPoint to share your group findings and conclusion(s). You must include calculations and your interpretations of your graphs IN CONTEXT. Remember to use your technology, mathematical, and artistic skills as you prepare your poster and organize a presentation to the class.

Hear it from the expert:

- We will be welcoming a financial planner to sit in on our presentations and share with us her/his expertise in the time-value of money, the power of investing, and the reality of finding the interest rates we used. During the presentations, think of good questions to ask and feedback to share with the groups and our guest.

Feedback:

- What things went well in this activity? What do you wish you could change? What advice do you have for the next time I share this activity with students?
- Rate your performance as a team member: 1 2 3 4
- Rate your team's ability to work together effectively: 1 2 3 4
- What is the most important thing you will take away from this activity?
- Write a brief summary sharing what you learned with someone who knows nothing about investing, compound interest, and future value. For extra credit, teach someone what you learned and ask for their feedback on your mini-lesson.

Rubric (I am not including definitions of the point values—I prefer to have the students develop these as a class in prior activities. It helps develop norms, personal accountability, and a deep understanding of what's expected when we work together to develop the rubric. It changes each semester).

Communication	Independent learner
1 2 3 4	1 2 3 4
Supporting your team	Respecting other teams
1 2 3 4	1 2 3 4

Ability to stay on task
1 2 3 4

Accuracy of calculations
1 2 3 4

Group Presentation/Poster/PowerPoint
1 2 3 4

Attentiveness during other presentations
1 2 3 4

Active involvement with guest speaker
1 2 3 4

What I learned summary
1 2 3 4

Extra Credit: Feedback from your "student" after mini lesson
1 2 3 4

Extension:

Students will begin a research project in preparation for the investment and retirement units. Students will be asked to research both pre-tax and post-tax investment opportunities including, but not limited to, Roth IRA, Traditional IRA, 401K/403b, growth mutual funds, and standard savings accounts. Using career research from a previous unit, they will determine their ability to meet their financial retirement goals of $1,000,000 after 40 years of investing/saving. If they do not believe they will achieve their financial goals, they need to extend the career research project to a similar career in the same field with a higher earning potential or make adjustments to their budget to allow for a higher periodic contribution. This will impact their overarching budget project throughout the course, impacting investment contributions, savings, educational costs, etc.

Initially students will play "Build Your Stax" online (https://buildyourstax.com/), learning in real time about how to develop an investment portfolio using a variety of investment opportunities. Each opportunity is described and defined in a 20-minute online game. The goal is to earn as much money as possible using a variety of investment strategies while also dealing with random real-life "pop-up" scenarios which impact their financial situation. After completing the game, perhaps more than once to develop a better understanding of the different investment opportunities available, students will begin online research of the investment opportunities.

Through this game and research students will begin to develop an investment portfolio and take personal ownership to meet their needs and allocate 15% (or more if they choose or need) of their gross income to meet their financial retirement goal of $1,000,000. This is one of many pieces of a comprehensive course project connecting education, career pathways, income, investments, and budgets for a successful financial future. Below you will find activities and student materials to scaffold this project over several chapters. A game that works with students to build an investment plan to diversify investment opportunities can be found below.

- Career Research Template attached
- Investment Research Template attached
- Cash Flow Analysis Spreadsheet attached
- Stax Investment Game: https://buildyourstax.com/

Investment Research Template

Roth IRA

Pre-tax____ Post-tax____

Description of the fund

Pros/Cons of the fund/account?

Where/How does one open this fund/account?

Typical rate of return?

Sites used:

Traditional IRA

Pre-tax____ Post-tax____

Description of the fund

Pros/Cons of the fund/account?

Where/How does one open this fund/account?

Typical rate of return?

Sites used:

401K/403b

Pre-tax____ Post-tax____

Description of the fund

Pros/Cons of the fund/account?

Where/How does one open this fund/account?

Typical rate of return?

Sites used:

Growth Mutual Funds

Pre-tax____ Post-tax____

Description of the fund

Pros/Cons of the fund/account?

Where/How does one open this fund/account?

Typical rate of return?

Sites used:

Standard Savings Accounts

Pre-tax____ Post-tax____

Description of the fund

Pros/Cons of the fund/account?

Where/How does one open this fund/account?

Typical rate of return?

Sites used:

Other Investment Option(s)

Pre-tax____ Post-tax____

Description of the fund

Pros/Cons of the fund/account?

Where/How does one open this fund/account?

Typical rate of return?

Sites used:

Career Research Template

Name: Date: Period:

Career Researched:

Website Used:

1. What is the average salary for this career? Can I afford to live on this with a family?

2. What level of education, certification or training is necessary for this occupation? How much will that cost?

3. What does a typical day look like?

4. What excites me about this career? Why would I be passionate about it?

5. What personal strengths and weaknesses would this job show?

6. Is there room for growth and promotion?

Financial Algebra
Chapter 10, Section 4
Cash Flow Analysis Spreadsheet

Income	
Primary Employment	$34,600
Secondary Employment	$1,200
Other Income	$500
Total Income	**$36,300**

Fixed Expenses	
Rent/Mortgage	$600
Car Loan Payment	$300
Education Loan Payment	$300
Personal Loan Payment	$100
Health Insurance Premium	$150
Life Insurance premium	$0
Car Insurance Premium	$150
Homeowner's/Renter's Insurance	$0
Cable TV	$50
Total Fixed Expenses	**$1,650**

Variable Expenses	
Groceries (Food)	$800
Dining Out	$150
Fuel (Car)	$0
Cell Phone	$80
Land Line Phone	$0
Electricity	$40
Water	$0
Sewer	$0
Sanitation	$0
Medical	$0
Entertainment	$0
Savings	$500
Debt Reduction	$250
Other	$0
Total Variable Expenses	**$1,820**

Non-Monthly Expenses (per year)	
Medical/Dental	$300.00
Auto Related	$300.00
Home Related	$300.00
Life Insurance	$0.00
Tuition	$5,000.00
Vacation	$1,200.00
Gifts	$0.00
Contributions	$0.00
Repairs	$0.00
Taxes	$2,000.00
Other	$0.00
Total Non-Monthly Expenses (per year)	**$9,100.00**
Total Non-Monthly Expenses (per month)	**$758.33**
Total Expenses	**$4,228.33**
Monthly Cash Flow	**($1,203.33)**

TEST QUESTIONS	
a.) Total Income	$36,300.00
b.) Total Fixed Expenses	$1,650
c.) Total Variable Expenses	$1,820
d.) Total non-monthly expenses	$9,100.00
e.) Average non-monthly expenses	$758.33
f.) Total Expenses	$4,228.33
g.) Monthly Cash Flow	($1,203.33)

Primary Employment	$29,700
Secondary Employment	$3,700
Other Income	$2,150
Rent/Mortgage	$700
Car Loan Payment	$250
Education Loan Payment	$400
Personal Loan Payment	$125
Health Insurance Premium	$150
Car Insurance Premium	$140
Cable TV	$65
Groceries (Food)	$750
Fuel (Car)	$275
Cell Phone	$80
Electricity	$40
Savings	$445
Debt Reduction	$110
Medical/Dental	$175.00
Auto Related	$140.00
Home Related	$100.00
Tuition	$2,000.00
Vacation	$1,200.00
Taxes	$315.00

Years	Rate	Periodic Investment	Years	Rate	Periodic Investment	Years
10	4%	$ 100.00	20	4%	$ 100.00	30
10	6%	$ 100.00	20	6%	$ 100.00	30
10	8%	$ 100.00	20	8%	$ 100.00	30
10	10%	$ 100.00	20	10%	$ 100.00	30
10	4%	$ 150.00	20	4%	$ 150.00	30
10	6%	$ 150.00	20	6%	$ 150.00	30
10	8%	$ 150.00	20	8%	$ 150.00	30
10	10%	$ 150.00	20	10%	$ 150.00	30
10	4%	$ 200.00	20	4%	$ 200.00	30
10	6%	$ 200.00	20	6%	$ 200.00	30
10	8%	$ 200.00	20	8%	$ 200.00	30
10	10%	$ 200.00	20	10%	$ 200.00	30
10	4%	$ 250.00	20	4%	$ 250.00	30
10	6%	$ 250.00	20	6%	$ 250.00	30
10	8%	$ 250.00	20	8%	$ 250.00	30
10	10%	$ 250.00	20	10%	$ 250.00	30

Rate	Periodic Investment	Years	Rate	Periodic Investment
4%	$ 100.00	40	4%	$ 100.00
6%	$ 100.00	40	6%	$ 100.00
8%	$ 100.00	40	8%	$ 100.00
10%	$ 100.00	40	10%	$ 100.00
4%	$ 150.00	40	4%	$ 150.00
6%	$ 150.00	40	6%	$ 150.00
8%	$ 150.00	40	8%	$ 150.00
10%	$ 150.00	40	10%	$ 150.00
4%	$ 200.00	40	4%	$ 200.00
6%	$ 200.00	40	6%	$ 200.00
8%	$ 200.00	40	8%	$ 200.00
10%	$ 200.00	40	10%	$ 200.00
4%	$ 250.00	40	4%	$ 250.00
6%	$ 250.00	40	6%	$ 250.00
8%	$ 250.00	40	8%	$ 250.00
10%	$ 250.00	40	10%	$ 250.00

Years	Rate	Periodic Investment	Years	Rate	Periodic Investment	Years
10	6%	$ 100.00	20	6%	$ 100.00	30
10	8%	$ 100.00	20	8%	$ 100.00	30
10	10%	$ 100.00	20	10%	$ 100.00	30
10	6%	$ 150.00	20	6%	$ 150.00	30
10	8%	$ 150.00	20	8%	$ 150.00	30
10	10%	$ 150.00	20	10%	$ 150.00	30
10	6%	$ 200.00	20	6%	$ 200.00	30
10	8%	$ 200.00	20	8%	$ 200.00	30
10	10%	$ 200.00	20	10%	$ 200.00	30
10	6%	$ 250.00	20	6%	$ 250.00	30
10	8%	$ 250.00	20	8%	$ 250.00	30
10	10%	$ 250.00	20	10%	$ 250.00	30

Rate	Periodic Investment	Years	Rate	Periodic Investment
6%	$ 100.00	40	6%	$ 100.00
8%	$ 100.00	40	8%	$ 100.00
10%	$ 100.00	40	10%	$ 100.00
6%	$ 150.00	40	6%	$ 150.00
8%	$ 150.00	40	8%	$ 150.00
10%	$ 150.00	40	10%	$ 150.00
6%	$ 200.00	40	6%	$ 200.00
8%	$ 200.00	40	8%	$ 200.00
10%	$ 200.00	40	10%	$ 200.00
6%	$ 250.00	40	6%	$ 250.00
8%	$ 250.00	40	8%	$ 250.00
10%	$ 250.00	40	10%	$ 250.00