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Credit Card Interest Curriculum for Algebra 1 and Algebra 2

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Credit Card Interest Curriculum for Algebra 1 and Algebra 2

Agnieszka Wallace

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Abstract

This curriculum project was designed to support teachers to implement credit card interest literacy into the Algebra 1 and Algebra 2 curriculum and was created by a second career teacher from the financial field. Financial mistakes made early in life can have serious implications and could be very costly. Studies show that less than one-third of young adults understand the concept of compound interest. This curriculum project includes compound interest algebra topics connected to financial applications of credit card interest.

**Keywords:** Financial Literacy, Financial Education, Credit Card Interest, Compound Interest
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Credit Card Interest Curriculum for Algebra 1 and Algebra 2

Introduction

In today’s demanding financial environment, we are confronted with complicated financial decisions at a young age. Financial literacy is a critical component in making good financial decisions. Financial mistakes made early in life can have serious implications and could be very costly (Lusardi & Mitchell, 2014). Less than one-third of young adults have basic knowledge of interest rates, inflation, and risk diversification (Lusardi, Mitchell, & Curto 2009). Research shows that people with low financial literacy will hinder their ability to accumulate wealth because they are more likely to struggle with debt. Studies show that many borrowers do not know what interest rates are being charged on their mortgages or credit cards (Lusardi & Mitchell, 2014). Ignorance about basic financial concepts directly affects behavior and decision making and as a result can negatively affect individual well-being (Lusardi, 2015).

Research suggests that personal finance should be integrated into math education. There are many opportunities to meet financial literacy goals in a mathematics classroom (Crawford-Ferre et al., 2016). Optimal financial decisions rely on the ability to analyze costs and benefits. Cole et al. (2015) claim there is a direct link between financial literacy and mathematics skills. Many “underestimate the speed at which compound interest accumulates, and that those who make the biggest mistakes borrow the most” (p. 4). Based on this research, this curriculum project will focus on developing compound interest knowledge, specifically credit card interest, in Algebra 1 and Algebra 2 mathematics education.

Financial education needs to connect and engage students to important personal finance concepts and decisions that have long term implications. That is why it is important to fill those gaps by modeling financial literacy and reality (Lusardi & Mitchell, 2014). According to
Crawford-Ferre, Wiest, and Vega (2016), providing students with real-world experience in their mathematics classrooms can increase their financial literacy skills.

**Vocabulary and Definitions**

- **Annual Fee** - A once-yearly charge for having a credit card. Cards with annual fees usually have a lower interest rate.
- **Annual percentage rate (APR)** - This is the annual interest rate you will be charged if you carry balances on your credit card.
- **Balance transfer** - A transfer of debt from one credit card to another, usually for a fee.
- **Credit line** - A credit line or limit is the amount of money the card issuer will let you borrow.
- **Due date** - The is the day your payment is due. After the due date, you may be assessed a late payment fee.
- **Finance charge** - A finance charge is the total cost of borrowing, including interest and fees.
- **Grace period** - The grace period is the time during which you are allowed to pay your bill without incurring a late fee.
- **Minimum finance charge** - This is the minimum amount of interest you will be charged if you don't pay the balance in full.
- **Minimum payment** - The minimum payment is the lowest amount of money required to satisfy a current bill.
- **Over-the-limit fee** - This fee can be charged when your balance goes over your credit limit.
- **Periodic Rate** - APR expressed over a (shorter) period of time.
• Variable interest rate - With variable-rate cards, your APR can change with the prime rate

**Purpose Statement**

The purpose of this curriculum project is to provide credit card compound interest lessons designed to support teachers as they seek to engage students in contextual and real-life scenarios. The focus on financial literacy within the curriculum brings concepts critical for understanding compound interest to the forefront of mathematical problem solving. Such learning opportunities can support teachers as they work to help students better understand the challenges and consequences of financial decisions.

**Literature Review**

**Problem**

In today’s demanding financial environment, we are confronted with complicated financial decisions at a young age. Financial literacy is a critical component in making good financial decisions. Financial mistakes made early in life can have serious implications and could be very costly. Lusardi and Mitchell (2014) define financial literacy as “people’s ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions” (p.6).

A study by Lusardi, Mitchell, and Curto (2009) showed that financial literacy among young people is very low. Less than one-third of young adults have basic knowledge of interest rates, inflation, and risk diversification. Although, it is important to note their findings showed an evident relationship to sociodemographic and family financial dispositions as well as cognitive abilities. Research shows that people with low financial literacy will hinder their ability to accumulate wealth because they are more likely to struggle with debt. Other factors being less likely to participate in the stock market, choose mutual funds with lower fees, and plan for
Studies show that between 1997 and 2007 the average undergraduate student loan debt rose by 58% (including inflation) and credit card debt rose by 74%. According to Lusardi et al. (2009), the US Senate Committee on Banking, Housing, and Urban Affairs reported in 2002 that high levels of debt are preventing young workers from taking advantage of employer provided pensions, 401K’s and Ira’s.

Cost of Financial Ignorance

Lusardi and Mitchell (2014) define the ‘cost of financial ignorance’ as “transaction costs incurred by less informed Americans and the component of these costs related to the lack of financial knowledge” (p. 24). Financial ignorance, also linked to ‘debt literacy’, includes incurring credit card fees, late payment bills, going over credit limits, taking out cash advances, and paying only the minimum payment. Lusardi and Mitchell (2014) concluded that people who lacked financial literacy skills were substantially more likely to use high cost methods of borrowing listed above, especially young adults. Their studies found that only one-third of population knew how long it would take for debt to double if one were to borrow at a 20 percent interest rate. This lack of knowledge confirms assumptions that failing to understand compound interest along with the terms and conditions of consumer loans and mortgages can have costly consequences. This topic became an area of concern during financial crisis in 2009 as many mortgage defaults suggested that debt management was the issue. Studies showed that many borrowers did not know what interest rates were being charged on their mortgages or credit cards (Lusardi & Mitchell, 2014). Ignorance about basic financial concepts directly affects behavior and decision making and as a result can negatively affect individual well-being. As the demand for individuals to become increasingly responsibility for their own security and confronted with
more complex financial situations, it is crucial for people to be well equipped with at least basic financial concepts (Lusardi, 2015).

**Measuring Financial Literacy**

Many researchers have used the following three questions designed by Lusardi and Mitchell (2008) to measure financial literacy. These questions have been used in several surveys in the United States as well as national surveys in other countries all yielding very similar results. The results listed below are from a study by Lusardi and Mitchell ‘Comparative Statistics of Responses to Financial Literacy Questions Around the World’ (Lusardi & Mitchell, 2014). The first question measures numeracy, or the capacity to do a simple calculation related to compounding of interest rates.

*Numeracy/knowledge of interest compounding*

1. Suppose you had US$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: (more than US$102, exactly US$102, less than US$102? Do not know (DK). Refuse to answer.)

The second question measures understanding of inflation, again in the context of a simple financial decision.

*Knowledge of inflation*

2. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy: (more than, exactly the same as, or less than today with the money in this account? DK. Refuse to answer.)
The third test of knowledge about "stocks" and "stock mutual funds" and of risk diversification, since the answer to this question depends on knowing what a stock is and that a mutual fund is composed of many stocks.

**Knowledge of risk diversification**

3. Do you think that the following statement is true or false? “Buying a single company stock usually provides a safer return than a stock mutual fund.” (DK. Refuse to answer.)

The results of the study showed that few people across all countries could correctly answer all three basic financial literacy questions. In the United States, only 30% of people could answer all three questions correctly. Based on these results, it seems that the low levels of financial literacy found in the United States are also widespread throughout the world. The concept that people seemed to have the most difficulty understanding is risk diversification. A very high percentage of people responded that they 'do not know' the answer to the risk diversification question (Lusardi & Mitchell, 2014). According to more recent data from the 2009 National Financial Capability Study (NFCS), which surveyed a representative sample of the US population, results were similar. Several other studies confirm these findings. One of the first studies measuring financial literacy by Bernheim (1995) stressed that most individuals lack basic financial knowledge and numeracy. Lusardi and Tufano (2009) reported that most respondents in a representative sample of US households have limited debt literacy (Lusardi, 2015). According to Lusardi (2015), most of the US population cannot perform simple calculations and do not understand basic financial concepts such as interest compounding and risk diversification.
Further research suggests that knowledge of more complex concepts is even rarer. Concepts such as the difference between bonds and stocks, mutual funds, and basic asset pricing.

Measuring high school student’s financial literacy around the world has recently been taken up by the OECD’s Programmed for International Student Assessment (PISA). In 2012, a module on financial literacy was added to its review of proficiency in mathematics, science, and reading. In so doing, PISA has taken the position that financial literacy should be recognized as a skill essential for participation in today’s economy (Lusardi & Mitchell, 2013).

**Argument for the need for financial education in school**

“Financial literacy impacts financial decision making, with implications that apply to individuals, communities, countries, and society as a whole. Given the lack of financial literacy among the population, it may be important to remedy it by adding financial literacy to the school curriculum” (Lusardi, 2015, p.261).

According to a 2009 Sallie Mae survey, students expressed they wished they had more financial knowledge. 84% of students said they needed more education on financial management topics, 64% would have liked to receive information about financial management topics in high school and 40% would have liked to receive such information as college freshmen (Lusardi et al., 2009). Research by Lusardi et al. (2009) validates the need for financial education curriculum in high schools. Providing financial education in high schools will be beneficial to those students whose parents or family members are not financially knowledgeable. And most importantly, financial literacy education in high schools will expose students to financial scenarios and options before they must make their own financial decisions. Therefore, it is crucial to improve the effectiveness of financial literacy programs currently offered in high school. It is important to consider, since a large portion of the population does not have basic financial knowledge, we
cannot assume that short exposure to financial literacy education will fill those knowledge gaps. Financial decisions today are increasingly personalized as compared to the past. Individuals are required to make decisions in the context of much more complex financial markets and financial products. In the US, the cost of college education has been increasing at a faster rate than inflation. Families need to start planning for college sooner than before, need to be wise about financial aid, and need to manage student loans efficiently (Lusardi, 2015). That’s is why it is important to fill those gaps by modeling financial literacy and reality. Financial education needs to connect and engage students to important personal finance concepts and decisions that they can relate to and over a longer period of time (Lusardi & Mitchell, 2014).

Theoretical Perspective

Zone of Proximal Development (ZPD) can support how students learn and process mathematics required for financial education. According to Baumann and Hall (2012), the framework for financial education should be learner-oriented and characterized as an ongoing lifelong process known as financial erudition. Financial erudition can be shaped by the theoretical perspective supported by ZPD. The goal is to support the individual in their present as well as in the future financial well-being (Baumann & Hall, 2012). Technology has the potential to play a formative role in enhancing financial education and can support the learner effectively according to their respective needs throughout their lifetime (as cited in Baumann & Hall, 2012, p. 512). Financial erudition extends beyond financial literacy and entails deep and critical engagement of sensible living (as cited in Baumann & Hall, 2012, p. 512).

Financial Literacy Curriculum and Real-World Experience

Harold Rugg’s 1920 presidential address emphasized the most pressing questions in organizing curriculum is determining the content of the course. “The inherent difficulty in
determining what is to be taught is probably the reason why the AERA presidents never seemed to take up the curriculum as the central focus of the presidential address” (Ladson-Billings, 2016, p. 104). Rugg believed curriculum should include problems of contemporary life as well as social and political laws and models of living. He stressed the curriculum committees needed to reorganize the curriculum in more innovative ways and apply experimental methods of thinking.

Maxine Greene’s 1982 address called Public Education and the Public Space. According to the author, she expressed concerns regarding whether or not the curriculum is tied to the relevance of the students’ real lives. Curriculum imagination is a possible solution to the lack of active engagement in our schools. Crafting and processing images in students’ minds will lead to discovery and deeper understanding. Without imagination, the ability to understand issues and ideas as well as exploring new perspectives is inhibited. A curriculum should be created in a similar fashion, it should be “shaped by how is it represented and experienced” (Ladson-Billings, 2016, p. 104). The authors research suggests it is impossible to have a uniform curriculum for everyone. For example, urban schools, elite private schools, and specialty schools all have different needs. As social issues are constantly changing, curriculum should reflect and incorporate these changes.

According to Crawford-Ferre, Wiest, and Vega (2016), providing students with real-world experience in their mathematics classrooms can increase their financial literacy skills. The authors suggested numerous personal financial literacy tasks to increase “the skills and knowledge on financial matters to confidently take effective action that best fulfills an individual’s personal, family and global community goals” (as cited in Crawford-Ferre et al., 2016, p.79).
Optimal financial decisions rely on the ability to analyze costs and benefits. Cole et al. (2015) states, “our findings suggest that increasing math requirements would be a more effective way to improve financial outcomes” (p. 36). There is a direct link between financial literacy and mathematics skills. Many “underestimate the speed at which compound interest accumulates, and that those who make the biggest mistakes borrow the most” (p. 4).

Other research suggests that personal finance should be integrated into math education (as cited in Crawford-Ferre et al., 2016, p.79). There are many opportunities to meet financial literacy goals in a mathematics classroom. “The skill sets overlap as students learn to make sense of quantities and their relationships in problem situations, to reason inductively about data, and to apply the mathematics they know to solve problems in everyday life, society, and the workplace” (Crawford-Ferre et al., 2016, p.80). Research conducted by Baumann and Hall (2012) showed that financial education should be included in mainstream curriculum and “form a core, intrinsic part of the curriculum explored within and across all disciplines and subjects” (p. 512).

Cirillo, Drake, Eisenmann, and Hirsch (2009) focused on how teachers use and adapt impersonal curriculum materials and provided suggestions regarding curriculum development, vision, and coherence that allows teachers to meet students’ needs, while at the same time teaching standards and objectives. One of the direct impacts of the accountability movement in education is that teachers rely heavily on mass produced curriculum materials provided by the state or district. Cirillo et al. stated these materials are impersonal and do not offer individual differentiation, which is necessary to make connections and promote deeper understanding. To address this, creating a curriculum vision was emphasized. “Teachers who manage the complex
task of attending to students’ needs as well as to standards and objectives should have a well-defined curriculum vision…” (Cirillo et al., 2009, p. 71).

Research by Beswick (2011) focused on the relationship between the effectiveness of context problems and their intended purpose to increase student participation, engagement, and achievement. The author discussed purposes for context problems, provided evidence in relation to each purpose, and problems likely to enhance participation, engagement, and achievement.

Beswick (2011) presented five purposes of context problems. First, meeting the economic needs of society which focuses on the ability to apply and transfer mathematical knowledge to everyday life. Developing this skill is far more complex than simply including context in problems. Second, using mathematics to improve students’ understanding of important issues. Third, improving students understanding of mathematical concepts. Realistic Mathematics Education (RME) suggests that mathematics “should be learned so as to be useful” (as cited in Beswick, 2011, p. 371). Familiar contexts have the potential to give meaning to the problem. Although, we need to consider that some students ignore context, while some focus on context but still fail to engage. Students perceptions, experience, and ways of communication all directly affect the connections they make with context. Contexts could be “potentially a bridge or a barrier in relation to transferring mathematical knowledge from school to the real world” (as cited in Beswick, 2011, p. 373). Tasks given to students should include a purpose, students’ perspectives on the reason to engage with the task and utility, appreciation of the usefulness of mathematical ideas. According to Beswick (2011), “…students should be given sufficient autonomy in their approach to a task that they can construct their own goals for the activity” (p. 378).
Crawford-Ferre et al., 2016 also stressed the importance on contextualization. *Compare services*, a personal financial literacy task, focused on proportional reasoning, equations, creating and analyzing graphs, and number sense. Comparing similar products or services requires evaluation and research. This task provides students with a real-world activity of considering contextual factors beyond numbers. “Real-world scenarios encourage students to apply mathematics beyond finding the “correct” answer in order to reason with the intent of making a defensible decision” (Crawford-Ferre et al., 2016, p.80). It is important to build background knowledge for students by structuring and monitoring instructional tasks. Teaching mathematics in the context of financial literacy can be aligned with grade-level content while teaching students real-world skills.

Marita and Hord (2016) research showed that problem based learning interventions, such as enhanced anchored instruction (EAI) allow students to learn through open-ended, real-world problem scenarios, where students take a hands-on approach to mathematics concepts. The study consisted of students receiving EAI instruction in addition to explicit teaching and the other group consisted of only EAI instruction for fraction computation. Although, both groups made progress, the students receiving explicit instruction scored higher on the computation skills, but conceptual understanding test results were the same for both groups (as cited in Marita & Hord, 2016, p. 8). The authors stated, “Higher levels of mathematical and technical skills are needed for most current jobs, and all students, including those with LD, must have sufficient skills to solve problems in challenging situations” (Marita and Hord, 2016, p. 2).

Baumann and Hall (2012) research suggested that financial outcomes are a result of the interaction between financial behavior and the environment. Financial education should be a combination of skill, knowledge, and attitude. “An acceptance of the principle that financial
education can influence behavior, and that this behavior then coupled with the environment influences financial outcomes, is key to recognizing the limits and the strengths of financial education” (as cited in Baumann & Hall, 2012, p. 512).

As personal financial situations change based on sociocultural and economic factors, so must the teaching. A fundamental part of learning is how a person learns and in what situation the learning is occurring. Learning to teach is a continuous process that requires re-contextualizing. Specifically, the ability to transfer resources and discourses based on specific situations (Peressini, Borko, Romagnano, Knuth, & Willis, 2004). Over the past couple of decades, there has been a notable decline in the participation in mathematics, trained mathematicians, and enrollments in mathematical study. Research shows that students are becoming disengaged during their middle years of schooling (Beswick, 2011). This early disengagement is speculated to be a result of not capturing students’ interests in contextual problems (Beswick, 2011). This identifies a need for specific pedagogy essential to reform-based teaching such as selection and use of mathematical tasks and mathematical discourse. For example, using student’s experiences and backgrounds to help make connections to real world applications and engaging students in oral and written discourse through active participation (Beswick, 2011).

**Implications for Teachers**

Many factors influence a teacher’s practices. A continuous reflection on curriculum vision enables teachers to adapt curriculum materials while meeting standards as well as students’ needs. Incorporating knowledge, beliefs, resources, vision, and support is the key to providing coherent mathematics instruction for all students (as cited by Cirillo et al., 2009).
It is important to consider that students have their own goals for their learning that might not align with the teacher or curriculum goals. In efforts to align these goals, teachers should have explicit conversations about relationships between school and non-school math. According to Beswick (2011), “…it seems that context problems have the potential to improve students’ mathematical understandings, but the relationships are complex, idiosyncratic, and very much dependent upon contexts beyond that evoked, or intended to be evoked, by the problem” (p. 379).

Hill, Ball, and Schilling (2008) focused their research on conceptualizing and developing measures of teachers’ combined knowledge of content and students. Although it is widely believed amongst scholars that pedagogical content knowledge (PCK) is effective for teaching and student learning, there are few studies showing well-specified descriptions of the relationship between PCK and student achievement.

Hill et al. (2008) believed teachers hold other forms of relevant classroom knowledge in addition to content specific knowledge. Specifically, what a teacher knows about a students’ mathematical thinking process. In order to conceptualize and develop measures for assessing this knowledge, it is imperative to separate KCS from a teachers’ content knowledge. For example, a teacher could possess superior mathematical skills but little knowledge of how students learn the content. A key part of developing criteria for assessment was based on beliefs that teachers should invoke knowledge of students in addition to using mathematical reasoning in determining student thinking. For instance, already knowing about a student’s domain versus trying to figure out a students’ thinking during teaching. These are measuring different skills and different knowledge the teacher possesses. Hill et al. (2008) concluded that their study emphasized the importance of conceptions of good teaching and measures of good teaching.
Although findings were not concrete, the authors hope their efforts will stimulate and inform future studies and attempts to develop measures (Hill et al., 2008).

According to Goos et al. (2002), there is a need for further research in examining the teachers’ role in creating successful collaboration. Some studies suggest students’ thinking can become confused without teacher’s guidance. Other research suggests intervention may be misdirected, cause more confusion, and deny students opportunities to resolve their own difficulties (as cited in Goos et al., 2002, p. 219). “There are finely tuned appraisals to be made about the timing, amount, and type of assistance to provide, if a delicate balance between encouraging persistence and avoiding frustration is to be achieved.” (Goos et. al., 2002, p. 220).

Baumann and Hall (2012) also discussed the concept of situated learning and how learning contexts can have diverse personal learning requirements for different communities. Furthermore, emphasized the importance of continuing professional development of educators in financial matters. Other researchers gathered reports from a sample of teachers across the United States (Porter, McMaken, Hwang, & Yang 2011). In Mathematics, teachers reported to show more emphasis than Common Core Standards (CCS) on: memorization, conjectures, solving non-routine problems, and geometric concepts. Teachers reported less emphasis than CCS on; performing procedures, demonstrating understanding, and number sense. As the country moves towards CCS, teachers will be required to place less emphasis on memorization and a much greater emphasis on analysis (Porter et al., 2011). On the contrary, a misalignment worth noting is that with the increasing standards and accountability movement, most of the focus is on assessments and schools making “Adequate Yearly Progress” goals (Ladson-Billings, 2016).
Curriculum

Algebra 1: Financial Literacy: Compound Interest Lesson

Common Core Standards

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph
- F.IF.1 Determine an explicit expression, a recursive process, or steps for calculation from a context.
- F.I.E.1.c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- F.I.E.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Financial Literacy Extension

The current common core curriculum focuses on introducing students to simple and compound interest savings. Students practice using simple and compound interest formulas and compare interest savings in both situations. The financial literacy extension is to introduce the concept of paying compound interest, particularly credit card interest. Students will compare scenarios and use online tools to calculate credit interest as well as algebraically. The driving
question will be “Would you pay $$$ for that?” The goal is for students to realize the long-term implications of interest and just how much it costs to borrow money.

**Introduction:** *(context and items should be changed according to the interests of your students)*

You have been wanting the brand-new Xbox for months now. You have done your research and found the best prices are at Walmart.

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td>New Xbox</td>
<td>$499.99</td>
</tr>
<tr>
<td>Game</td>
<td>$69.99</td>
</tr>
<tr>
<td>Wireless controller</td>
<td>$64.99</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$634.97</strong></td>
</tr>
</tbody>
</table>

**There is another store selling it for $875. Would you buy that one?**

Present this scenario: Your parents will not buy this for you and you have $700 saved up from all your summer work but you don’t want to spend all your cash since you worked so hard to save it. Your friend says – “Hey, I’ll buy that for you and you can pay me back later… but I want $875 with interest” Would you buy it?? ($240.03 more).

This question sets the tone for this lesson as most people do not consider long term implications when borrowing money and rarely take the time to calculate how much an item ends up costing.
in the end. (This introduction can be applied to car loans, personal loans, mortgages, home equities etc.)

**Activity 1:** The next part of the lesson asks students to research and find credit card interest rate calculators online. Rather than providing the students with an online credit card interest calculator link, this a great opportunity for students to practice looking for their own resources. There are many websites that students can choose from. Once students find a calculator, discuss other fees associated with credit cards. Late payment fees, over limit fees, and annual fees. The average APR is between 13-24% and can be increased to 29% for going over your limit. Sometimes there are special promotions such as 0% for 12 months but can be easily lost with a late payment. Students should experiment with the credit card interest calculators playing around with different monthly payments, balances, and APR’s. Students should be collaborating in their groups discussing what they discovered. Ask the students how much they would have to pay to avoid paying any interest.

**Activity 2:** The last part of this lesson will be an activity worksheet comparing two different credit card scenarios. Each person completes one chart, discuss, compare in groups and as a class. (Credit card interest is typically calculated with a daily interest rate but for this activity we will use a monthly interest rate. The focus is not only how that interest is calculated but for students to realize that compound interest makes credit card purchases far more expensive than they imagine.) After students complete their charts they will look for patterns to determine a best fit function. A common misconception will be that it is a linear function.
Joe

Balance: $3000  
Monthly New Purchases: $120  
Monthly Payments: $175  
APR: 13.99%  
No annual fee

Mary

Balance: $3000  
Monthly New Purchases: $120  
Monthly Payments (min): $98  
APR: 0% 6 months, 18.99%  
Annual fee: $99

APR

Monthly Interest Rate

Periodic Interest Rate

Annual Fee

Late Payment Fee
JOE:

APR: ______%  

Monthly Interest: ______%  

Ex)

<table>
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<th>Balance</th>
<th>New Purchase</th>
<th>Monthly Payment</th>
<th>Interest</th>
<th>Late Payment</th>
<th>Annual Fee</th>
<th>Cumulative Interest and Fees</th>
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Best fit function: ________________________________  Linear or exponential?
Balance:

Cumulative Interest and Fees:

MARY:

APR: _____% for ____ months, then _____%  
Monthly Interest: _____% for 6 months, then _____%  

Ex)

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Best fit function: _______________________________  Linear or exponential?
Balance:

Cumulative Interest and Fees:

**Conclusion:** End lesson with a group discussion. Show students a sample credit card statement.

**Big Idea:** To avoid accruing interest, you need to pay the new balance on your credit card statement each month. The minimum payment is enough to keep you in good credit rate standing, but paying interest is unnecessary if you spend within your means.
Common Core Standards

- A.SSE.3.c Use the properties of exponents to transform expressions for exponential functions. For example, the expression $1.15t$ can be rewritten as $(1.15^{1/12})^{12t} \approx 1.01212^t$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

- F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.

- F.BF.1.a Determine an explicit expression, a recursive process, or steps for calculation from a context.

- F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Financial Literacy Extension

The current Algebra 2 common core curriculum focuses on students computing future values of investments with continually compounding interest rates using formulas such as $F(t) = Pert$.

Again, the focus is on compound interest savings not debt interest. An example of an Algebra 2 common core curriculum problem would be: A youth group has a yard sale to raise money for charity. The group earns $800 but decides to put the money in the bank for a while. Their local bank pays an interest rate of 3% per year, and the group decides to put all of the interest they earn back into the account to earn even more interest.
The financial literacy extension is to introduce the concept of paying compound interest, particularly credit card interest. The driving question will be “Would you pay $$$ for that?”

The goal is for students to realize the long-term implications of interest and just how much it costs to borrow money. Students will also learn to calculate daily compound interest as well as create a step function graph of monthly activity.

**Introduction: (context and items should be changed according to the interests of your students)**

You have been wanting the brand-new GoPro for months now. You have done your research and found the best prices are on Amazon Prime.

![GoPro Fusion](https://via.placeholder.com/150)

**There is another store selling it for $1122? Would you buy that one?**

**Present this scenario:** Your parents will not buy this for you and you have $700 saved up from all your summer work but you don’t want to spend all you cash since you worked so hard to save it. Your friend says – “Hey, I’ll buy that for you and you can pay me back a little at a time… but I want $423 more than the actual cost.” Would you buy it?
This question sets the tone for this lesson as most people do not consider long term implications when borrowing money and rarely take the time to calculate how much an item ends up costing. (This introduction can be applied to car loans, personal loans, mortgages, home equities etc.)

**Activity 1:** The next part of the lesson asks students to research and find credit card interest rate calculators online. Rather than providing the students with an online credit card interest calculator link, this a great opportunity for students to practice looking for their own resources. There are many websites that students can choose from. Ask students to put in $699 at 22.9% APR paying a minimum payment of $21/mo. Results should look as follows.

<table>
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<tr>
<th>Average Interest Rate</th>
<th>22.90%</th>
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</thead>
<tbody>
<tr>
<td>Monthly Payment</td>
<td>$21.00</td>
</tr>
<tr>
<td>Total Interest Charges</td>
<td>$421.29</td>
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<tr>
<td>Months to Pay Off</td>
<td>53 months</td>
</tr>
</tbody>
</table>

This activity should be an eye-opening experience leading to deep conversations about credit card interest and how easily it is to overspend and get into credit card debt. It is extremely important to understand the vocabulary and credit terms. Students should know that most creditors reserve the right to change any of these terms at any time.

**Activity 2:** Review credit card vocabulary. APR, billing cycle, grace period, late payment fees, over limit fees, daily average balance, and annual fees. The average APR is between 13-24%. Credit card interest rates can range dramatically. Sometimes there are special limited time promotions for 0% or offers as high as 30%.
Credit Card Vocabulary

Interest calculation method___________________________________________

Fixed or variable APR ____________________________________________

Periodic Interest Rate______________________________________________

Billing cycle________________________________________________________

Grace period________________________________________________________

Fees________________________________________________________________

How do we calculate credit card interest?

• If you don’t pay your balance in full, ________________________________
  ___________________________________________________________ during the month.

Example:

Your credit card balance is $3,000 with an APR 21.99%.

On day 14 you pay off $150. Then on day 21 you pay off another $350.

What is your average daily balance?

1) What do we need to know?

   Billing cycle for that month: __________________________

   Annual percentage rate (APR) – 21.99%

   Periodic percentage rate __________________________

2) Calculate
What is the accrued interest for the month?

(**Multiply your average daily balance by the periodic interest rate and the number of days in the month to get the interest accrued for the month.)

3) Calculate

Sketch a Step Function Graph of Daily Balance?
Activity 3: In groups, students will graph a credit card scenario, calculate average daily balance, and monthly accrued interest.

Billing cycle 12/1/2018 – 12/31/2018

Dec 1st – Balance $1500
Dec 5th – Payment $350
Dec 14th – Purchase $475
Dec 27th – Annual fee $50

APR: 18.99%

Sketch a Step Function Graph of Daily Balance?

What is your average daily balance?

What is the accrued interest for the month?
Conclusion: End lesson with a group discussion. Show students a sample credit card statement.

**Big Idea:** To avoid accruing interest, you need to pay the new balance on your credit card statement each month. The minimum payment is enough to keep you in good credit rate standing, but paying interest is unnecessary if you spend within your means.
Conclusion Statement

There is no argument that the need for financial literacy is evident. Far too many Americans lack the basic financial skills necessary to make good financial choices. Knowledge of credit card interest and debt accumulation do not require strong mathematical skills but instead require strong conceptual understanding. The goal of this project was to help students think about long term implications of compound interest. There are many resources students can utilize to help them make better financial decisions. These lessons focus on credit card interest but can easily be adapted for car loans, mortgages, 2nd mortgages, and personal loans. The foundation for the conceptual understanding for both lessons is the driving question “Would you pay $$$ for that”? Unfortunately, many people do not know what they end up paying for an item once they start borrowing money and using credit cards. The results are shocking and open student’s eyes to the reality of how quickly credit card interest accumulates and how easy it is to get into debt.
References


understanding of science, 24(3), 260-271.


Student Work Keys Algebra 1:

Credit Card Vocabulary

Interest calculation method: **Average daily balance x Periodic Rate**

Fixed or variable APR: Fixed-consistent interest rate  Variable - fluctuates.

Periodic Interest Rate: \( \text{APR} \div 365 \text{ days} \)

Billing cycle: # of days in your statement covers

Grace period: time you have to pay off balance before accruing interest

Fees: late fees, cash advance, late transfer, over limit, annual.

How do we calculate credit card interest?

- **If you don't** pay your balance in full, __you accrue interest on your Avg. Daily Balance__ during the month.

Example:

Your credit card balance is $3,000 with an APR 21.99%.

On day 14 you pay off $150. Then on day 21 you pay off another $350.

What is your average daily balance?

1) What do we need to know?

   Billing cycle for that month: __31 days__
   Annual percentage rate (APR) = 21.99%
   Periodic percentage rate: \( \frac{21.99}{365} = 0.062\% \)

2) Calculate

   Day 1: Balance: $3000 \times 31 \text{ days} = 39,000
   Day 14: P/O $150 \times 7 \text{ days} = 1050
   Day 21: P/O $350 \times 11 \text{ days} = 3850

   Avg. Daily Bal. \( \frac{86450}{31} = 2788.71 \)
**What is the accrued interest for the month?**

(**Multiply your average daily balance by the periodic interest rate and the number of days in the month to get the interest accrued for the month.**)

3) Calculate

\[ 2788.71 \times 0.000902 \times 31 = \$52.04 \]

**Sketch a Step Function Graph of Daily Balance?**
**Activity 3:** In groups, students will graph a credit card scenario, calculate average daily balance, and monthly accrued interest.

Billing cycle 12/1/2018 – 12/31/2018

Dec 1st – Balance $1500
Dec 5th – Payment $350
Dec 14th – Purchase $475
Dec 27th – Annual fee $50
APR: 18.99%

**Sketch a Step Function Graph of Daily Balance?**

What is your average daily balance?

\[
1500 \times 4 = 6000
\]
\[
1150 \times 9 = 10350
\]
\[
1625 \times 13 = 21125
\]
\[
1675 \times 5 = 8375
\]

What is the accrued interest for the month?

Periodic Rate \( \frac{18.99\%}{365} = 0.0520\% \)

\[
1479.03 \times (0.000520) \times 31 = \$23.84
\]

**Total Fee’s:** \$50 + \$3.84 = \$73.84
CREDIT CARD INTEREST

JOE:

APR: 12.99 %

Monthly Interest: \( \frac{12.99}{12} = 1.17\% \)

Ex)

Month 1: Interest: \( 2500 \times (0.0117) = 29.25 \)

\( 2500 + 120 - 175 + 29.25 = 2474.25 \)

Month 2: Interest: \( 2474.25 \times (0.0117) = 28.95 \)

\( 2474.25 + 120 - 175 + 28.95 = 2448.20 \)

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Best fit function: \( \text{Exponential} \) Linear or exponential?

Balance: \( y = 2523.85(0.99)^x \quad \text{Dec @ Inc Rate} \)

Cumulative Interest and Fees: \( y = 45.05(1.2)^x \quad \text{Inc @ Inc Rate} \)
CREDIT CARD INTEREST

MARY:

APR: 0% for 6 months, then 18.99%
Monthly Interest: 0% for 6 months, then 1.58%

\[ 18.99/12 = 1.58\% \]

Ex1: Month 1:

\[ \text{Balance} = 2500 + 120 - 98 + 99 = 2817 \]

Month 2:

\[ 2522 + 120 - 98 = 2544 \]

\[ \text{Month 3 Balance} \]

\[ \text{Month 7: Interest} \]

\[ 2632(0.0158) = 41.59 \]

\[ 2632 + 120 - 98 + 41.59 = 2675.59 \]

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Best fit function: \[ \text{Exponential} \]

Balance: \[ y = 2415.61 \left(1.02\right)^x \]

Cumulative Interest and Fees: \[ y = 641.45 \left(1.14\right)^x \]