FINANCIAL LITERACY EDUCATION: CREATING PEDAGOGY THROUGH OPEN SOURCE SOFTWARE THAT PROMOTES EQUITABLE EDUCATION IN URBAN ENVIRONMENTS

By

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ABSTRACT OF THE DISSERTATION

FINANCIAL LITERACY EDUCATION: CREATING PEDAGOGY THROUGH OPEN SOURCE SOFTWARE THAT PROMOTES EQUITABLE EDUCATION IN URBAN ENVIRONMENTS

By CHARLES LOUIS SILBER

Dissertation Director:

Arthur B. Powell

Financial literacy education in the United States is currently facing a significant achievement gap across socio-economic boundaries. Variation across these boundaries for high school students appear in both international (PISA) and national (Jump$tart) results. Current research investigates the disparity but does not suggest specific pedagogical methods for ameliorating the gap.

This study explores how senior-year high school students, who are now of age, assume the responsibility of loans. A prototype learning environment, using open-source applications, where groups of three to four students can collaborate to complete assigned tasks has been created for student exploration. Six senior-high school students from Rutgers Future Scholars are the subjects. The results show an increase in knowledge growth across the six incremental tasks as the participants manipulated and addressed the variables that contribute to stages and outcomes of borrowing money from a financial institution. The participants shared their individual experiences after applying the application to solve the tasks presented and offered suggestions for future research.

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I also want to thank three individuals who helped guide and support me throughout the research and writing process. Lynne Kowski, my partner in multiple graduate courses where hours of working together established the work ethic needed to write this document. Brian Kenyon, a teacher at Arthur L. Johnson High School, who provided professional development in the applications of Google Classroom. To my closest friend for fifty years, Michael James Leslie, as we shared life experiences from very different backgrounds and taught me about the disparities that many experience throughout their lives based solely on their birth.

Dedication

I dedicate my dissertation to my soulmate and best friend, my wife Kathy. Throughout the five years of reading, researching, writing and revising, you were always there to not only support, encourage and financially support, but to assume the greater share of the household daily responsibilities which freed me to create without mental clutter. To my four adult children, Daniel, Sarah, Arthur and Andrew, I have set an example for you, that learning, and growth should never stop. I know you are proud of me, but more importantly, I hope I left a footprint that you will share with your children and to your children's children.

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Chapter 1 Introduction

1.1 Statement of the problem

Student achievement in financial literacy is a high educational priority worldwide[1]. The United States government with the implementation of the Common Core initiative have made improved student achievement a national objective[2]. The American educational system is not meeting its objectives for financial achievement. Our students are performing below standards outlined in the Common Core, as evidenced in both national[3] and international[4] surveys of student financial literacy. The problem is endemic. As such, its solution will require addressing the very structure of our system of financial literacy education.

1.2 Studies that Address the Problem

In her article, Huston (2010) states that measuring learning of financial literacy is essential to understanding the impact of educational programs as well as potential barriers to making improved financial choices. In another study, Lyons, Rachlis, Staten, and Xiao (2006) explored the role of financial education in the achievement of behavior change. The authors specified the importance of conducting outcome-based evaluations and concluded that:

- Researchers need to build a better link between theoretical models of behavior change as is applies to growth in knowledge of financial literacy and determine how impact data should be collected, analyzed, and interpreted.
- Researchers need to be more strategic in the projects they choose to evaluate and focus more on projects that have the greatest potential for documenting program impact using control groups and follow-up studies, as well as continue the

[1] Organisation for Economic Co-operation and Development (OECD)
[2] National Standards for Financial Literacy © Council for Economic Education
[3] Jump$tart Coalition for Financial Literacy
[4] Programme for International Student Assessment (PISA)

support of similar programs that do not have the resources to conduct rigorous evaluations.

- Lastly, the authors defined financial education and identified topics that should be included under its umbrella.

1.3 Deficiencies in the Past Studies

As part of the Jump$tart Coalition 2008 Personal Financial Literacy survey, students were asked to include their scores on college entrance examinations, either SAT or ACT. The purpose of this information was to determine whether financial literacy was related to academic ability, regardless of any financial education they may have received. The results showed a strong relationship between financial literacy and scores on the major college entrance exams. This result suggests that financial literacy, at least as measured by the standard Jump$tart examination (which stresses the ability to solve age-appropriate personal financial problems), may merely reflect the general ability to solve problems of any type. To support their theory, Cole, Paulson, and Shastry (2014) conclude that financial literacy is related solely to mathematical ability and not to financial literacy courses.

In the Test Results of High School Students by Aspirations (Mandell, 2008), characteristics of the state mandate for schools were demonstrated to be important when investigating its effect on improving financial knowledge scores (Walstad et al., 2010). Additionally, researchers have found state mandates for personal finance education that are more specific to have a more positive effect on student comprehension than broadly defined mandates. In contrast, the results from the 2008 Jump$tart survey show that there is a negative correlation between high school financial literacy courses and the results from the 31- question assessment. The national test data, however, are limited in their usefulness to evaluate the effectiveness of

financial education because of insufficient controls related to course content, test measurement, teacher preparation and amount of instruction (Lucey, 2005).

1.4 Significance of the Study and Target Audience

Research has shown a positive correlation associated with poverty rates in the respective communities and financial literacy achievement in education (Macartney, Bishaw, Fontenot, 2013). "However, the notion of an urban multicultural financial curriculum does not appear to have been extensively investigated or advocated" (Lucey & Giannangelo, 2006, p. 272).

Urban areas do not produce a conducive environment for African American and Hispanic families to attain upward mobility. While there is evidence in the literature to support this limitation in upward mobility, data regarding the potential factors associated with socioeconomic stagnation in urban centers are limited (Lucey & Giannangelo, 2006). National results of financial literacy surveys have demonstrated limited knowledge of the necessary financial topics among high school seniors. There is a need for research studies that attempt to explain the factors responsible for the decline in urban centers and that elucidate the role of financial literacy, if any, in this process.

My research is targeted towards urban high school students who score significantly lower in both international and national surveys in financial literacy education. The international economic crisis of 2008 was a reminder of the need to improve financial literacy education among all students, but more importantly, for students from lower socio-economic backgrounds.

1.5 The Research Questions

Combining advanced technologies (GeoGebra, Google Classroom, Knowledge Building Discourse Explorer) and pedagogical objectives as supported through the research of Powell and Alqahtani (2017) and Scardamalia and Bereiter (2006), monitored with the implementation of

social network analysis, can a pilot study applying these advanced technologies along with challenging tasks show an increase in knowledge growth as the participants manipulated and addressed the variables that contribute to stages and outcomes of borrowing money from a financial institution? Can the pilot study outcomes and the participants' shared individual experiences upon completion of the designed tasks, offer guidelines for further studies?

Chapter 2 Literature Review

2.1 National and International Overview

National survey results do not suggest an equitable distribution of instruction in high schools; in fact, they show a significant difference in scores between suburban and urban districts in financial literacy (Jump$tart Coalition, 2008). Moreover, the existing literature is not specific regarding approaches for ameliorating the gap in performance between suburban and urban school districts. Equity need not necessarily be achieved solely through the infusion of dollars into urban districts, but more importantly, through carefully designed academic programs and pedagogy.

This literature review will provide evidence to determine whether students in urban centers and specifically African American and Latino students, score significantly lower in national surveys on financial literacy (Jump$tart Coalition, 2008). The delivery of financial literacy to our students is part of a national trend that began at the end of the 20th century and became more imperative after the financial collapse of 2008 (Fox, Bartholomae, & Lee, 2005). The curriculum for financial literacy education is not standardized and therefore falls under non-specific domains in our high schools (Cole, Paulson, & Shastry, 2013). Training and professional development for teachers is rare or non-existent (Peng, 2007; Sloan, 2012). Likewise, urban centers of education are more adversely affected by the lack of a cohesive financial literacy system. The question becomes if, and how, this equity gap can be closed (Lucey & Giannangelo, 2006). International perspectives, as shown through PISA[5] results, suggest that the disparity in educational resources affecting urban centers may be underestimated; the United States falls in the middle of international rankings of financial literacy education (PISA, 2012). As our

[5] PISA: Programme for International Student Assessment.

economies continue to globalize (PISA, 2012), urban centers require a financial literacy curriculum that prepares students for real-world financial experiences (Lucey & Giannangelo, 2006).

The goal of financial education is to help students and adults achieve a level of financial literacy and become financially capable consumers. There is no "official" definition of financial literacy; therefore, pathways towards achieving this outcome are varied in the literature. Specific student age programs of measurement through survey assessment (PISA, Jump$tart are two of multiple sources of metrics). The research of educational programs targeting specific age groups up through adulthood includes both general and very clearly defined pedagogical methods. The present research evaluates these programs[6] using psychometric and statistical options available in computer applications software, such as Minitab, R, SPSS, and SAS. Multiple theories in psychology such as TTM (trans theoretical model of change) and the Theory of Planned Behavior have been adapted for research in financial literacy; statistical methods such as OLS (ordinary least squares), quantile regressions, and Analysis of Variance have been used to evaluate these findings.

2.2 Research Rationale

The 2010 Common Core State Standards Initiative (CCSSI, 2010) opens by stating its goal of providing clear and consistent learning outcomes to help prepare students for college, career, and life. With the Common Core goal in mind, I directed my research to determine whether curriculum shapes students' understanding of financial literacy to support a lifetime of good financial decision-making, and to determine whether the curriculum is being equitably

[6] Council for Economic Education. 2011. Survey of the States 2011: The State of Economic and Personal Finance Education in Our Nation's Schools. http://www.councilforeconed.org/ news-information/survey-of-the-states/

facilitated. Therefore, variation in student financial literacy assessments across socio-economic and cultural boundaries should be minimized. Most of the variation in assessment analysis should be contained within group boundaries.

2.3 Historical Perspective for National Financial Education

In May of 2009, Congressman Barney Frank, then Chairman of the House Financial Services Committee, gave the Commencement address to the graduates of American University. He stressed the importance of the public "having at least some knowledge of accounting." Below is the link to that speech and the accompanying video: https://podcasts.apple.com/sk/podcast/barney-frank-american-univeristy-2009-school-public/id438304336?i=1000094064543. Published articles of the federal government's role in the housing and economic crisis and the 2008 global collapse of the financial markets also emphasized a need for universal financial literacy education (Lusardi & Mitchell, 2013).

Public, private, and nonprofit sectors have been offering an increasing number of financial education resources and programs aimed at improving the financial knowledge, attitudes, and behaviors of students (K-12 and post-mandatory age education), families, and communities. The Jump$tart Coalition has over 560 resources in its financial education database. The National Endowment for Financial Education lists over 150 educational resources and curricula from a wide range of agencies, organizations, and firms in its Economic Independence Clearinghouse database. The Federal Reserve Bank of San Francisco includes 56 programs and resources in its Guide to Financial Literacy Resources (Hogarth, 2006). Yet, researchers have continued to struggle with developing measures that effectively gauge whether these resources and programs are working. There are widespread variations in the methods and measurements being used to document program impact, and many in the research community are still grappling

with the fundamental question of how to define program success (Schuchardt, Hanna, Hira, Lyons, Palmer, & Xiao, 2009).

Interest in personal finance education in US schools has increased significantly since the 1990s. From 1998 to 2009, the following changes occurred: states with content standards for personal finance education in the schools rose from twenty-one to forty-four, states requiring implementation of those standards increased from fourteen to thirty-four and states requiring that a personal finance course or economics course with personal finance content be taken before graduation from high school grew from one to 13 (Walstad, Rebeck, & McDonald, 2010).

Prior to the collapse of financial markets in 2008, many researchers were already concerned with the signs that they were seeing in the marketplace. Prior to the financial collapse of 2008, Fox, Bartholomae, and Lee (2005), wrote a predictive paper calling for the need for financial education. They noted (at the beginning of the paper) that a poor level of financial understanding contributed to alarming outcomes such as rising rates of bankruptcy, high consumer debt levels, and low savings rates.

In a publication authored by Lewis Mandell and funded through the Merrill Lynch Foundation, the results of the Jump$tart 2008 Survey of Young American Adults (high school seniors and for the first-time college students), the definition of standard of living is presented as a coordinated response to citizens' ability to possess financial resources and their knowledge of how to use resources efficiently (financial literacy). The Coalition found it "disturbing" that citizens with less income (ability) and education (literacy) were the marketed targets of the sub-prime mortgages[7]. These MBSs (Mortgage Backed Securities) and the high default rate that

[7] Subprime mortgages are mortgages targeted at borrowers with less-than-perfect credit and less-than-adequate savings.

accompanied them fueled the financial crisis, and as the Coalition states, financial literacy and macroeconomic ramifications are closely linked.

2.4 Contradictions and gaps in the literature

Evidence of the effectiveness of pre-college financial education has been mixed. Some studies have questioned the value of personal financial education in secondary schools. For example, Mandell (2008), using the Jump$tart data that he collected from the 2008 survey, found no evidence that students taking a money management or personal finance course knew more about the subject than students who had not taken such a course[8]. In a concurrent survey taken by students accompanying the Jump$tart assessment, high school students with higher SAT or ACT performance scored the highest on the 31 personal finance questions. Upon the recommendation of Shawn Cole from Harvard Business School, the SAT and ACT scores were added to the Jump$tart 2008 survey results (2013).

The study performed by Bernheim, Garrett, and Maki (2001) supports state mandates requiring high school students to take personal finance courses and provides strong statistical evidence to support its findings (Appendix D).

Furthermore, national research showed that the characteristics of the state mandate for schools mattered when investigating its effect on improving financial knowledge scores (Walstad et al., 2010). Researchers have found out that more specific state mandates for personal finance education have a more positive effect on student understanding than those that are more broadly defined. In contrast, as stated above, the results from the 2008 Jump$tart survey show that there is a negative correlation between high school financial literacy courses and the results from the 31- question assessment. These national test data, however, are limited in their usefulness to

[8] In addition to the 31 question survey, there were 18 additional classification questions. See appendix B

evaluate the effectiveness of financial education because of insufficient controls related to course content, test measurement, teacher preparation and amount of instruction.

Unlike most high school courses in mathematics or science, there can be widespread national differences in the content of personal finance courses, and these courses can give different emphases to each topic even if they cover the same topics. The test also includes only thirty-one knowledge items that may not closely match the content of personal finance courses nationwide or provide an appropriate degree of emphasis to the topics taught in a course. Furthermore, the quality and amount of instruction in a national sample can vary because teachers may not be well-trained to teach the material or because of differences in the amount of instruction provided over a semester. A final problem is that the test data do not measure the initial level of financial knowledge to assess changes resulting from instruction in personal finance (Lucey, 2005).

In an article, Huston (2010) states that measuring financial literacy is essential to understanding the effectiveness and impact of educational programs as well as the limitations to making effective financial choices that the programs are designed to address. She states that a construct is needed to measure consumers' ability to make effective financial decisions. Importantly, she found that a thorough examination of the existing literature reveals a paucity of research on financial literacy measurement. In her work, Huston cites an earlier article, by Marcolin and Abraham (2006), which identified the need for research focused specifically on the measurement of financial literacy.

The results presented by Marcolin and Abraham (2006) were based on research published between 1996 and 2008. It is important to note that the study was an evaluation of measurement of financial literacy and its outcomes and not a study of financial literacy education programs.

Seventy-one research articles were chosen based on whether the study used a measure of financial literacy or financial knowledge..

Lyons, Rachlis, Staten, and Xiao (2006), specified in the article titled Translating Financial Education into Knowledge and Behavior Change, the importance of conducting outcome-based evaluations and concluded that:

- Researchers needed to build a better link between theoretical models and behavior change and how impact data should be collected, analyzed and interpreted.
- Researchers need to be more strategic in the projects they choose to evaluate. More focus needs to be placed on projects that have the greatest potential for documenting program impact using control groups and follow-up studies, and continued support of similar programs that do not have the resources to conduct rigorous evaluations.
- Lastly, how to define financial education and what topics should be included in its umbrella. The article does not arrive at a conclusion for this point and concludes that more discussion is needed.

2.5 The Jump$tart Coalition

In the 1997-1998 academic year, the Jump$tart Coalition® for Personal Financial Literacy conducted its first Personal Financial Survey, a nationwide survey of 12th-grade students to determine their ability to understand and survive in the current economy. The mission is to educate and prepare the nation’s youth for future financial success. High school seniors were chosen as the population used to gauge financial literacy for two reasons. First, they were in the last year of basic schooling which is a requirement and is financed for all Americans. Second, as young adults who could sign binding contracts at age 18, they were confronting real financial

decisions that could have great consequences for their lives. The survey included 49 questions of which the first 31 were committed to the "test" part of the Survey. Questions 32-49 were classification questions (See Appendices A & B). The 31 test questions were multiple choice with four option answers. There were four primary areas of financial literacy understanding: (1) income; (2) money management; (3) saving and investing; and (4) spending and credit. The four categories were interspersed among the 31 survey questions. To control for Differential Item Functioning[9], test questions "were put into age-and life cycle-appropriate" to make them relevant to high school students. At the ten-year anniversary of surveys, funding was provided to create the document.

The 2008 survey included college undergraduates for the first time. Table 2.1, retrieved from Mandell (2009, p.14), limits the findings to high school seniors.

Table 2.1. Summary the results of the first ten years of surveys

Test Results of High School Students by Background	1997 Mean Score	2000 Mean Score	2002 Mean Score	2004 Mean Score	2006 Mean Score	2008 Mean Score	2008 % of Students	2008 % of Students Grade of C or Better	2008 % of Students Failing
	57.30%	51.90%	50.20%	52.30%	52.40%	48.30%	100%	4.70%	73.90%
Parent's Income									
Less than $20,000	55.20%	46.30%	45.70%	49.50%	48.50%	43.40%	10.70%	2.20%	85.20%
$20,000 to $39,999	58.20%	52.00%	50.70%	51.30%	50.80%	47.30%	20.10%	2.70%	77.90%
$40,000 to $79,999	59.60%	57.20%	52.30%	54.10%	53.70%	50.30%	26.50%	4.50%	70.90%
$80,000 or more	59.00%	55.00%	52.70%	55.90%	55.60%	52.30%	23.00%	9.50%	62.00%
Highest Level of Parent's Education									
Neither Finished H.S.	51.40%	47.00%	43.70%	44.60%	44.50%	44.20%	11.50%	1.60%	85.40%
Completed H.S.	57.10%	49.70%	47.50%	51.50%	50.60%	47.20%	24.40%	3.30%	77.10%
Some College	55.80%	53.80%	51.70%	52.60%	51.80%	49.00%	21.60%	4.50%	73.20%
College Grad or More	59.30%	55.10%	53.50%	55.40%	55.60%	51.80%	36.80%	7.55%	65.30%
Gender									
Female	57.90%	51.60%	50.70%	52.20%	52.30%	47.90%	55.30%	3.80%	75.40%

9 **Differential item functioning** (**DIF**) is a statistical characteristic of an item that shows the extent to which the item might be measuring different abilities for members of separate subgroups.

Male	56.90%	52.20%	49.80%	52.40%	52.60%	49.00%	44.70%	5.80%	71.60%
Race									
White	60.90%	54.50%	53.70%	55.50%	55.50%	52.50%	55.50%	7.10%	64.40%
African American	50.40%	47.00%	42.10%	44.00%	44.70%	41.30%	13.60%	1.40%	89.10%
Hispanic-American	55.10%	45.30%	44.80%	48.30%	46.80%	45.10%	20.10%	2.50%	83.40%
Asian-American	55.80%	53.50%	50.60%	48.30%	49.40%	47.20%	3.70%	1.70%	77.20%
Native-American	48.80%	38.60%	45.50%	46.70%	44.10%	37.70%	2.20%	0.50%	88.80%
Region									
Northeast				56.50%	53.80%	53.20%	6.90%	5.70%	57.25%
Midwest				52.40%	54.20%	51.75	27.10%	6.80%	65.10%
South				49.90%	49.90%	47.20%	40.10%	3.80%	77.50%
West				52.20%	52.80%	45.20%	25.90%	3.70%	82.10%

The first survey, in 1997, found that the average high school senior was unable to pass a simple test of personal financial literacy. Results of the 2000 and 2002 high school surveys indicated a decline from that low level. Results from the 2004 and 2006 surveys were optimistic that the downward trend in financial literacy may have finally turned around, but the 2008 survey produced the lowest result (48.3% pass rate).

Nationally, the mean scores in 2008 for African American and Hispanic high school seniors of 41.3% and 45.1%, respectively, were significantly lower than white students' mean score of 52.5%. Comparing relative poverty rates in the respective communities from the data on *Poverty Rates for Selected Detailed Race and Hispanic Groups by State and Place, 2007–2011* (Macartney, Bishaw, & Fontenot, 2013a) and from the *American Community Survey Briefs 2013* (Macartney, Bishaw, & Fontenot, 2013b), there is an indication of a positive correlation between financial literacy education and poverty levels. Figure 2.1 illustrates a bar chart that represents the national poverty percentages.

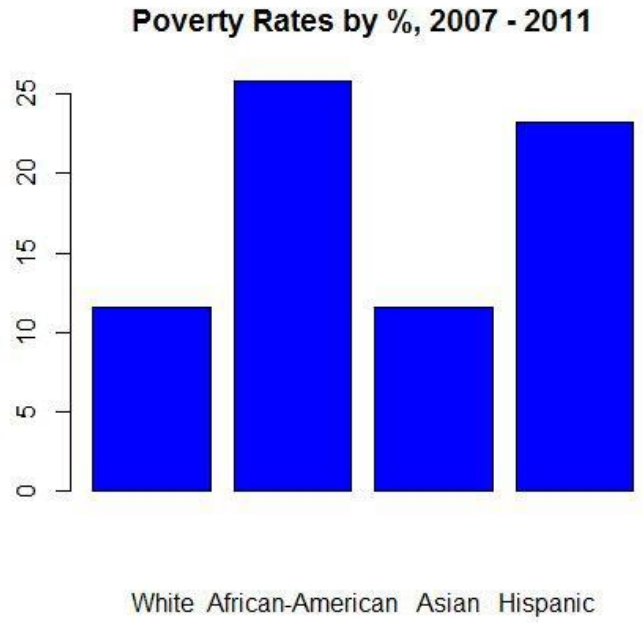


Figure 2.1. National poverty percentages from 2007 to 2011

2.6 New Jersey census data

In New Jersey, data from the U.S. Census Bureau (2010; see Table 2.2) showed a concentration of Hispanic and Black populations in urban centers. The populations of two municipalities in Essex County comprised more than 97% minority residents, including East Orange (97.8%) with the state's highest percentage of minority residents and Irvington Township (97.4%). In five other municipalities, minorities represented more than 90% of the total population: Camden County's Lawnside Borough (96.9%), Camden City (95.1%), Essex County's City of Orange Township (95.5%), Union County's Plainfield (91.7%), and Passaic County, Paterson (90.8%).

Table 2.2 New Jersey urban census data of Hispanic and Black populations

Municipality	County	Hispanic Population	Hispanic Population %	Black Population
Newark	Essex	93,746	33.80%	145,085
Patterson	Passaic	84,254	57.60%	46,314
Elizabeth	Union	74,353	59.50%	26,343

Jersey City	Hudson	68,256	27.60%	64,002
Union City	Hudson	56,291	84.70%	
Passaic	Passaic	49,557	71%	
N. Bergen Twp.	Hudson	41,569	68.40%	
Perth Amboy	Middlesex	39,685	78.10%	
West New York	Hudson	38,812	78.10%	
Camden	Camden	36,379	47.00%	37,180
East Orange	Essex			56,887
Irvington Twp.	Essex			46,058
Trenton	Mercer			44,160
Plainfield	Union			25,006

2.7 OECD and PISA

The OECD produces a triennial report on the state of international education: to share evidence of the best policies and practices, and to offer specific support to help countries provide the best education possible for all of their students. The assessment of 15-year old students is the world's most comprehensive and reliable indicator of their capabilities as well as a powerful tool that countries and economies can use to fine-tune their education policies:

> "Equipping citizens with the knowledge and skills necessary to achieve their full potential, to contribute to an increasingly interconnected world, and to convert better skills into better lives needs to become a more central preoccupation of policy makers around the world. Fairness, integrity and inclusiveness in public policy thus all hinge on the skills of citizens" (Angel Gurría, OECD Secretary-General). (Schleicher, 2018, p. 2)

The Organisation for European Economic Cooperation (OEEC) was established in 1948 to run the US-financed Marshall Plan for the reconstruction of the European post-war continent. By making individual governments recognize the interdependence of their economies, it paved the way for a new era of cooperation that was to change the face of Europe. Encouraged by its success and the prospect of carrying its work forward on a global stage, Canada and the US joined OEEC members in signing the new OECD Convention on 14 December 1960. The Organisation for Economic Co-operation and Development (OECD) was officially born on 30 September 1961. The Organisation for Economic Co-operation and Development is a forum

where the governments of 34 democracies with market economies work with each other, as well as with more than 70 non-member economies to promote economic growth, prosperity, and sustainable development. OECD coordinates its information on a broad range of topics to help governments foster prosperity and fight poverty through economic growth and financial stability. Their goal is to help ensure that the environmental implications of economic and social development are considered. Figure 2.2 presents OECD's organizational structure (retrieved from http://www.oecd.org/about/how-we-work/)

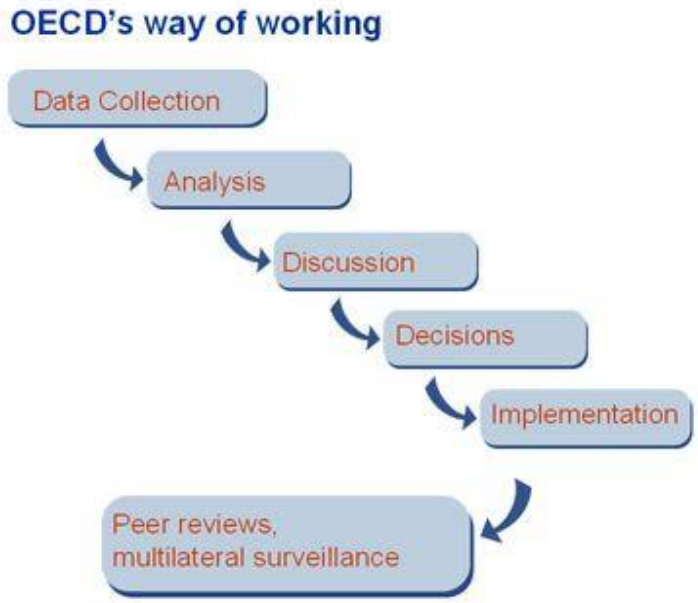


Figure 2.2. OECD's way of working

Every three years beginning in 2000, the OECD puts out a world-wide test among its member nations titled Programme for International Student Assessment (PISA). To better compare student performance internationally, PISA targets a specific age of students. PISA students are aged between 15 years 3 months and 16 years 2 months at the time of the assessment and have completed at least 6 years of formal schooling. They can be enrolled in any type of institution, participate in full-time or part-time education, in academic or vocational programs, and attend

public or private schools or foreign schools within the country. The subjects on the test are Reading, Science, and Mathematics. Beginning with the 2012 test, Financial Literacy was added to the examination. In 2014, the results of the 2012 test were published in a multi-volume document. Financial Literacy results are detailed in Volume VI (OECD, 2014b).

PISA results document for policy makers in participating countries what the "highest performing and most rapidly improving education systems can do." Since financial literacy was included for the first time in 2012, countries can only evaluate their own educational systems by evaluating financial literacy results as they correlate with mathematics and reading results. New policy goals can be established against measurable goals achieved by both internal and other education systems.

The PISA assessments focus on the level students can both utilize the knowledge and skills they have learned and practiced in school as they are confronted with real-life situations and challenges where that knowledge becomes relevant (OECD, 2014a). The PISA 2012 Technical Report states:

> PISA assesses the extent to which students can use their reading skills to understand and interpret the various kinds of written material that they are likely to meet as they negotiate their daily lives; the extent to which students can use their mathematical knowledge and skills to solve various kinds of numerical and spatial challenges and problems (OECD, 2014c, p. 22).

PISA also uses Student Questionnaires to collect information from students on various aspects of their home, family and school background, and School Questionnaires to collect information from schools about various aspects of organization and educational provision in schools. In PISA 2012, 11 countries also administered a Parent Questionnaire to the parents of the students participating in PISA. Using the data from Student, Parent, and School Questionnaires, analyses linking contextual information with student achievement could address:

- differences between countries in the relationships between student-level factors (such as gender and socio-economic background) and achievement;
- differences in the relationships between school-level factors and achievement across countries;
- differences in the proportion of variation in achievement between (rather than within) schools, and differences in this value across countries;
- differences between countries in the extent to which schools moderate or increase the effects of individual-level student factors and student achievement;
- differences in education systems and national context that are related to differences in student achievement across countries; and
- through links to PISA 2000, PISA 2003, PISA 2006 and PISA 2009, changes in any or all of these relationships over time (OECD, 2014c, p. 22)

Table 2.3 summarizes the key features of PISA 2012 (adapted from OECD, 2014b, p. 31-2).

Table 2.3. Some key features of PISA 2012

Feature	**Description**
The content	Mathematics, reading, science, and for the first time financial literacy
The students	510,000 from a population of 28 million 15-year-olds in the schools of the 65 participating countries
The assessment	Paper-based tests, lasting two hours Test items mixture of multiple choice and free response
The scoring	PISA employs scaling models based on Item Response Theory methodologies

2.8 Examples of questions used in the 2012 financial literacy assessment

PISA defines financial literacy as:

> knowledge and understanding of financial concepts and risks, and the skills, motivation, and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life (OECD, 2012, p. 33).

The PISA exam for financial literacy contains five content areas of understanding and knowledge that correlate positively with their definition of financial literacy (OECD, 2016).

Appendix F contains the invoice from which students are asked a series of multiple level questions (Appendix F). Scoring is based on a correct response for level 1 questions and a partial credit model for higher level questions. The difficulty level assigned to each question is highlighted in Appendix F. For example, Question 3 (Appendix F) requires students to interpret a financial document in a complicated situation that is likely to take place in real life. Students are required to calculate the correct amount due, given that the quantity described on the invoice is incorrect. In this task, full credit is given for the responses considering the tax change and postage, and partial credit is given to responses that only consider one of those factors. The partial-credit score is located at Level 3 while the full-credit score is located at Level 5. To get full credit, students need to interpret and use financial and numeric information in an unfamiliar context and solve a financial problem by using multiple numerical operations (i.e. addition, subtraction and calculation of percentages). To get partial credit, students need to interpret and use financial and numeric information and apply basic numerical operations (i.e. subtraction).

2.9 Relationship between financial literacy and student background[10]

On average, across OECD countries and economies, students' socioeconomic status explains a larger proportion of the variation in financial literacy than gender and immigrant background. Among the components of socioeconomic status, parents' occupation explains a larger proportion of performance variation than parents' education. Overall, the demographic and socioeconomic factors considered in this analysis explains

10 Countries and economies are presented in three groups: those whose mean performance is above the OECD average, those whose mean performance is not statistically different from the OECD average, and those whose mean performance is below the OECD average.

22% of the total variation in financial literacy performance, which is similar to the proportions of explained variation in mathematics (23%) and slightly lower than that in reading (27%). The PISA index of socioeconomic factors (OECD, 2014b, pg. 84):

- parents' education and occupation
- indicators of family wealth based on a survey of home possessions
- educational resources available at home

Students are considered "socioeconomically advantaged" if they are among the 25% of students with the highest PISA index in their country or economy, while socioeconomically disadvantaged students are among the 25% of students with the lowest PISA index. On average across OECD countries and economies, financial literacy performance is positively associated with socio-economic status, but that there is more variation in performance than socio-economic status can predict. The report states:

> Equity means providing all students, regardless of gender, family background or socioeconomic status, with similar learning opportunities. PISA measures equity by the strength of the relationship between students' socio-economic status and their performance: the stronger the impact of a student's socioeconomic status on his or her performance, the less equitably the country/economy provides students with opportunities for learning. PISA results in other domains consistently indicate that high performance and greater equity in learning opportunities and outcomes are not mutually exclusive: one does not have to be sacrificed to achieve the other (OECD, 2014b, p. 84).

Table 2.4 (adapted from OECD, 2014b, p. 84) shows the relationship between financial literacy and socio-economic status. On average, across OECD countries and economies, 13.6% of the variation in student performance in financial literacy within each country and economy is associated with the PISA index of economic, social, and cultural status. The "equity" goal is to have a low association between student performance and socioeconomic status (column #2). The difference in performance within a country across socioeconomic status should be low. The

second and third columns are measures of equity in financial literacy performance across socioeconomic levels. In summary:

- Estonia combines high performance (529 versus the average of 500) and high equity as it displays above-average performance and above-average equity (i.e. a weak association between performance and socio-economic status 6.7% versus the average of 13.6%).
- Italy and the Russian Federation also display above-average equity, 9.6% and 7.5%.
- In New Zealand, the relationship between student performance and socio-economic status is stronger than average.
- Finally, in the United States, the Financial Literacy performance was not significantly different from the normal average (492 vs. 500), and neither is the association between performance and socioeconomic status (16.6% versus 13.6%). But, the United States had the second-highest percentage (16.6%) of explained variation across socioeconomic groups, just below New Zealand's highest percentage. The performance difference across socioeconomic groups is exactly the international average (41 points), but still in the highest 66th percentile.

This finding suggests that a low socioeconomic standing is consistent with a low score on the financial literacy assessment.

Table 2.4. Comparing countries' and economies' performance in financial literacy and equity

Country/Economy	1. Mean performance in financial literacy	2. Strength of the relationship between financial literacy performance and socio-economic status	Performance difference across socio-economic groups
OECD average-13	**500**	**13.6**	**41**
Estonia	529	6.7	24
Australia	526	11.3	42
Flemish Community (Belgium)	541	11.3	37
Poland	510	12.2	31
Shanghai-China	603	12.5	29
Czech Republic	513	13.3	45

New Zealand	520	19	64
Latvia	501	13.2	32
United States	492	16.6	41
Italy	466	7.5	25
Russian Federation	486	9.6	36
Croatia	480	10.1	33
Columbia	379	13	33
Israel	476	14.4	50
Spain	484	14.6	32
France	486	15.5	50
Slovenia	485	16.3	41
Slovak Republic	470	18.2	48

Key
1. Countries/economies with mean performance in financial literacy above the OECD average 2. Countries/economies where the strength of the relationship between financial literacy performance and socio-economic status is below the OECD average 3. Countries/economies where performance differences across the socioeconomic spectrum are below the OECD average
1. Countries/economies with mean performance in financial literacy not statistically different from the OECD average 2. Countries/economies where the strength of the relationship between financial literacy performance and socio-economic status is not statistically different from the OECD average 3. Countries/economies where performance differences across the socioeconomic spectrum are not statistically different from the OECD average
1. Countries/economies with mean performance in financial literacy below the OECD average 2. Countries/economies where the strength of the relationship between financial literacy performance and socio-economic status is above the OECD average 3. Countries/economies where performance differences across the socioeconomic spectrum are above the OECD average

2.10 Summary and Suggestions for a New Pedagogy

The First World War was commonly referred to as the "War to End all Wars." It never received a Roman numeral until the Second World War just as the Great Depression was considered to be the depression to end all depressions. The financial crisis peaking in 2008 was not a crisis of unemployment, but a crisis of worldwide asset depreciation across most capital markets and at the same time the reduction of individual wealth. Short-term policies were put in place by the United States and other developed countries. All governments realized the importance of having long-term programs in place to improve citizen skills both through the education system and in the workplace. The Program for International Student Assessment (PISA), for the first time in

2012, included a financial literacy assessment. The PISA work is published under the responsibility of the Secretary-General of the Organisation for Economic Cooperation and Development (OECD) and the next assessment was in 2015. The OECD is an outgrowth of the original Marshall Plan as an instrument for continued cooperation among nations. It realized that the development of financial literacy skills among young people is increasingly perceived by policy makers as essential. The PISA document 2012 lists three areas of concern:

- Given the greater complexity of financial products and services and systems, financial choices to be made by today's youth are much more challenging than previous generations and, many of today's youth may be first generation to experience these choices. In addition, gaps between socio-economic statuses can be closed through proper financial literacy education. Parents with lower education, income or wealth may be less equipped than other parents to impart financial literacy to their children.
- Financial risks may be expanded more as life expectancy increases along with a decrease in welfare and occupational safety nets, accompanied by a changing global job market.
- 15-year old students have access to many financial services, some long-term financial decisions such as post compulsory education payments require planning as parents may no longer be able to bear the burden themselves of payment.

Young people can learn about financial literacy matters from a variety of sources, including parents, friends, schools, as well as personal experiences such as a part-time job, bank account, debit or credit card. As more and more countries introduce financial education into schools, as part of a national strategy for financial education across the whole population with a view to advancing financial literacy among young generations, assessment of the success of these

programs can be continually monitored through the international PISA results of 15-year old, or Jump$tart Coalition of high school seniors in the United States. As of 2014, the United States was one of more than 50 countries that had either implemented or designed a national strategy for financial education. Many of these strategies make specific references to the introduction of financial education in schools and/or identify young people as specific stakeholders. In the United States, the Financial Literacy and Education Commission, chaired by the Secretary of the Treasury, released the National Strategy for Financial Literacy in 2011. The Commission is continually introducing updates in order to improve the skills of American students.

Despite the progress made, only a small number of countries have developed financial education in a structured way. OECD (PISA, 2012) reports that even in countries where some form of financial education is provided in schools, the content and even the definition varies, with some countries and schools offering economics or business studies rather than teaching students how to manage their personal finances. Only a few countries have developed dedicated financial education frameworks and have introduced financial education into the school curriculum. In addition, the provision of financial education in school is often not tied to an official standardized curriculum.

In many cases, schools may have flexibility in integrating financial education into the curriculum, and teachers may have flexibility as to whether or not to include aspects of financial literacy within their subjects. Teachers' decisions to provide financial education to their students are also linked to the availability of teaching material and professional development, which may be very limited. The literature presented is conflicted on which mechanism to deliver the curriculum, through mathematics or business courses; who should deliver it, which types of

pedagogical methods will best serve the students; and finally, an examination on whether all stakeholders are actually getting the information.

The literature I researched on specific curriculum and professional development for financial literacy was limited. The literature on curriculum design for urban centers was even less robust. I found two important documents, one a literature review previously noted (Lucey & Giannangelo, 2006) and the second, a book written by a local author with strong ties to the city of Newark, New Jersey (Troutt, 2014). These two documents are the inspiration for my research on the gaps in the existing literature and my own creation of an application and task design for student involvement in one targeted area of financial literacy. I am particularly interested in student knowledge of mathematics and careful planning before assuming the responsibility of a loan, whether it be for education, automobile or the starting up of a new business venture. Since, as stated earlier, curriculum designers are unsure which academic department should be teaching financial literacy, the application and task design I created will support any avenue of instruction. In addition, the delivery of the application and tasks is done through a virtual portal. Interactive dialogue and discovery will contribute to a successful financial practice (Lucey & Giannangelo, 2006). The unfortunate alternative to the lack of financial instruction in the urban centers can be best stated in a quote from Henry Ford that David Troutt (2014) used to open Chapter 2 of his book: “We shall solve the city problem by leaving the city” (p. 41).

Chapter 3 Methodology

3.1 Vygotsky's Zone of Proximal Development

The concept of zone of proximal development (ZPD) was developed by Lev Semenovich Vygotsky during the late 1920s and elaborated until his death in 1934 (Shabani, Khatib, & Ebodi, 2010, p. 27). In Mind in Society: The Development of Higher Psychological Processes, Vygotsky defined the ZPD as “the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peer”. That is, the ZPD was understood by Vygotsky to describe the current or actual level of development of the learner and the next level attainable through the use of "instrumental transformation of technological tools into instruments that mediate users’ activity" (Alqahtani & Powell, 2016, p. 72) and adult (educator) or capable peer facilitation.

The idea when applied to the school environment, students learn best when working together with peers during joint collaboration, and it is through such collaborative endeavors with students of variable skills, it is possible that learners learn and internalize new concepts and skills (Shabani, Khatib, & Ebodi, 2010). The main goal of education from Vygotskian perspective is to keep learners in their own ZPDs as often as possible by giving them interesting and culturally meaningful learning and problem-solving tasks that are slightly more difficult than what they do alone, such that they will need to work together with the teacher as a facilitator and observer of the lesson (Shabani, Khatib, & Ebodi, 2010). The idea is that after completing the task jointly, the learner will be able to complete the same task individually next time, and through that process, the learner’s ZPD for that particular task will have been raised. This

process is then repeated at the higher level of task difficulty that the learner's new ZPD requires (Shabani, Khatib, & Ebodi, 2010).

The equitable distribution of financial literacy instruction in New Jersey urban schools is not supported by national survey results (Jump$tart Survey), which show a significant gap in scores between suburban and urban districts. In order to narrow this gap, I have chosen a specific topic that is common to all graduating senior high school students, and that is the understanding of the implications of taking out a loan, whether it be for a car, a micro business or for education.

"Knowledge building represents an attempt to refashion education in a fundamental way so that it becomes a coherent effort to initiate students into a knowledge creating culture" (Scardamalia & Bereiter, 2006). Powell and Alqahtani (2016) propose that "investigative technological tools," should include specifically designed tasks, and an environment where small groups of students can collaborate, and researchers can monitor, gain insight and quantify progress in student understanding of mathematical understanding. Scardamalia and Bereiter (2006) propose creating "epistemic artifacts" that serve in the advancement of knowledge. These artifacts are knowledge building tools to which I have created a loan app using open source dynamic software from GeoGebra[11]. To support the app, I have created six investigative tools which I refer to as tasks. Powell & Alqahtani (2017) state:

> In instrument mediated activity, instruments mediate users' activity or action to achieve a certain goal. While engaging in an activity, users monitor consciously the continuous transformation of an object towards their goal. This mediator role that instruments play governs the user-object relations, which might take epistemic or pragmatic forms. The

11 **GeoGebra** is an interactive geometry, algebra, statistics and calculus application, intended for learning and teaching mathematics and science from primary school to university level.

> epistemic mediation form focuses on the object and its properties. In this form, the instrument helps the user understand the object and its structure (p. 73).

3.2 The explanation of the application and the tasks

The application opens with three "sliders"[12]: amount borrowed, interest rate, and monthly payment (see Figure 3.1). The sliders are synced to a spreadsheet, so the effects on monthly payments can be carefully examined by moving the sliders and noticing changes in the spreadsheet. The spreadsheet consists of eight headings: payment number, monthly payment, amount applied to principal, amount applied to interest, balance due, percent of balance owed, expected percent of balance owed, and the difference between the two percentages. Expected percent owed (column I) and the difference between percent owed and expected percent owed (column K) challenge the idea that, for example, I have a 10-year loan, after 5 years, I expect 50% of the loan to be paid off. The reality can be seen in the spreadsheet. These last three columns will challenge students' "prevailing wisdom" about how a loan is calculated and hopefully, lead to some interesting collaborative discussions among the students. "In this context, student-generated theories and models are to be judged not so much by their conformity to accepted knowledge but by their value as tools enabling further growth" (Scardamalia and Bereiter, 2006, p. 112).

The slider page also displays the total amount paid for the loan and the total interest that is paid. Aligned with the app are 6 tasks to be completed by students who collaborate in groups of, for example, three-four. Each student will be supplied with a laptop or tablet to record their results. Student collaborative responses to the tasks are imported in Google Classroom in a spreadsheet format, that identifies each student's contributions. Using open source software,

[12] In GeoGebra, a slider is the graphical representation of a free number or free angle. You can easily create a slider for any existing free number or angle by showing this object in the Graphics View.

KBDeX, which was introduced to the Rutgers GSE in the spring of 2016, discourse can be examined and quantified for collaborative and individual student growth.

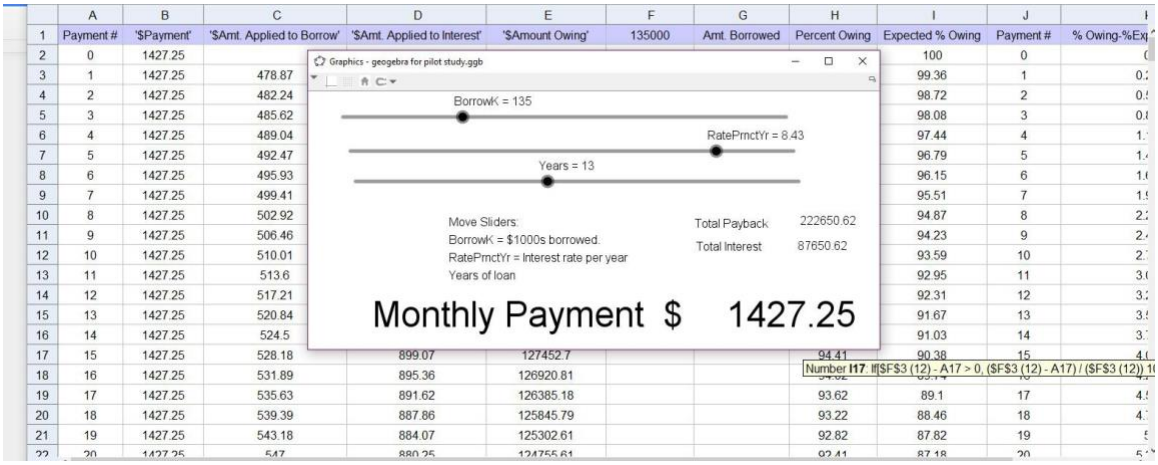


Figure 3.1. The loan app: spreadsheet and sliders.

When we speak of engaging students in "the deliberate creation and improvement of knowledge that has value for a community" (Scardamalia & Bereiter, 2003), the main value is new knowledge gives rise to and accelerates the development of newer knowledge. Therefore, student-generated models are to be evaluated by their value as tools enabling further growth (Scardamalia and Bereiter, 2006).

3.3 The six tasks and their objectives

3.3.1 Task 1: The Sliders

The Three Sliders

The applet is built around the three sliders and the spreadsheet. Each slider represents a different "variable" or factor that contributes to the calculation of a loan payment.

The first slider: the amount borrowed

Say you want to borrow $10,000 to buy a car. The first slider adjusts for all amount borrowed starting at $5,000 and topping out at $500,000, with $500 increments. Note the values are in thousands, so when you see the lowest value at 5, that represents $5,000. I know, boys, you are thinking about that Tesla. Boys and girls, think about the Fiat models instead.

Yes

No

The second slider: the annual interest rate

The second slider represents the annual interest rate that is calculated based on a monthly compounding formula at which you are borrowing the money. Please note you are borrowing from a commercial institution not a parent, grandparent, or close relative, so at 0% interest you are paying back exactly what you borrowed. In the real world, you are paying back more than what you borrowed and the greater the interest rate, the more money you are paying back over what you borrowed.

No

Yes

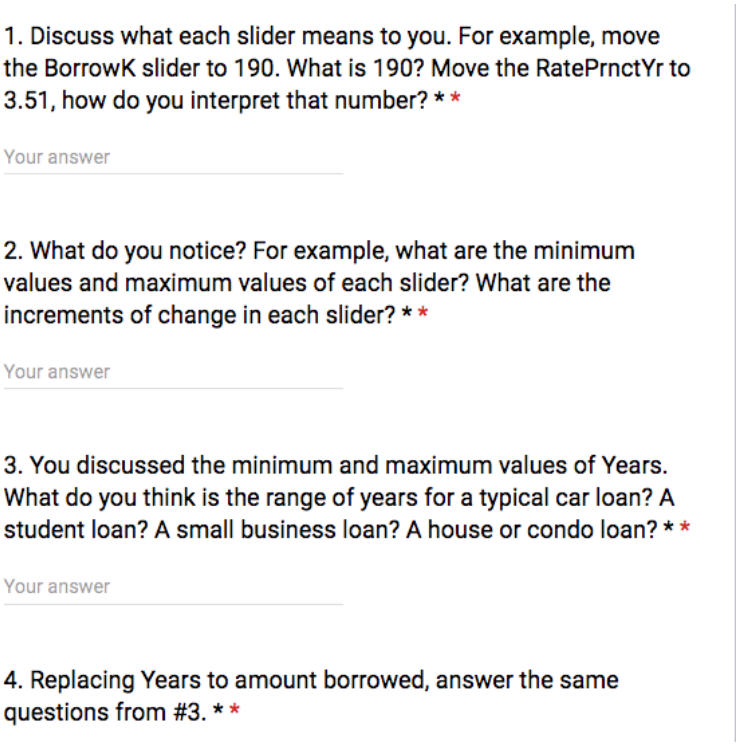


Figure 3.2. Task 1: The sliders

3.3.2 Task 2: Use the sliders and learn each purpose.

Each subsequent task was created with the intent of engaging students in "the deliberate creation and improvement of knowledge that has value for a community" (Scardamalia & Bereiter, 2006, p. 112). Figures ## that follow relate to Task #2. Questions #3 & #4 in this task ask students to build on the information gained from the sliders and require deeper thought as to the implications of the total interest paid on a loan simply by fixing both the amount borrowed and interest rate but changing the number of years over which the loan is to be paid. Question #4 asks students to think about what life circumstances can determine the length of the term of a loan. This problem personalizes the task question and supports "knowledge that has value for a community" (Scardamalia & Bereiter, 2006, p. 112).

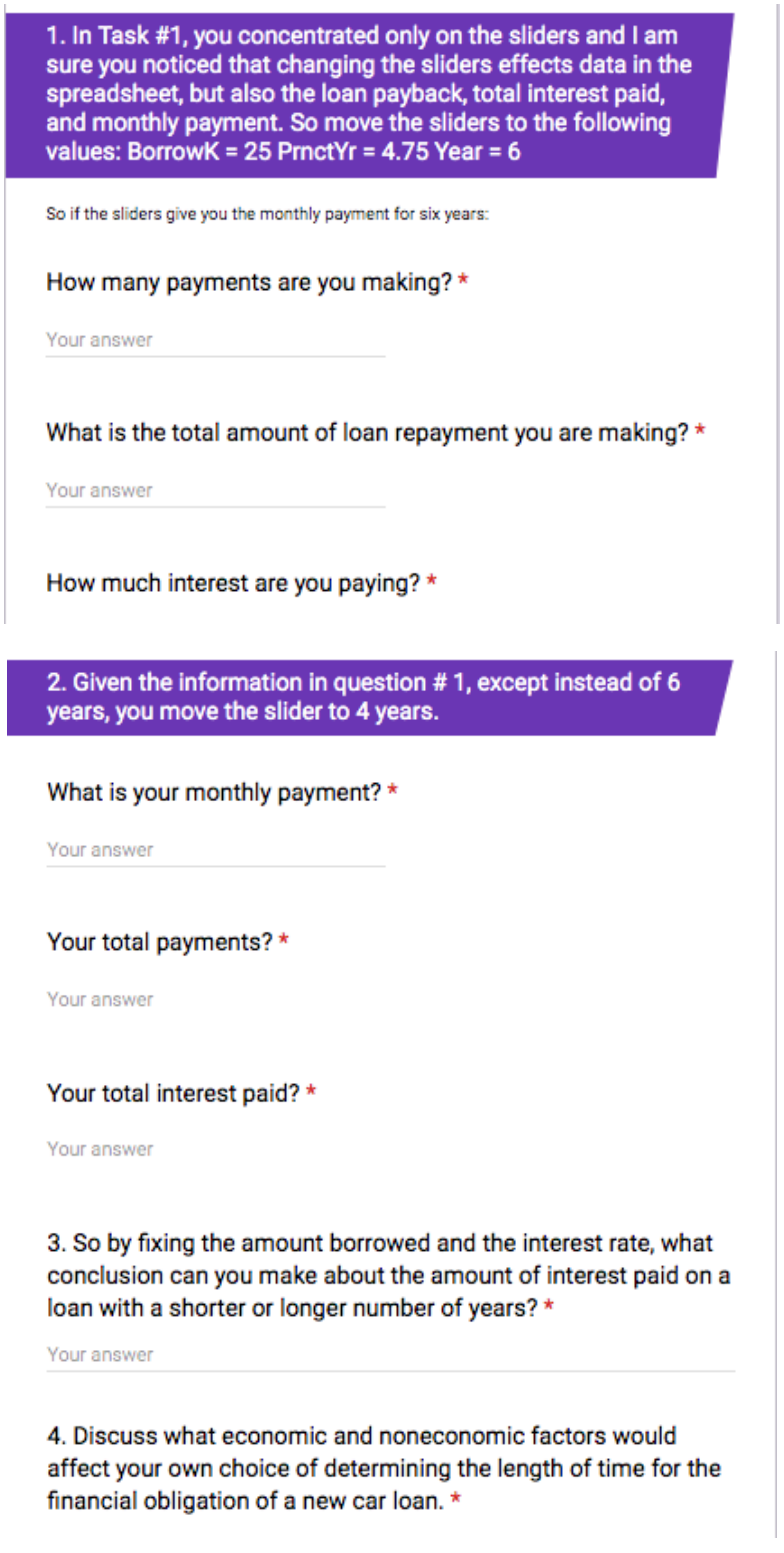


Figure 3.3. Objective Task #2: Use the sliders and learn each purpose.

3.3.3 Task 3

Task 3 introduces for the first time, the effects that the sliders have on the spreadsheet (see Figure 3.4). The objective: In this short segment, students will notice that loan repayments are done monthly and that the actual loan payment is a fixed amount. We are making the first transition from the sliders to the spreadsheet.

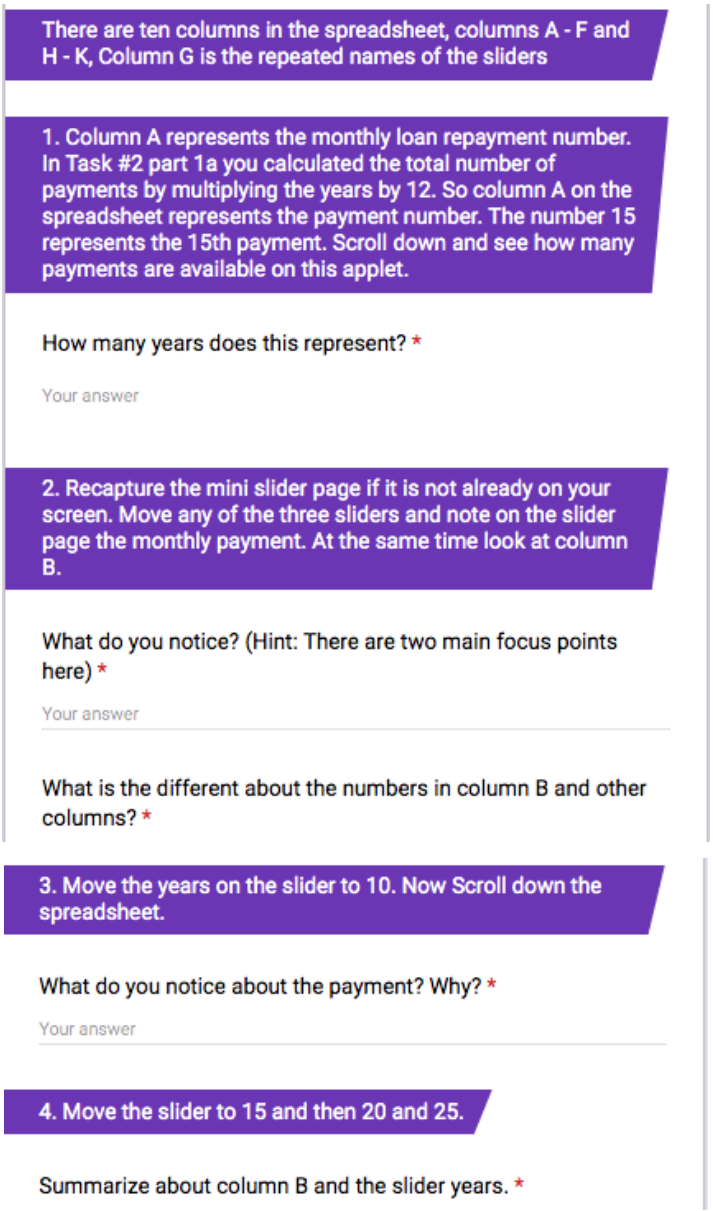


Figure 3.4. Task 3 sliders.

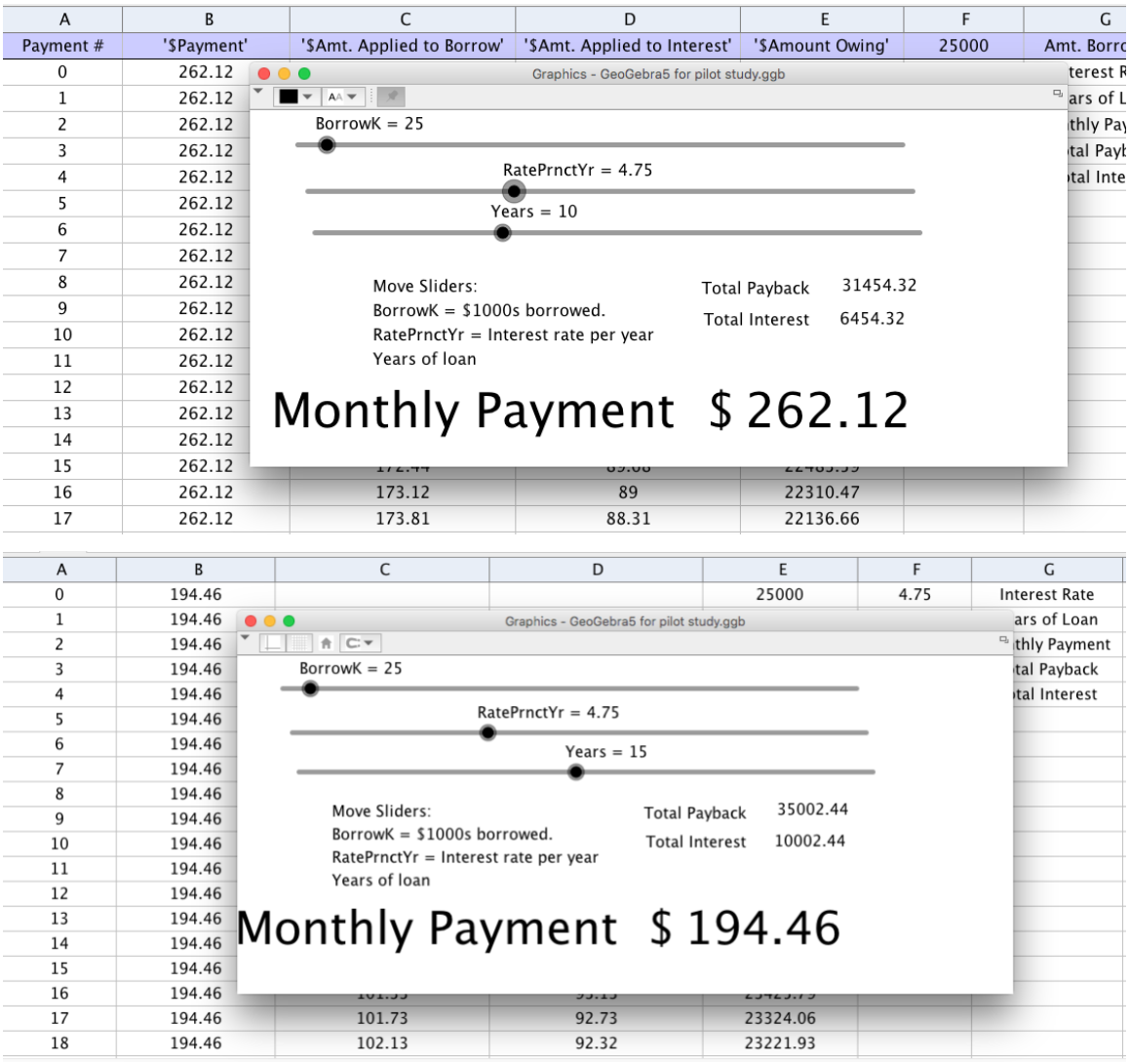


Figure 3.5. The spreadsheet for Task 3.

The intent is for students to notice that the payment stays fixed for the life of the loan. See column B in both screenshots. The years increased from 10 to 15, but the monthly payment given the number of years will always remain the same. The other columns in the spreadsheet have either decreasing (D, E, H, I), increasing (C), or increasing and decreasing (K) values, depending on what the column represents (see Table 3.1 for the column listings and explanations).

Table 3.1. The spreadsheet column headings and explanation

Column	Heading	Explanation

A	Payment #	Increasing the progression of payments
B	'$Payment'	The fixed $ monthly payment for the life of the loan
C	'$Amt. Applied to Borrow'	the portion of the $ payment that is applied to the original amount borrowed
D	'$Amt. Applied to Interest'	the portion of the $ payment that is applied to the interest amount borrowed
E	'$Amount Owing'	After the $ payment, the amount remaining owed to the principal
H	Percent Owing	After the $ payment, the percent still Owed
I	Expected % Owing	For example, when half of the total payments are made, there is an expectation that 50% of the loan has been paid.
J	Payment #	Repeat of column A
K	% Owing-Expected % Owing	The actual difference between the % owing on the loan and what % the borrower is expecting owing.

3.3.4 Task 4

Task 4 asks the students to investigate and summarize the changes in columns C & D as the sliders are moved (see Figure 3.6). The objective is for students to understand that only a portion of the payment is applied to the loan principal, while a portion is applied to the interest. Students will also notice that the apportionments change as the loan progresses and they will notice the "direction" of the changes (see Figure 3.7).

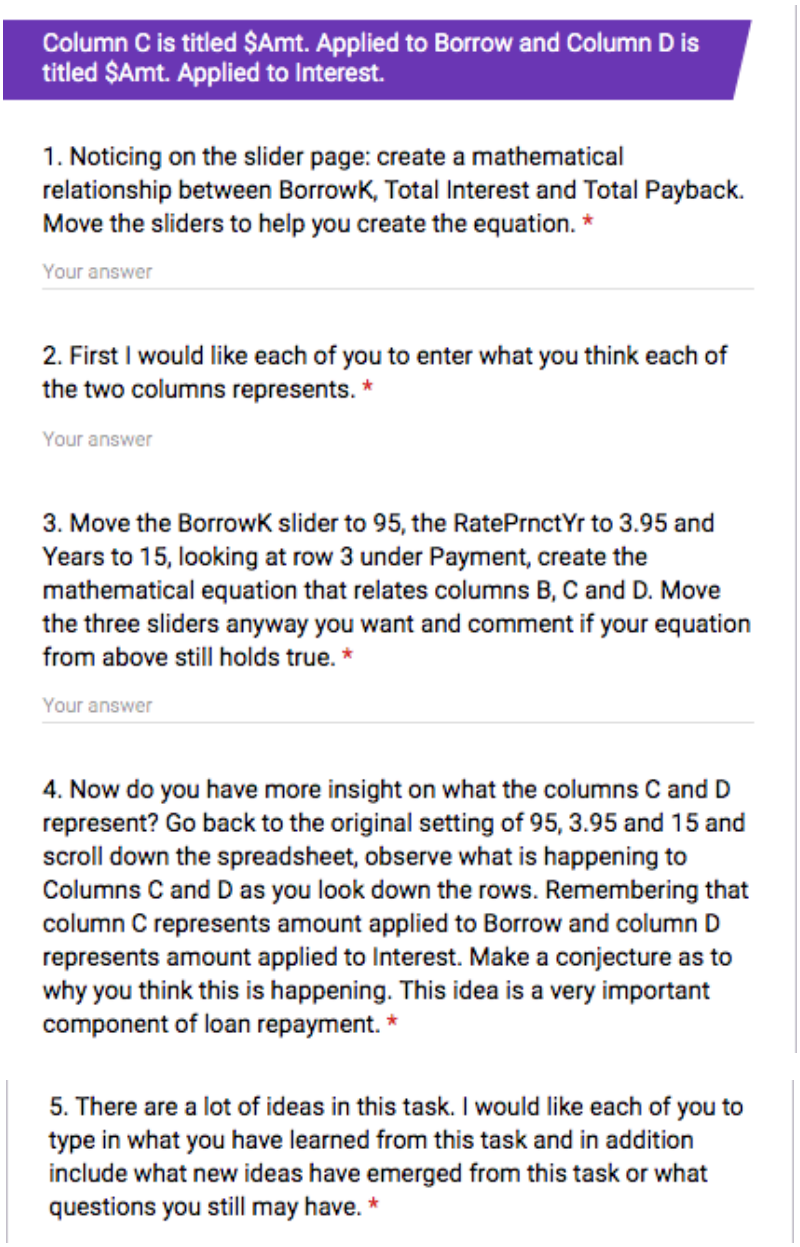


Figure 3.6. Task #4 Columns C & D questions.

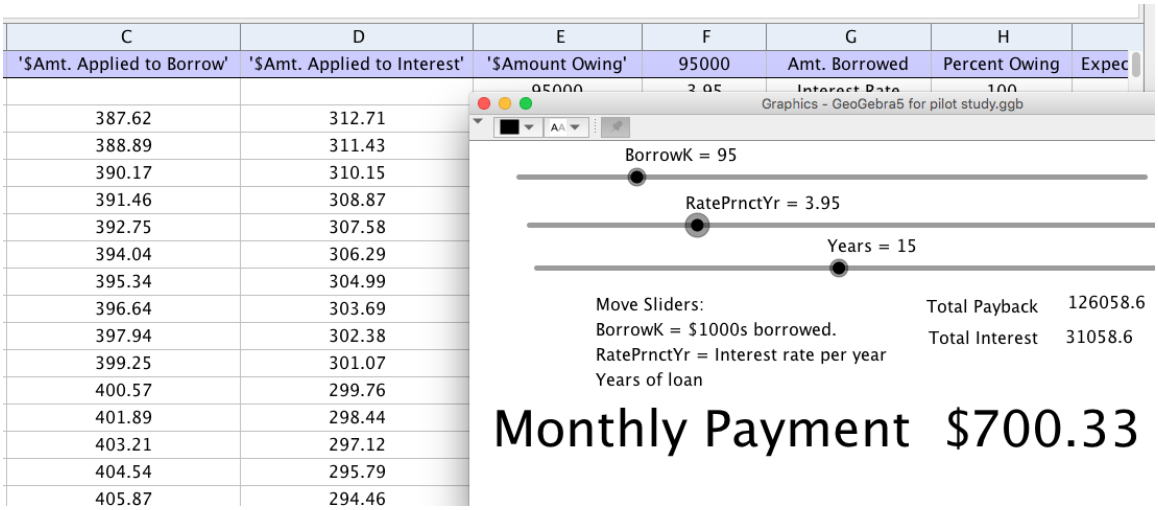


Figure 3.7. Task #4, a view of the spreadsheet, columns C & D.

Note that the amount applied to the principal increases as more payments are made, while the amount applied to interest decreases as more payments are made. Question #5 on Task 4 challenges students to create a deeper dialog within each group in order to gain a better understanding of how the payment of a loan is partitioned. Vygotsky's Zone of Proximal Development[13] interprets the growth in knowledge that is promoted with this question.

3.3.5 Task 5

In Task 5, students are asked to interpret the sliders' effects on columns E, H and I. Column E quantifies the balance due on the loan after payment has been made. Column H is the percent of the loan still outstanding while column I quantifies the 'expected' balance of the loan. The expected percent is simply the ratio of the payment made to the total number of payments. The non-linear relationship between the amount owed and the total borrowed is first introduced in this task. Task #6 will clarify this relationship visually. The tasks were created specifically so that it is not necessary for the app and the tasks to be included solely in a mathematics curriculum.

[13] ZPD, through social interaction in dialogue, the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peer. This is explained in detail in the sub chapter Social Network Analysis at the end of this Methodology chapter.

Column E is titled "$Amount Owing" and column H is "Percent Owing." So column E refers to the amount still owed on the loan after a payment is made. Column H is the percent of the loan still owed after the payment is made. Column I will be explained as you perform the task.

1. So we are all together, move the sliders from top to bottom to: 135, 4.03, 15. Just to confirm, make sure your monthly payment is $1000.61. Now go to the spreadsheet and let's do some arithmetic. Nah, let the software embedded in the spreadsheet do the arithmetic. Much better. Here's how this works. From the previous task, we noticed that the $ Applied to Borrow each payment is increasing and the $ amount applied to interest is decreasing with each payment. Use your mouse and click on cell F9, then the = on your keyboard. Click on cell E10 then the – on your keyboard and finally cell E9 and enter. By how much did the amount owed on your loan become reduced? *

Your answer

2. Now go to cell F165. Are you getting close to paying off your loan? How close? How many more payments do you need to make? Again press = on your keyboard, then click on cell E165 then the – on your keyboard and finally on E164 and enter. By how much did the amount owed on your loan now become reduced? What can you conclude? (Hint: are you making much headway in paying off a loan in the early months?) *

Your answer

3. So now you have a 15 year loan. Does it make sense that after half the payments are made you should owe 50% of the balance? Column I represents the percent you would expect to owe after each payment. So scroll down Column I till you get to the 50% cell. Look to the column directly to the left. Do you still have 50% of the loan remaining? What is your interpretation? Record that percent still owing and remember the slider values. To support your conjecture, go to Column E to check the dollar amount owed at the same payment. Are you convinced? *

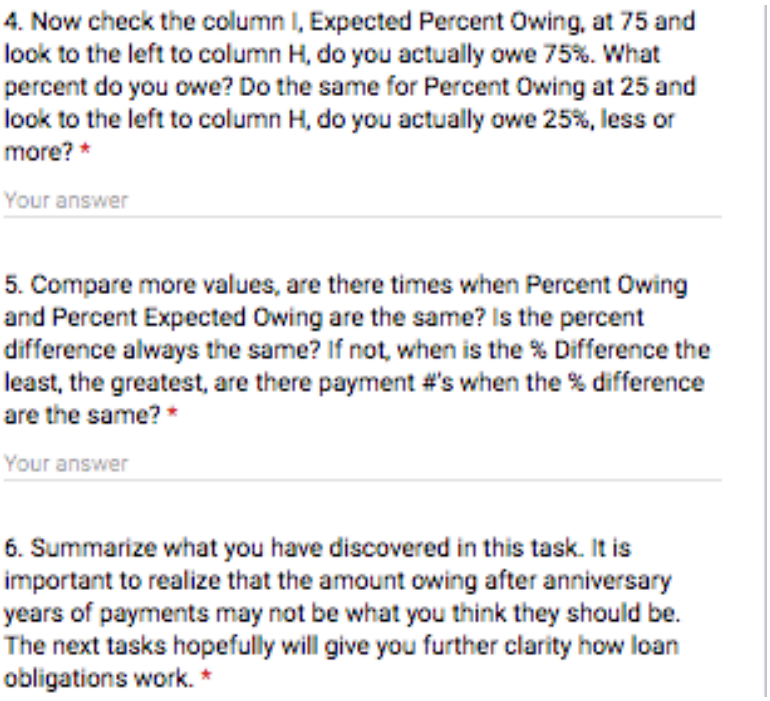


Figure 3.8. Task 5 questions.

Table 3.2 is the values shown in columns E, H and I from the spreadsheet after the 90th payment or half-way of a 15-year loan (see Appendix C). By comparing actual percent owing and expected percent owing, students will recognize an important characteristic of loan repayment. They will discover two contributing factors to the gap. One is the interest and the other is the number of years. They will see that the amount borrowed does not affect the gap. In Task 6, more clarity will become evident as the gap between percent owing and expected percent owing increases as the interest rate and or the number of years increases.

Table 3.2. Columns E, H & I on the Spreadsheet: '$Amount Owing', Percent Owing, Expected % Owing

Half-way point of a $135k, 15-year loan

E	H	I
'$Amount Owing'	Percent Owing	Expected % Owing

$77607.27	57.49	50

Note: a 15-year loan requires 180 monthly payments.

3.3.6 Task 6

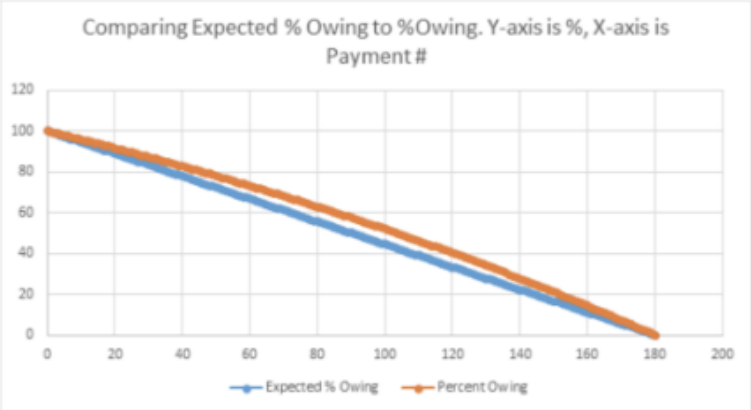
Task 6 investigates the effects on Columns H, I & K on the spreadsheet as the sliders are changed. Objective: to gain an understanding of what is meant by expected percent owing, and then to comment on the graphs displaying the relationship

- Between the percent Owing to payment # and % expected to payment #.
- The graphical relationship between the differences between the % Owing - % Expected owing to the payment number.

This final task completes the investigation of the relationship between the payment number and the difference between percent owing and expected percent owing. In this task, subjects are noticing the graphical relationship in which the prior task depended on an algebraic view of the relationship. Task #6 creates a visual environment in which subjects can build knowledge in an alternate medium. There are two graphs in this task. The first graph, I created showing the linear relationship of expected % owing and the non-linear relationship of percent owing versus payment #. The goal is to assist subjects' understanding that the algebra of both expected percent and actual percent are different; and the changes that are in the "curvature" as we adjust the sliders.

For the second graph in the task, the subjects create their own graph of %owing - %Expected Owing versus Payment #. The students are asked to comment about what the curvature actually represents on the curvature of the graph and how the curvature changes with the changes in the three variables of the sliders.

Column K, gives the difference between %Owing and % Expected Owing.



1. Comment on what you notice as you scroll down column K. Just to review, 90 payments is half of the loan time. When you make your 90th payment, do you expect 50% of the loan paid off? What is the actual percent paid off? *

2. Look at the graph above, the x-axis represents the number of loan payments and the y-axis represents the percentage of the loan still owing. Both the expected percent due and the actual percent due are on the graph. There is a gap showing, what does the gap represent? *

Your answer

3. Approximately what month is the gap the greatest? *

Your answer

4. Let's make the problem a bit simpler to observe for this task. Move the sliders to borrowing $100,000 at an interest rate of 3.2%. We are keeping the years to 15. Just to check make sure your monthly payment is $700.24. After your 90th payment which is half of the total payments made, how much do you still owe? *

Your answer

5. Go back to column K, the percent difference in amount owing vs expected amount owing is what? *

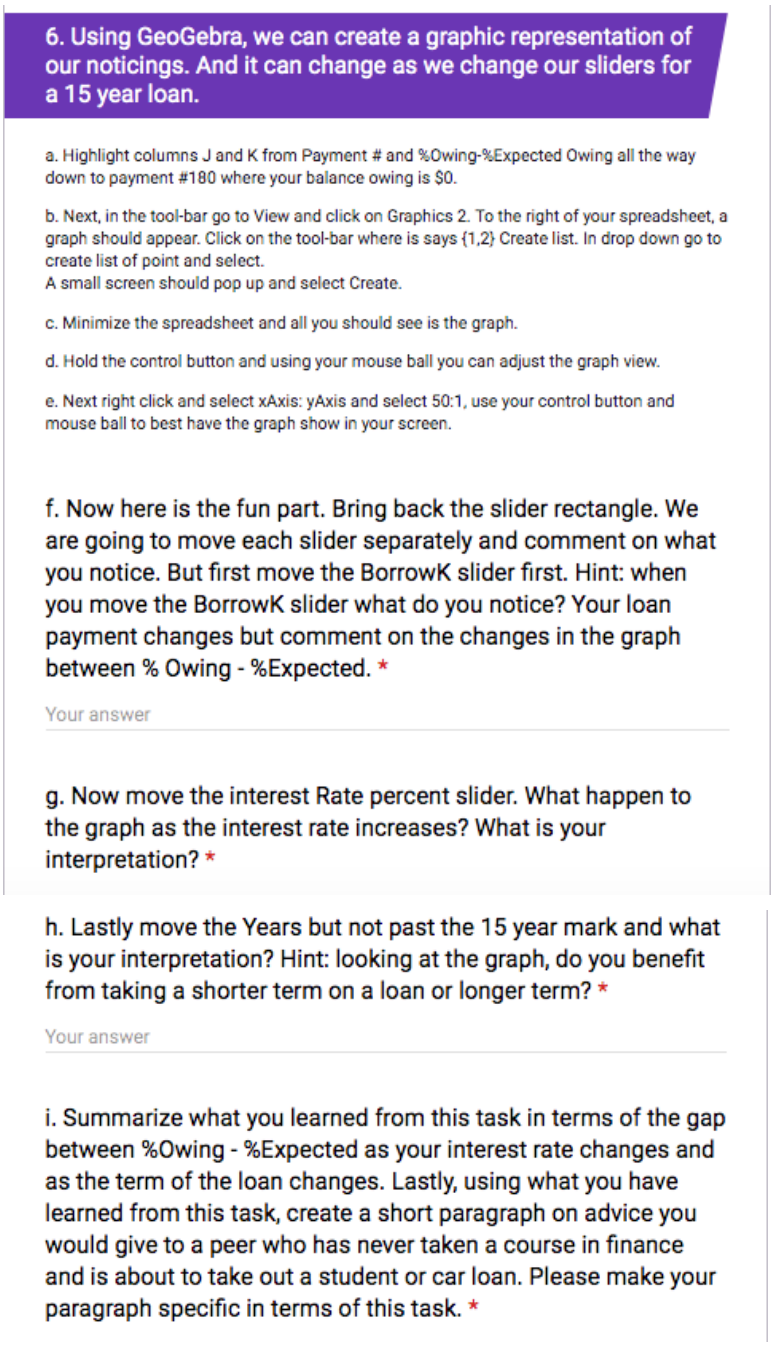


Figure 3.9. Task 6, Columns H, I and K on the spreadsheet.

3.4 Social Network Analysis: Knowledge Building, Creation and Analysis

The core idea is suggested by the conjunction of the two keywords, 'creation' and 'building': "Knowledge is the product of purposeful acts of creation and comes about through building up a structure of ideas out of simpler ideas" (Bereiter & Scardamalia, 2014, p. 35).

A Knowledge Building classroom focuses on the advancement of community knowledge as students assume collective responsibility. Individual learning then becomes an important by-product of both the creation and building of knowledge (Scardamalia & Bereiter, 2006). Bereiter & Scardamalia (2014) state that education must give serious thought to the gradual transfer to students of the kinds of epistemic responsibilities traditionally reserved for the teacher.

Therefore, in a knowledge building environment, teachers create tasks whereby stakeholders: assume the responsibility of formulating knowledge goals, identify problems and difficulties, assess knowledge progress, revise questions, and experience growth in "intellectual engagement and equality of opportunity" (Bereiter & Scardamalia, 2014, p. 40).

Knowledge creation and/knowledge building with technological tools can provide a number of supports that are essential in enabling students to carry through efforts of knowledge creation. Therefore, the technology design challenge is to produce tasks such that the responsibility for growth lies in the hands of the students rather than "micromanaging the process the way 'scripts' are prone to do" (Bereiter & Scardamalia, 2014, p. 43).

There are social network analysis software technologies that provide meaningful quantitative analysis to researchers, teachers, and students engaged in collaborative knowledge work. These social network analysis tools identify the more varied interaction among students and between students and ideas. These quantitative analyses provide teachers with a deeper assessment of knowledge growth than traditional assessment methods.

Collaborative instrumental appropriation is described as follows:

> In the process of ‘instrumental genesis’, users develop mental schemes that transform the tool from being simply a material ‘artifact’ to become a functional ‘instrument’, used in ways that become progressively more mathematically sophisticated. Users develop schemes concerned not just with immediate operational manipulation of the tool (referred

> to as ‘usage’ schemes), but with ulterior mathematical action (referred to as ‘instrumented action’ schemes). It is this latter aspect that links users’ developing mastery of the tool with the wider development of their mathematical knowledge (Ruthven, 2008, p. 383).

As incorporated into the classroom, students develop schemes concerned not just with immediate manipulation of the tool but the broader development of both individual and cooperative mathematical knowledge Ruthven (2008). Instrumental genesis differentiates an artifact (a man-made object/tool) from an instrument (a psychological construct) by defining the latter as formed by an artifact together with one or more associated utilization schemes that emerge from an instrumental activity. Tools are artifacts that can amplify or modify our abilities to create knowledge building or knowledge creation. They are shaped and fashioned in ways that contain the potential to manifest human imagination. Hence, the value of a tool is intertwined with its user, and how one uses it (Leung & Yip-Cheung, 2006).

3.5 Knowledge Building Discourse Explorer KBDeX

In a paper presented at the Collaborative Innovation Networks Conference (“COINs2010;” Matsuzawa, Oshimaa, Oshimaa, Niiharaa, 2011) the authors compared collaborative learning environments, even the most well-structured with specific tasks and bounded time limits, versus “knowledge building” environments where students are encouraged to collaborate in a “flexible manner” within their groups. The time schedule is not fixed which allows for the “emergent nature of the learning.” And, with the additional benefit of an unbounded time schedule, students see no end to their learning. The question becomes, how do we assess what “knowledge building” has taken place? Currently, there are three “methodological” approaches to quantify the emergence of knowledge by researchers (Matsuzawa et al., 2011):

- In the first approach, researchers establish rubrics which identify what content knowledge students are expected to acquire. How much student knowledge has advanced can be seen by the rubric score?
- The second approach involves researchers analyzing the process of learning by examining smaller units to categorize different "cognitive actions." The researchers then identify different patterns of "cognitive processes." This is different from the first approach since emergent knowledge is now evaluated more on a micro level than the total view from a single rubric score.
- The third approach employs one of the methods of discourse analysis. This becomes more of a descriptive model which can be used as a case study.

Knowledge Building Discourse Explorer (KBDeX)© was created as a computer-supported collaborative learning environment for analyzing the network structure of discourse. The goal is to "capture collective knowledge advancement" through a macroscopic lens, "not only to facilitate productive communication between researchers who are engaged in research on knowledge building or emergent collaborative learning, but also to encourage learners to explore their own group dynamics by themselves" (Matsuzawa et al., 2011).

KBDeX software uses a network science analytical approach to the individual differences in learners' contributions to discourse in a collaborative learning environment. The software analysis platform to visualize network structures of discourse is based on a two-dimensional graph of words × discourse units. KBDeX users must prepare discourse data in comma separated format (.csv) and a list of target words in general text format (.txt) that you want to select for creating a two-dimensional graph. The list of target words, (nouns only), is created by the researcher based on the learning objectives, while the discourse from the subjects is imported to

Knowledge Forum® from Google Classroom spreadsheets. KBDeX software retrieves the data automatically from Knowledge Forum®. Figure 3.10 shows the list of target nouns in the left panel. The frequency of all words in the middle panel, with the target words in red. The right panel is the imported text from Knowledge Forum from the three subjects engaged in a collaborative learning environment.

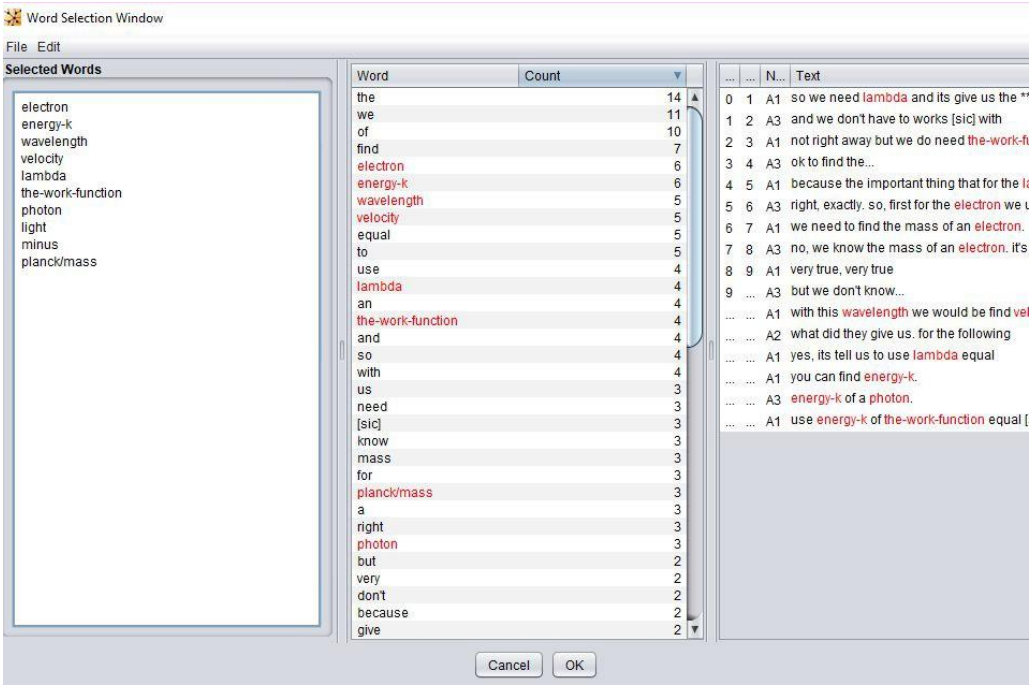


Figure 3.10. Sample KBDeX Word Selection Window

KBDeX builds three different network structures from the data and shows them with a discourse viewer (see Figure 3.11). The main view of KBDeX has four windows: (1) The discourse viewer which shows an overview of the discourse and selected word (top left window and target words in red), (2) the network structure of students (top right window), (3) the network structure of discourse units (as note in the Knowledge Forum®) (bottom left window), and (4) the network structure of selected words (bottom right window). The networks of notes (3) and words (4) are created by the two-dimensional network of notes × words; each of them is shown as a one-mode

projection of a two-dimensional network. The network of students (2) is also a one-mode projection of the words × students' two-dimensional network (Matsuzawa et al., 2010).

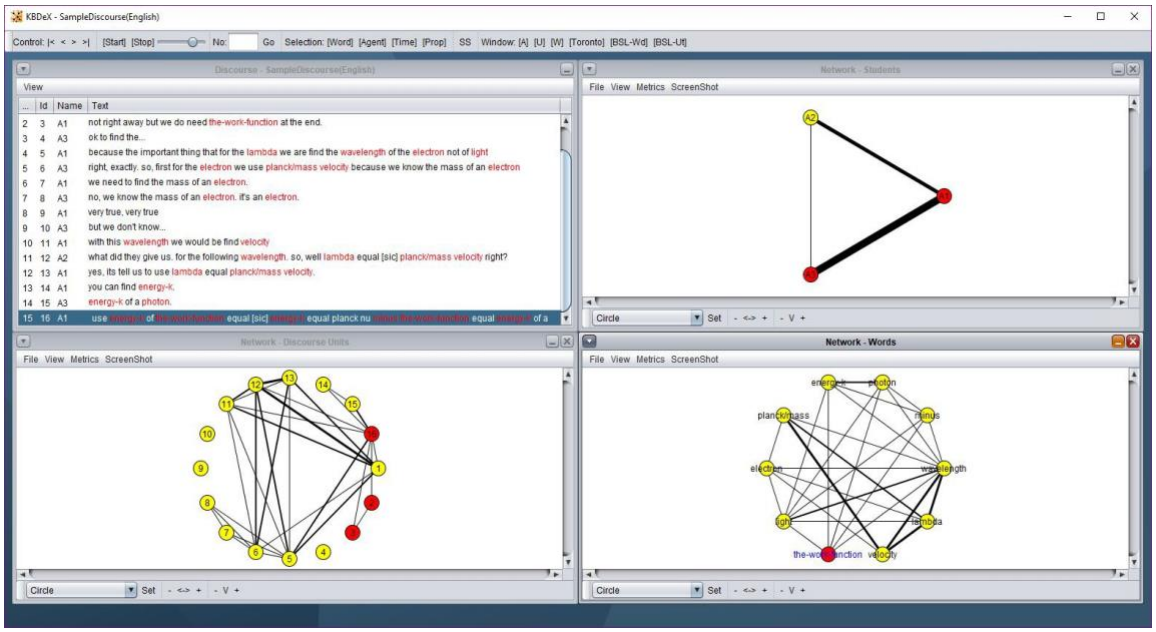
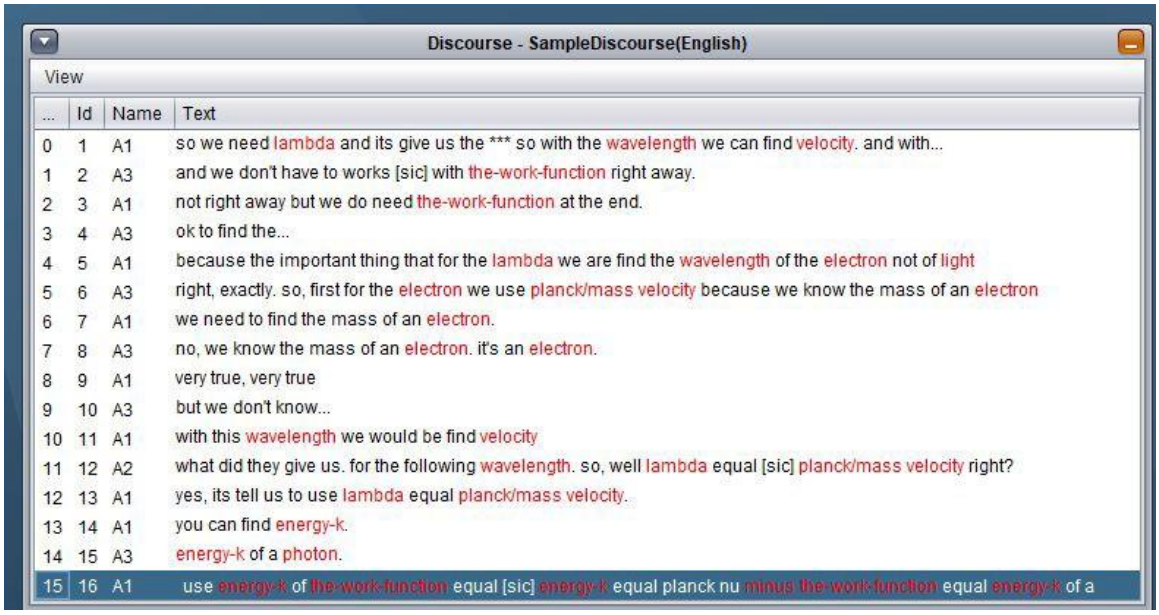


Figure 3.11. Sample KBDeX Discourse Viewer.

For easier viewing, see the separated panels below:



Discourse - SampleDiscourse(English)

View

...	Id	Name	Text
0	1	A1	so we need lambda and its give us the *** so with the wavelength we can find velocity. and with...
1	2	A3	and we don't have to works [sic] with the-work-function right away.
2	3	A1	not right away but we do need the-work-function at the end.
3	4	A3	ok to find the...
4	5	A1	because the important thing that for the lambda we are find the wavelength of the electron not of light
5	6	A3	right, exactly. so, first for the electron we use planck/mass velocity because we know the mass of an electron
6	7	A1	we need to find the mass of an electron.
7	8	A3	no, we know the mass of an electron. it's an electron.
8	9	A1	very true, very true
9	10	A3	but we don't know...
10	11	A1	with this wavelength we would be find velocity
11	12	A2	what did they give us. for the following wavelength. so, well lambda equal [sic] planck/mass velocity right?
12	13	A1	yes, its tell us to use lambda equal planck/mass velocity.
13	14	A1	you can find energy-k.
14	15	A3	energy-k of a photon.
15	16	A1	use energy-k of the-work-function equal [sic] energy-k equal planck nu minus the-work-function equal energy-k of a

Figure 3.12. Sample discourse units for three subjects with selected nouns in red.

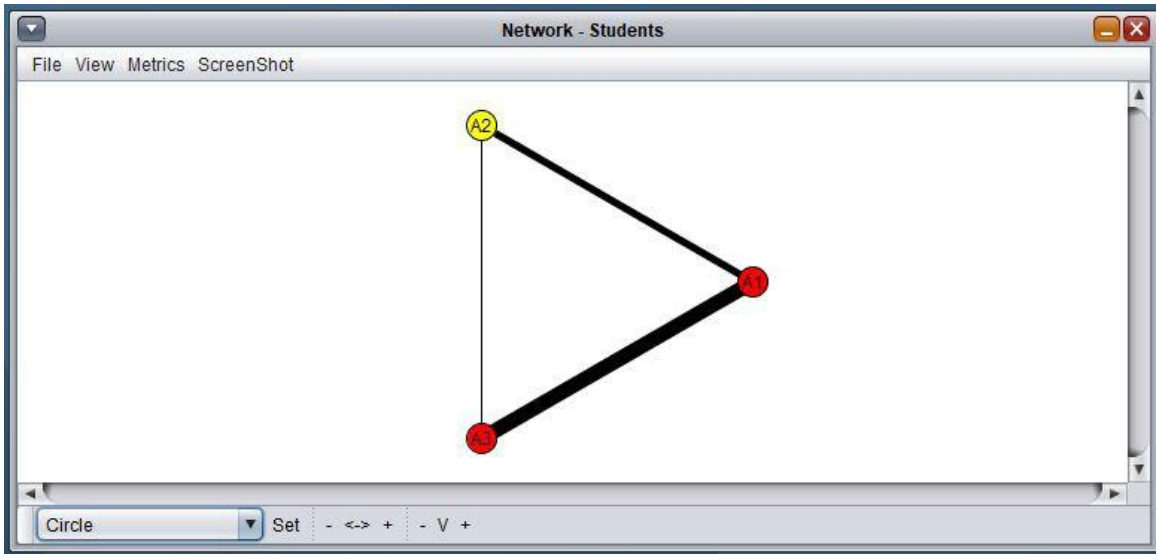


Figure 3.13. Sample of Graph of Interaction of Students. Note: the interaction among the subjects based on the target word used. The thicker the line, the more repeated interaction between subjects.

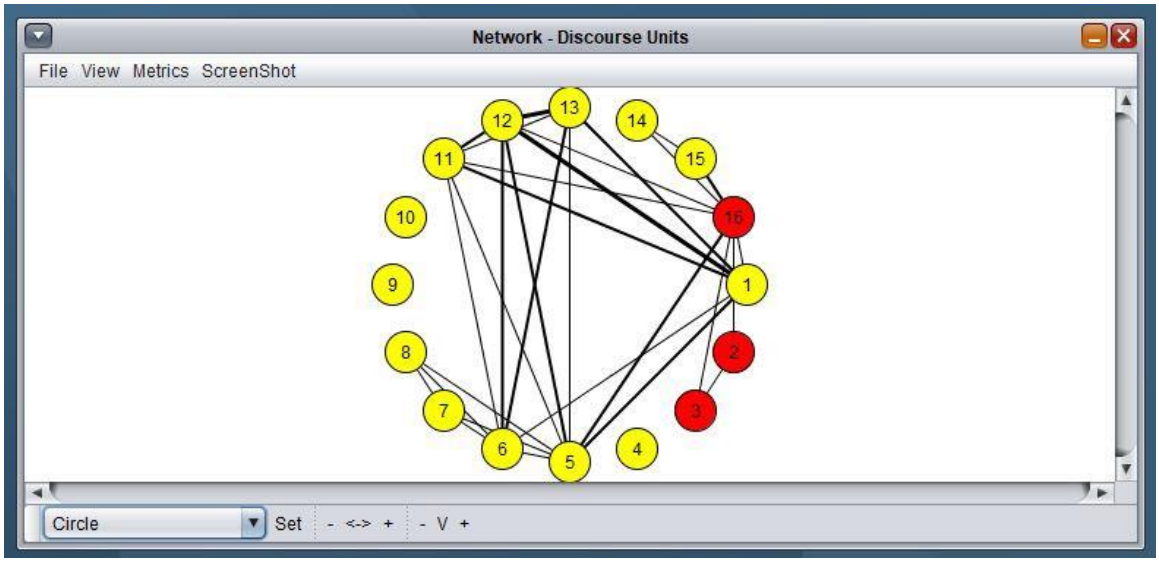


Figure 3.14. Sample of Network of the discourse units.

There are 16 discourse units, but three include the target word. The red circles represent the same target word used by subjects A1 and A3 in discourse.

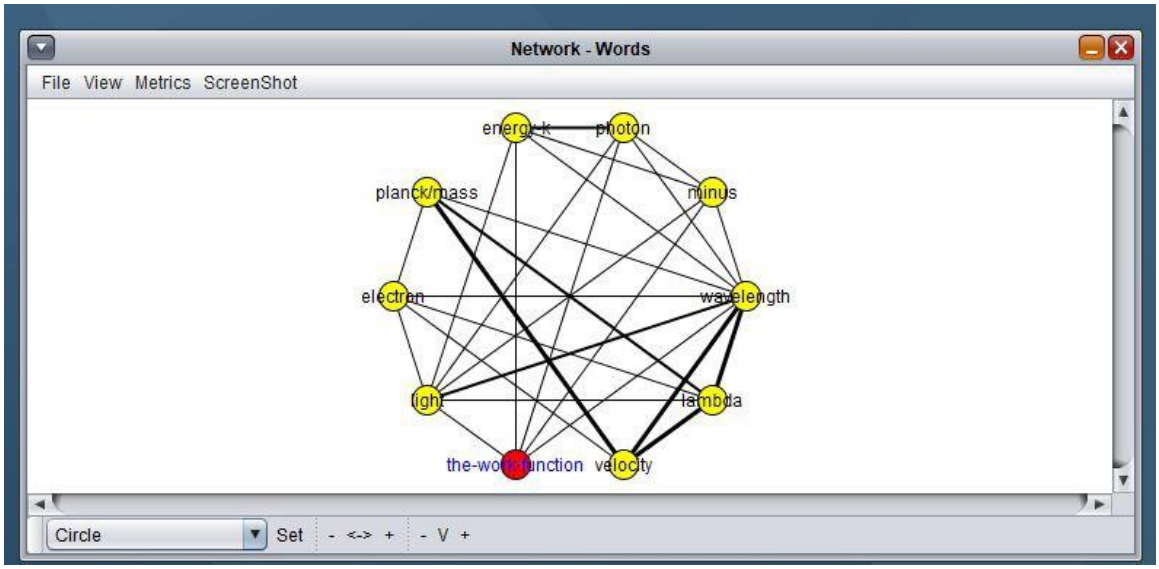


Figure 3.15. Sample of Network of words: keywords chosen a priori to the task. Note: The red circle is the same target word in the previous panels.

According to Oshima, Oshima, & Matsuzawa (2012):

> Exchange between learning modes is iterative, such that learners continuously participate in social practices of knowledge creation, and individuals generate knowledge that not only directly contributes to the advancement of community knowledge but also determines how best to contribute to this advancement (p. 906).

Traditionally, there are two types of learning assessment approaches: acquisition and participation metaphors. The authors of KBDeX prefer a higher complexity assessment based on the knowledge-creation metaphor.

> In the knowledge-creation metaphor, researchers are not only concerned with learners' comprehension of domain-specific knowledge but also with individuals' contributions to community knowledge. The learners' epistemic activities of utilizing their individual knowledge to improve their community knowledge cannot be analyzed by assessing static knowledge in a pre- and post-test design. Categorization of written or oral discourse during learning might be able to identify the epistemic activities, but such a coding scheme is content-free and what knowledge learners actually contribute cannot be examined (Oshima, et al., 2012, p. 907).

The new approach proposed by Oshima et al. (2012) applies social network analysis, but proposed a different type of social network, one based on the words learners use in their

discourse in a CSCL (computer supported collaborative learning) environment. The authors through their development of KBDeX software and the Knowledge Forum® analyze discourse data for examining participation patterns and states of community knowledge. KBDeX can measure a variety of coefficients used in complex network science, such as those for betweenness centrality (BC), degree centrality, and closeness centrality. Betweenness centrality is a measure of the number of node pairs for which the shortest path between them passes through a selected node. High betweenness centrality suggests that the selected node works as a key mediator in linking other nodes. Betweenness Centrality therefore identifies nodes in the network that are crucial for information flow.

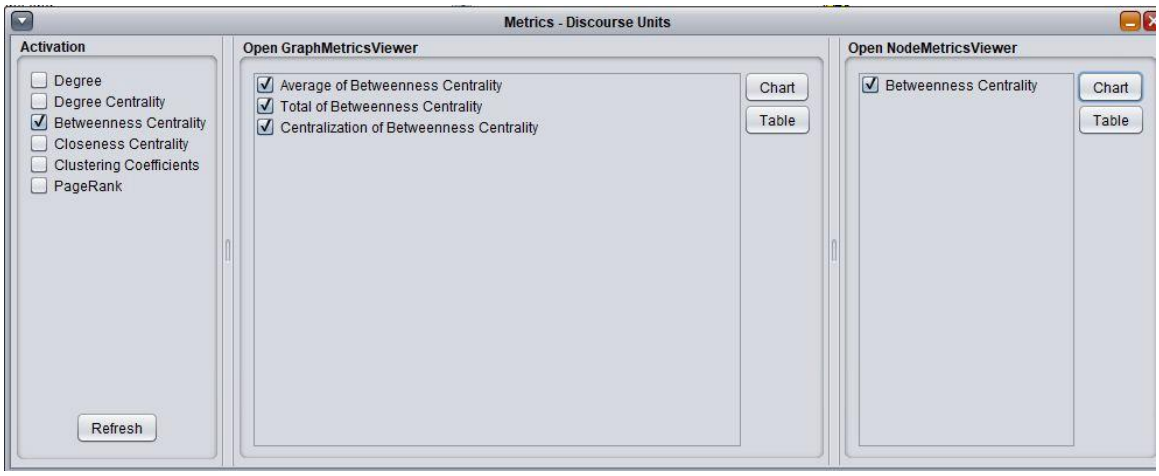


Figure 3.16. Selecting the metric for measuring Betweenness Centrality

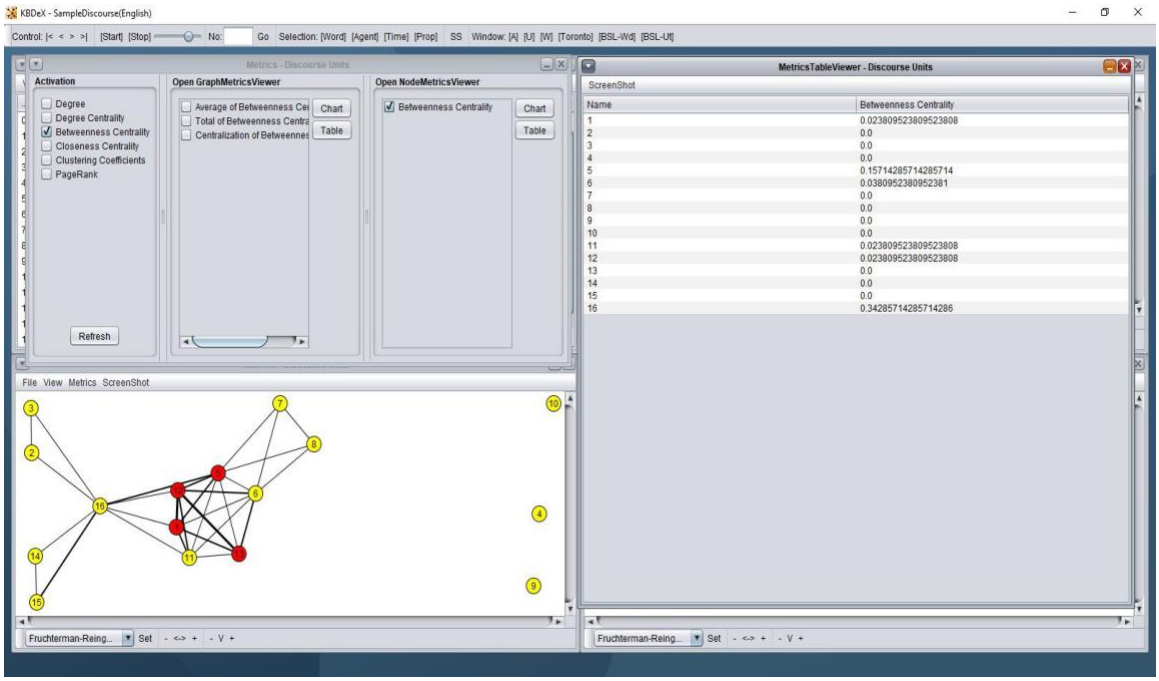


Figure 3.17. Sample of betweenness centrality among 16 discourse units.

Degree centrality is a straightforward concept that indicates cumulative path lengths by which each node is linked to other nodes in the network. High degree centrality means that the node is at the center of the network, or near the center of a local cluster in the network. The degree of a node in a network is the number of edges connected to it.

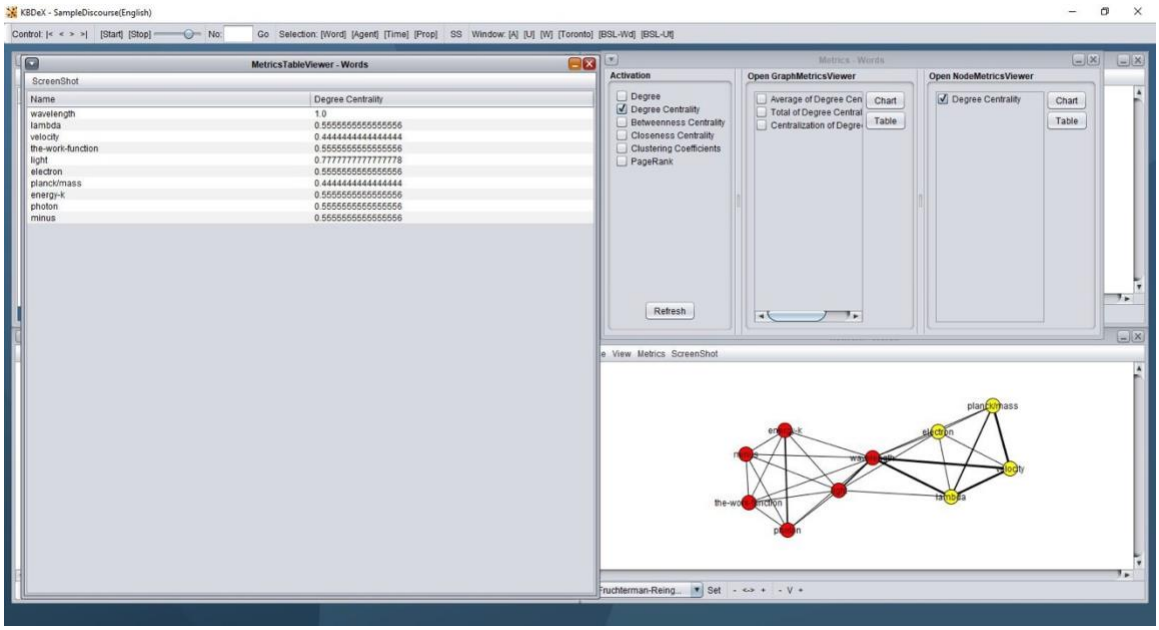


Figure 3.18. Sample of target word "wavelength" in red.

Researchers are interested in discourse data for examining participation patterns and states of community knowledge. In addition, we are looking at the individual contributions to the community. KBDeX software provides platforms for both, by examining the networks of discourse units, subjects, and target words.

3.6 Methodology Summary

Summarizing the process of closing the financial literacy gap of senior high school urban students:

- Creation of the loan app using open source software
- Creating six tasks for students to apply the software
- Collaboration in small groups using Google Classroom
- Quantifying the results applying KBDeX software

Chapter 4 Results

In 2007, Rutgers, the State University of New Jersey established the Rutgers Future Scholars Program to increase the high school graduation rate of low income but academically promising students in Camden, Newark, New Brunswick, and Piscataway. In 2016, students from Rahway were admitted to the program. Students who successfully completed the program and are admitted into Rutgers University are eligible to receive four years of free tuition via grants and scholarships. Each year, the Rutgers Future Scholars program selects 200 students from the five school districts, plus select students from one Rutgers-affiliated Charter School (Leap Academy University Charter School).

Six senior high school Rutgers Future Scholars equally divided between boys and girls from different high schools in Newark piloted the program to apply the six tasks that accompany the Loan App. The students met on two successive Saturdays in January for three hours each day. They were randomly assigned into two groups of three and each student was supplied with a Chromebook. The goal is to apply the principles of Social Network Analysis to the discourse and apply the software application of Knowledge Building Discourse Explorer, to quantify the growth in understanding of both the collective group and the individual as they are able to manipulate and understand the complete set of variables that contribute to the stages and outcomes of borrowing money from a financial institution. Within each group, students worked collaboratively but recorded their responses to the tasks individually in Google Classroom. The discourse was exported to Google Sheets as part of the Classroom Environment. I selected a sample of the many responses and created Excel spreadsheets in order to export to the KBDeX software.

Prior to the tasks, the students were given an individual Pre-Pilot survey in Google Classroom to gain insight into their daily lives (questions 1-4) and to their prior knowledge (questions 5-8) about the variables that contribute to the outcomes of assuming the responsibility of a loan.

Table 4.1. The pre-pilot questions

1. Check all answers that apply to you:
Do you have a part-time job at least 6 months out of a year? **Do you have a credit card or debit card in your name?** **Do you have a savings account that you contribute to regularly?** **(Monthly, weekly deposits), Do you contribute directly to household expenses?** **Do you do your own laundry or regularly cook family meals?**
2. In the next five years will you need to borrow money to pay for education, a car, a business or other? Four students replied yes, and two replied no.
3 a. If you answered "no" to question # 2, check all that you will be self-funded
3 b. If you answered "yes", from the list above, check which categories you will need to borrow money.
4. Whether you answered "yes" or "no" to question #2, what sources are you most likely to borrow money from?
5. When we are discussing a loan, what do we mean by "interest"?
Only two students used the word "percentage" in their response.
6. When we are discussing a loan, what do we mean by the "principal"?
Five of the students answered correctly
7. How often are payments made against a loan?
Three students knew that loan repayments are made monthly. One did not know any answer.
8. If you sign for a 10-year loan, after 5 years you have paid off: **Four students replied, "less than half" but did not explain their reasoning.**

In Task #1, the six Rutgers Future Scholars were introduced to the Loan App and were asked to move the sliders and comment on what they noticed. The sliders represent the three variables; amount borrowed, interest rate and the number of years. The six students in their two groups of three began their collaborative investigation of borrowing money from a financial institution. Each student had access to the sliders and recorded their noticings individually.

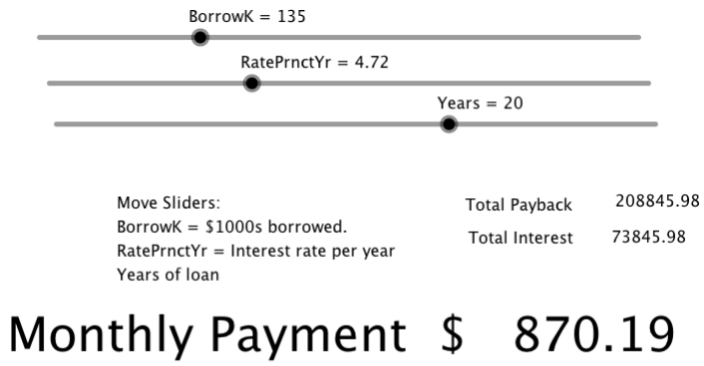


Figure 4.1. The sliders.

4.1 Task #1

1. Discuss what each slider means to you. For example, move the BorrowK slider to 190. What is 190? Move the RatePrnctYr to 3.51, how do you interpret that number?
2. What do you notice? For example, what are the minimum values and maximum values of each slider? What are the increments of change in each slider?
3. You discussed the minimum and maximum values of Years. What do you think is the range of years for a typical car loan? A student loan. A small business loan. A house or condo loan.
4. Replacing Years to amount borrowed, answer the same questions from #3.

KBDeX is an analysis platform to visualize network structures of discourse based on a graph of words × discourse units. The target words are selected by a researcher in consideration of the learning objectives. There are criteria used to select the words which are considered to be important: 1) to learn the subject-matter 2) epistemic words. KBDeX can measure a variety of coefficients used in complex network science, such as those for betweenness centrality (BC), degree centrality, and closeness centrality. I have exported to the KBDeX software the

discussions from the first two questions. The challenge for the students was to move the sliders and see and interpret what is each slider's purpose.

The top left panel represents the total discussions within the two groups. Id's one through three and seven through nine (SB, BV, DT) represent the first group, while four through six and ten through twelve represent the second group (JL, JO, MC). There are four panels in the results, but for ease of viewing in the document, each panel is shown separately in Figures 4.2, 4.3, 4.4, 4.5.

Prior to the discussion, the researcher designates key words that are significant in understanding the task. Here are the key words chosen for task#1, questions 1 & 2:

loan, value, increments, slider, maximum, minimum, number, year, payment, month(ly), rate, borrow, interest, percent. When a student uses a keyword in their discourse, the software highlights that word in red as seen in the panel in Figure 4.2.

Id	Name	Text
1	SB	190 is actually the $190000 that you took out on a loan. the second number is the percent interest.
2	BV	you borrow $190,000 with a 3.51% interest rate, so per month you have to $1,440.66.
3	DT	you are borrowing $190,000, and with the 3.51 interest rate, the monthly payment would be $1440.66
4	JL	190 represents 190,000 dollars borrowed. the 3.51% represents the interest rate per year. the final number represents a
5	JO	190 is the amount we borrowed, in thousands. the rateprnctyr is the percent we need to pay on the money borrowed.
6	MC	190 represents 190,000 dollars borrowed. 3.51 is the interest rate per year.
7	SB	for the first slider, the minimum is 1(or $1000), and the maximum is 500 ($500000). the maximum for the second slider
8	BV	the minimum you can borrow is $1,000, but the maximum value you can borrow is $500,000. the minimum value for the
9	DT	the minimum value is 1,000 while the maximum is 500,000.
10	JL	the minimum value for the borrowk slider is 0k, while the maximum value is 500k with increments of 5k. the minimum
11	JO	the borrow minimum is 0 and maximum is 500 with increments of 5, the rateprncryr minimum is 0 and the maximum is
12	MC	the minimum value for borrowed k is 0 and the maximum is $500,000 in increments of 5k. the minimum value of rate

Figure 4.2. Discourse from questions 1 & 2 from Task #1

The remaining three panels show the interaction between the: Network-students, Network-Discourse Units, Network Words. The top right panel represents the network of students (see Figure 4.3). These are the six students in the two separate groups who participated in the pilot

study. Even though there are two separate groups, the responses can be similar, and the software "recognizes" the keywords that the researcher designates as an understanding of the task.

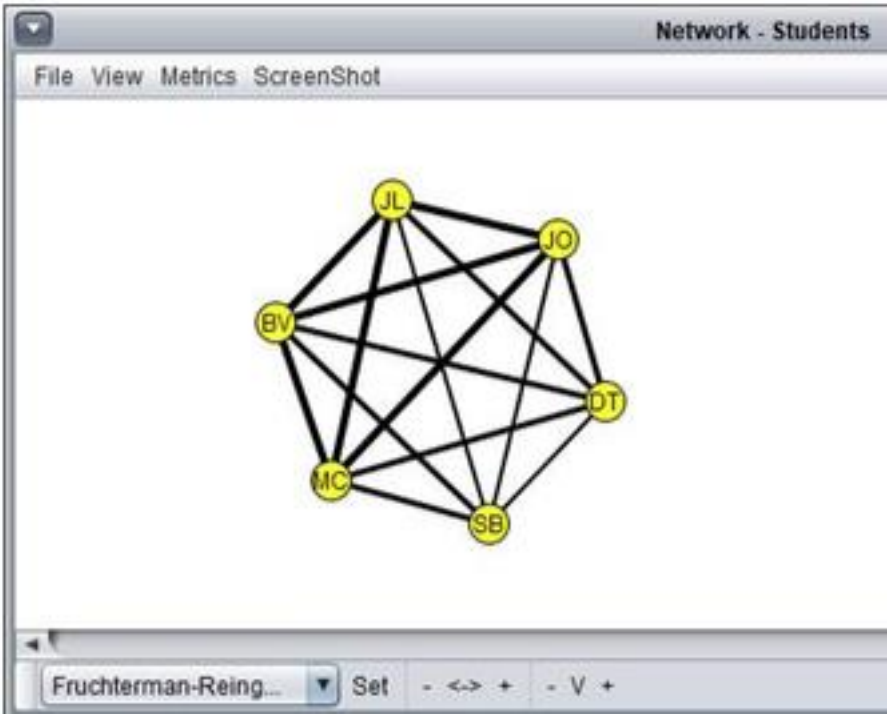


Figure 4.3. Top right panel: Network of Students

The Fruchterman-Reingold Algorithm is a force-directed layout algorithm. The idea of a force directed layout algorithm is to consider a force between any two nodes. The heavier the lines, the greater the connection between the nodes. Notice that JO, JL, and SB were in the same group and yet the connection with SB is weak but the connection between JL and JO is thick. In the group DT, BV, and MC, DT has a weak link between his/her group members. BV and MC have a strong link. This indicates that at the very first task, interaction among all three group members was not necessarily equal, as this is only the first task and a very basic task.

The panel on the lower left of the screen (see Figure 4.4) represents the Network-Discourse Units. There are twelve nodes, each representing an observation from the two groups for the two questions. The KBDeX software calculates the Betweenness Centrality that

identifies nodes in the network that are crucial for information flow. Discourse units 8, 10, 11, and 12 visually appear to have the highest betweenness centrality, which can be interpreted to mean that these discourse units are the center of the students' collaborative interpretation of the sliders. The two groups were able to arrive at the same conclusions.

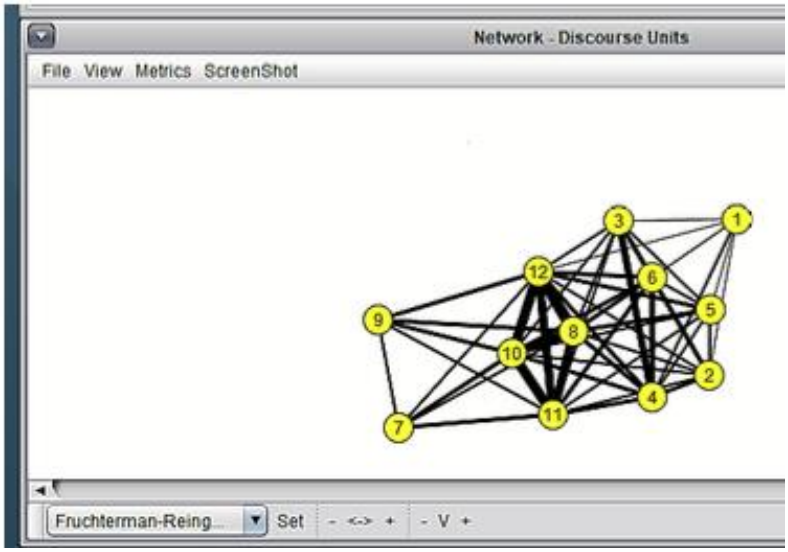


Figure 4.4. Lower left panel: Network - Discourse Units.

Figure 4.5 shows a table that quantifies the analysis from Fruchterman-Reingold force directed layout algorithm.

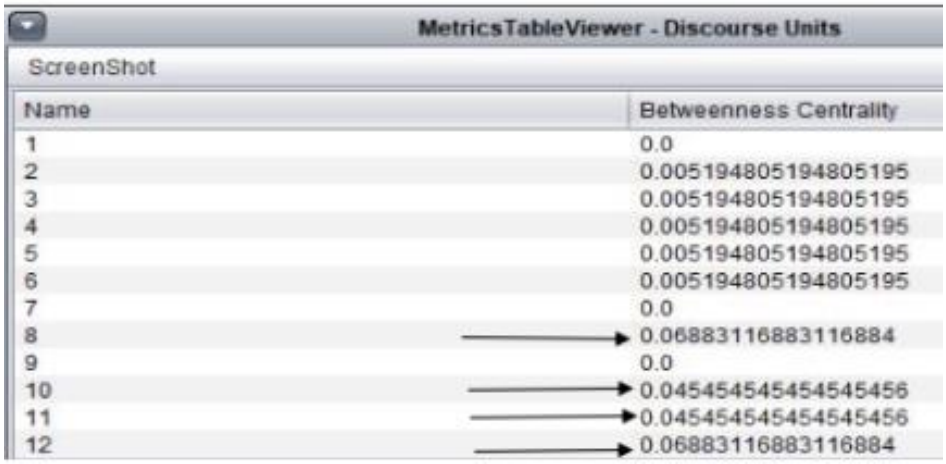


Figure 4.5. Betweenness Centrality corroborating the viewing screen in Figure 4.4

The lower right panel (see Figure 4.6) represents the Network of Words.

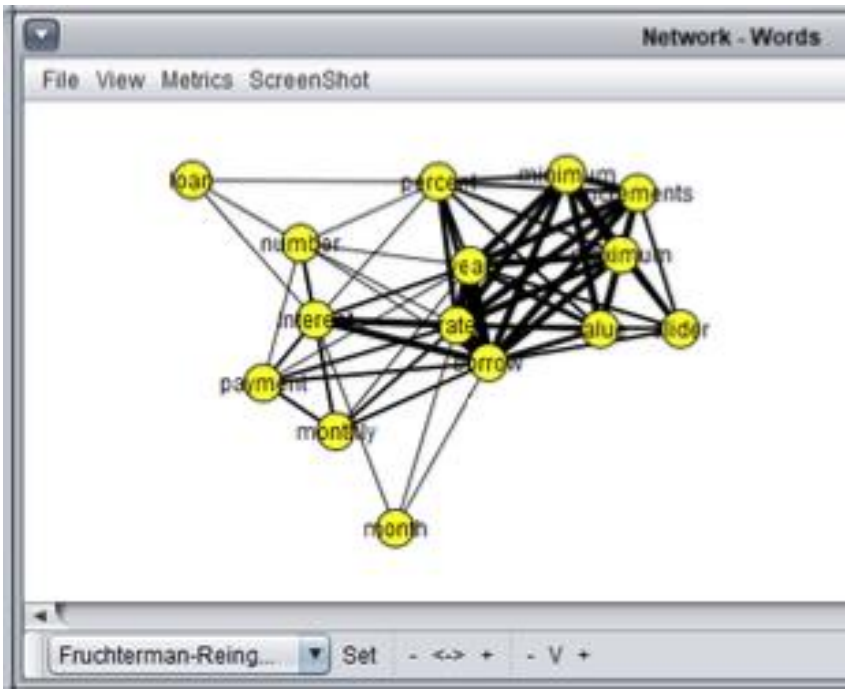


Figure 4.6. Lower right panel: Network – Words.

Degree centrality is a straightforward concept that indicates cumulative path lengths by which each node is linked to other nodes in the network. High degree centrality means that the node is at the center of the network, or near the center of a local cluster in the network. The degree of a

node in a network is the number of edges connected to it. In this case, we are examining pathways where the chosen nouns are used with each other in discourse at a high frequency. In the pilot study, the nouns rate, borrow, year and percent had the highest degree centrality (see Figure 4.7). Those nouns became the focal points of discourse.

Name	Degree Centrality
number	0.5714285714285714
loan	0.21428571428571427
interest	0.6428571428571429
percent	0.7142857142857143
month	0.21428571428571427
rate	0.9285714285714286
borrow	0.9285714285714286
monthly	0.42857142857142855
payment	0.42857142857142855
year	0.8571428571428571
slider	0.5
maximum	0.5714285714285714
minimum	0.5714285714285714
increments	0.5714285714285714
value	0.5714285714285714

Figure 4.7. Degree Centrality: Network-Words Task #1

4.2 Task #2

Task #2 challenges the students to gain a deeper understanding of the sliders. Below are questions 3 and 4 of the task:

3. So, by fixing the amount borrowed and the interest rate, what conclusion can you make about the amount of interest paid on a loan with a shorter or longer number of years?

4. Discuss what economic and noneconomic factors would affect your own choice of determining the length of time for the financial obligation of a new car loan.

Figures 4.8 and 4.9 are the discourse for questions #3 and #4. In #3, two students JL and MC who were in different groups applied more of the selected words in their discourse. However, all six students answered that the faster (less years) you pay off a loan, the less interest (JL and MC used the noun "interest" in their response) or the less (the remaining four students, who did not use "interest" in their response) you have to pay. It is interesting to note that the two students who used "interest" in their discourse, were not the same two students who in the pre-pilot survey questions, used the term "percentage" when asked, "In discussing a loan, what do we mean by interest?"

Question #4 enables students to think deeply about the amount of time (years) for a loan based upon the current economic factors they might be experiencing as they enter adult independence. Students can then peek into the future to examine life choices they are about to engage in. Note the chosen financial specific words in red. Life choices such as job, car, bills, children, etc., as these terms refer to life-style rather than financial exposure were not chosen for common discourse. They do, however, populate the discourse among the students and provide a positive picture of how students foresee their future.

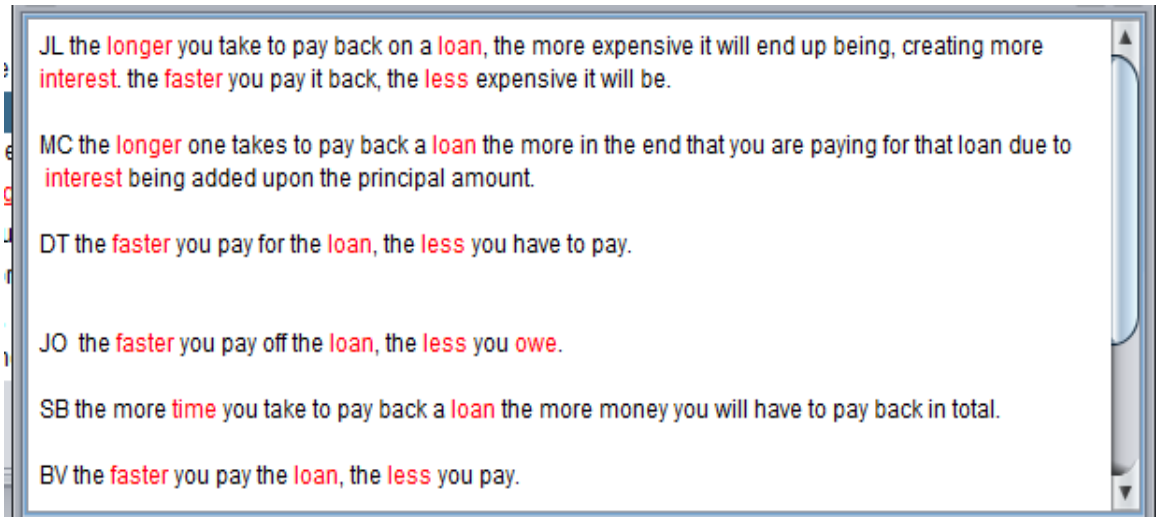


Figure 4.8. Discourse from Question #3 Task 2.

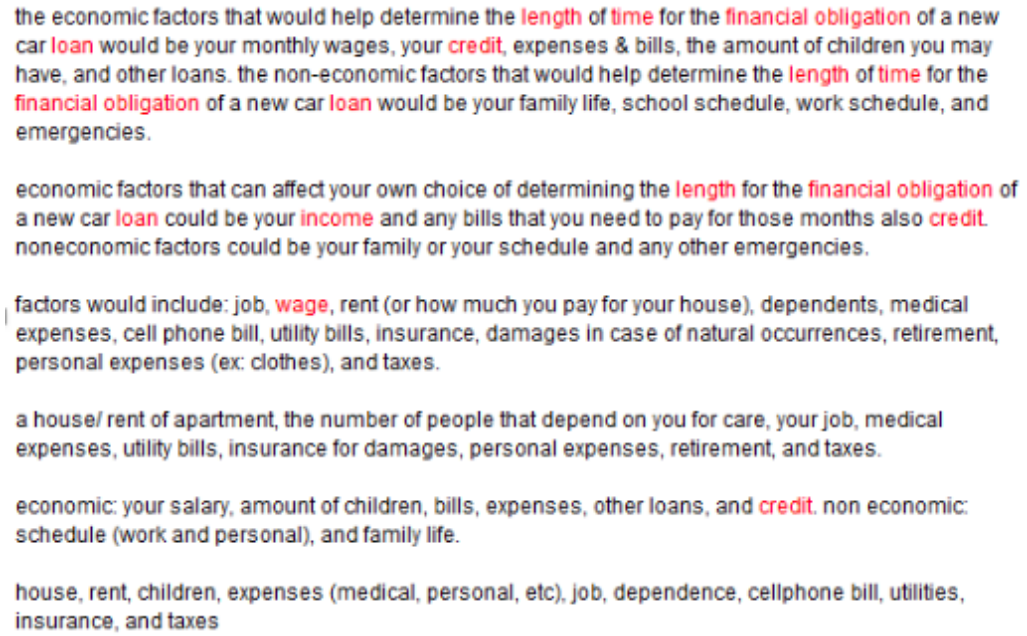


Figure 4.9. Discourse from Question #4 Task 2.

Figure 4.10 represents the Network-Words for Task #2. Note the word "loan" has the highest degree of betweenness centrality. Students are gaining experience, with the use of sliders, in understanding the variables that contribute to their knowledge of a loan.

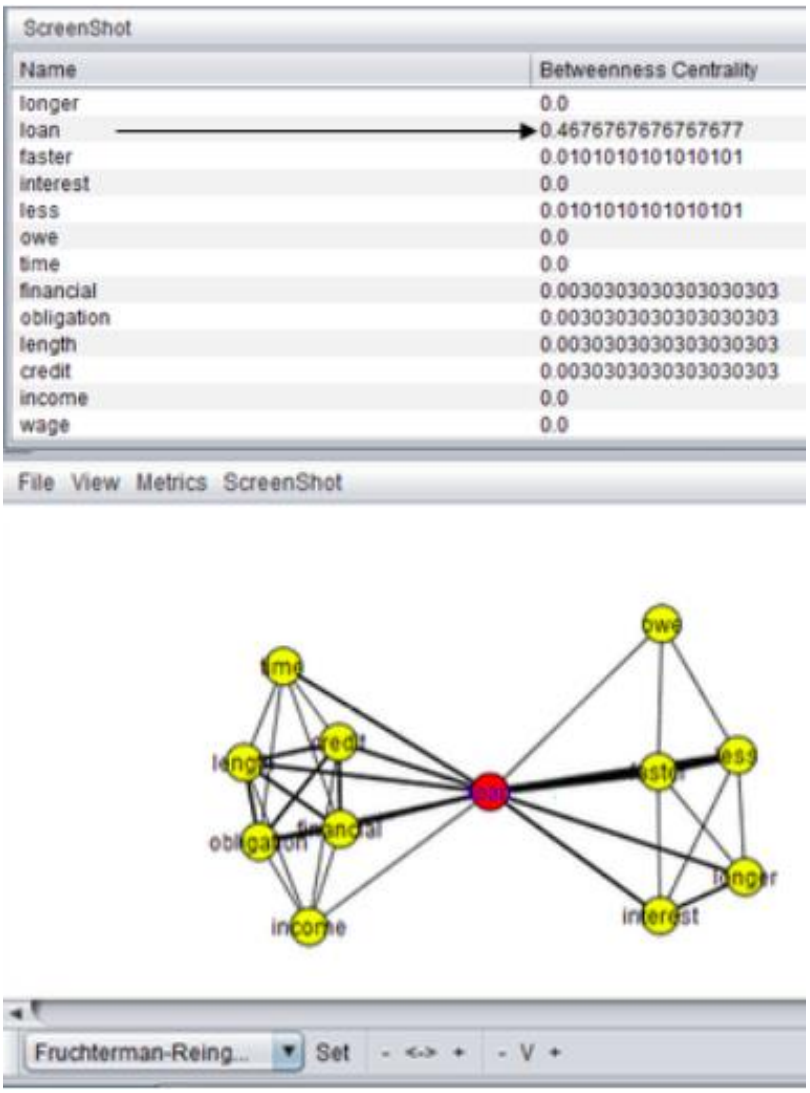


Figure 4.10. The word "loan" is a central node shown in two modalities.

4.3 Task #3 Columns A & B on the Spreadsheet

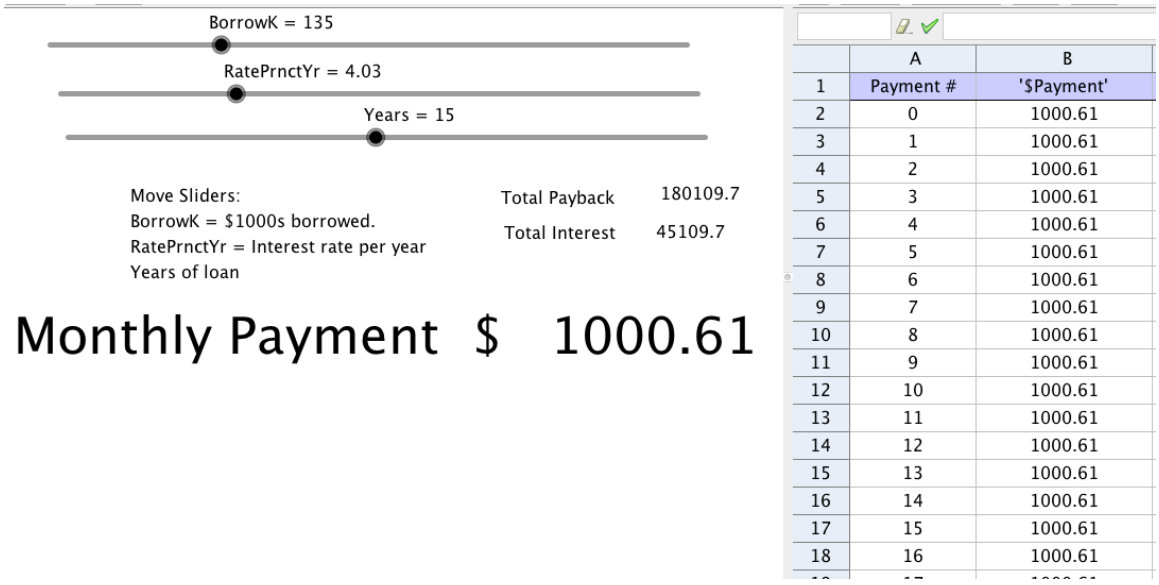
Tasks #3–6, the students begin investigating the dependent variables (the spreadsheet columns), as the sliders are moved. Each of the columns, B - E, and H, I, K, represent a different variable that contributes to a specific outcome of borrowing money**.**

Task #3 is the students' first experience linking the sliders with the spreadsheet. In this task, students are exploring the connection between the slider panel and Columns A & B on the spreadsheet. Column A is the payment number. It is simply the number of years on the slider

multiplied by 12, for making monthly repayments to the loan. Column B is the dollar monthly payment. As each individual slider is moved, what is noticed with "Monthly Payment" on the slider and Column B on the spreadsheet? As all students are working with the same variables, they were asked to set the sliders as shown in Figure 4.11. The sliders are set at $135,000 for amount borrowed, interest rate at 4.03%, and for a term of 15 years. The spreadsheet simultaneously changes with changes in the sliders.

Here are three of the questions in Task 3 and in Table 4.2 their responses.

- What do you notice about the numbers in column B as they are different from the other columns in the spreadsheet?
- Therefore, what can you conclude about the $Payment of a loan?
- Summarize how changes in the slider years affects column B



	A	B
1	Payment #	'$Payment'
2	0	1000.61
3	1	1000.61
4	2	1000.61
5	3	1000.61
6	4	1000.61
7	5	1000.61
8	6	1000.61
9	7	1000.61
10	8	1000.61
11	9	1000.61
12	10	1000.61
13	11	1000.61
14	12	1000.61
15	13	1000.61
16	14	1000.61
17	15	1000.61
18	16	1000.61

Figure 4.11. The slider panel and spreadsheet columns A & B.

Task #3 is asking the students to notice changes in the monthly payment as a function of the number of years while keeping the interest and the amount borrowed constant. All students in

their discourse noticed that the payment of a loan stays fixed for the lifetime of the loan, but also noticed that the rest of the columns change as additional payments are made. The discourse notes that as the years of the loan increases, the monthly payment decreases. As of this point in the tasks, students have not realized that as you increase the number of years of a loan, the total amount of interest you pay on the loan increases. Here is an example of where the students' understanding is at this current point as taken from the discourse in Table 4.2: "**the more time in years take to pay off the loan the less value of column B is which means you would be paying less a month for a longer time (in years).**"

Table 4.2. The discourse panel from KBDeX for three of the questions in Task 3

	QUESTION #1
JL	**the numbers in column B remain constant unlike the other columns that have fluctuating numbers**
MC	**the numbers remain constant while others increase or decrease**
JO	**the numbers in column B remain constant unlike the other columns that do change**
SB	**column B stays the same for all payments, while in the other columns the numbers fluctuate**
BV	**in column B, all the numbers stay the same, but in the other columns, they have different values**
DT	**the payments in column B are all the same, but in the other columns they have different values**
	QUESTION #2
JL	**the amount paid is the same for every payment because it is divided evenly among the number of months in ten years (120 months)**
MC	**the amount is exactly the same for every payment because it divides it evenly among the number of months in the 10 years you will pay the loan back in**
JO	**the payments stay the same because it is divided equally among the number of months in 10 years**
SB	**the payment stays the same for every month**
BV	**the payment stays the same because you're constantly paying that same price in the years you have to pay**
DT	**the payments in column B are constant without change**
	QUESTION #3

JL	**when money borrowed and rate percent per year remains constant the of years determines the number in column B where more years means lower payments**
MC	**the more time in years take to pay off the loan the less value of column B is which means you would be paying less a month for a longer time (in years)**
JO	**the more years the smaller the payment becomes bit it will take more time and the interest could affect it more**
SB	**as the years increases the amount you pay monthly decreases**
BV	**as the years increases the amount you pay monthly decreases**
DT	**as the number of years increases, the amount of payment decreases**

4.4 Task #4 Columns C & D on the Spreadsheet

The objective of Task #4: all students are to understand that in the payment of the loan, only a portion of the payment is applied to the balance of the loan, and a portion is paid to the interest. Students will also notice that the apportionments change as the loan progresses and they will notice the "direction" of the changes. Column C is the amount of the payment that is applied to the balance owed to the loan. Column D is the amount of payment that is applied to the interest. The following are two of the questions in Task #4 that best represent the collaborative work within the two groups.

- First, I would like each of you to enter what you think each of columns C & D represents.
- Return to the original setting of 95, 3.95 and 15 and scroll down the spreadsheet. Observe what is happening to the values in columns C & D. Make a conjecture as to why you think this is happening.

Figure 4.12 below are the results of the discourse extracted from the KBDeX software. The discourse is arranged by the two groups. 1 – 3, and 7 – 9 are one group and the other group is 4 – 7 and 10 – 12. Highlighted in red are the pre-selected nouns from the discourse that represent the student understanding of changes in columns C & D as the payment of the loan progresses.

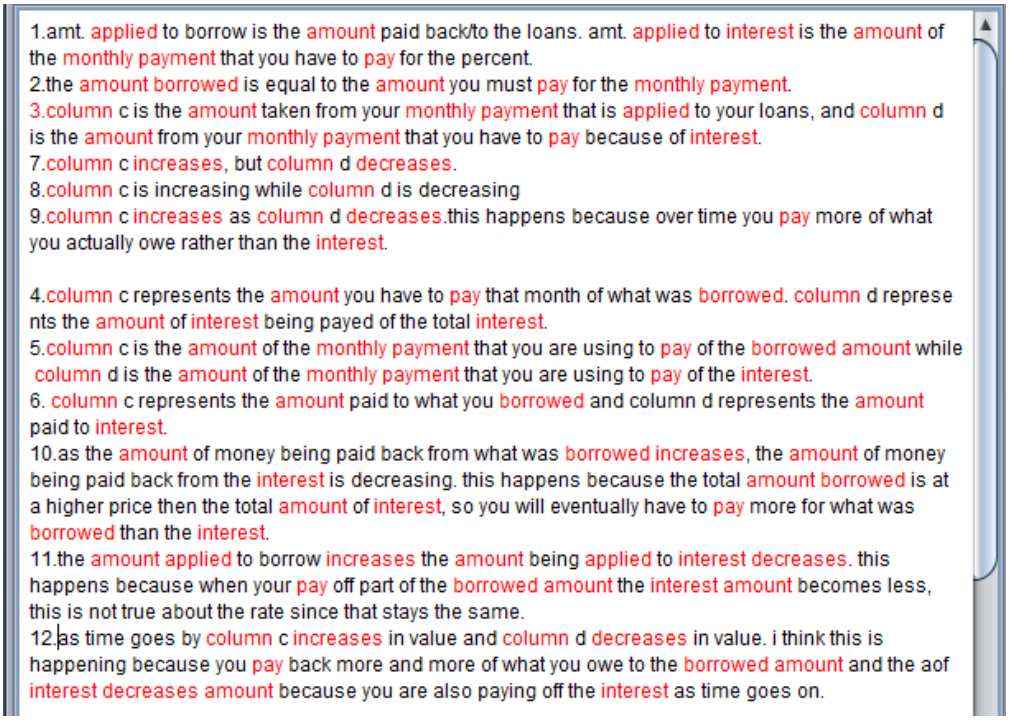


Figure 4.12. Discourse panel from the KBDeX output.

In Figures 4.13 and 4.14, collaboration within groups is not always equal as the "thickness" of the segments connecting the nodes is easily visualized. In Figure 4.13 the collaboration between BV and DT is weak. In Figure 4.15 all collaboration is visually equal.

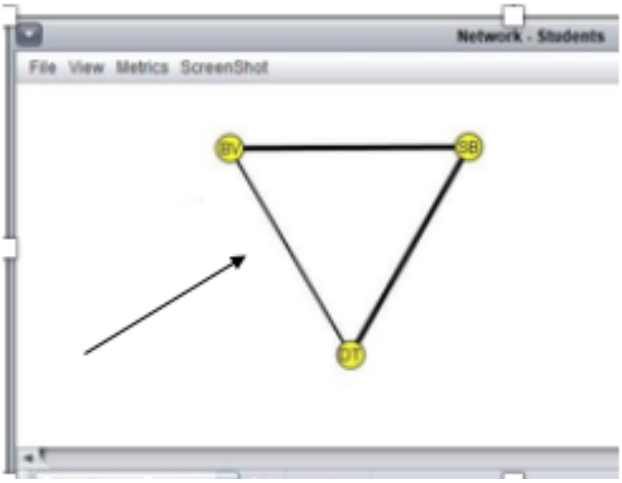


Figure 4.13. Network - Students Collaboration BV DT SB.

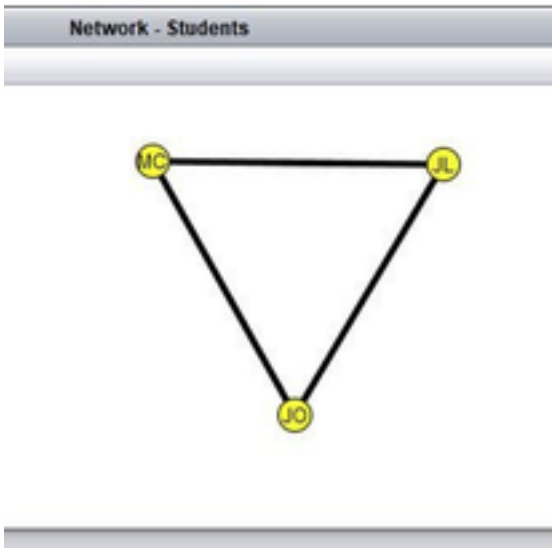


Figure 4.14. Network - Students Collaboration MC JO JL.

Re-examining the pre-pilot study (see earlier Table 4.1 and Figure 4.1) may show some insight into the collaboration. In viewing Table 4.3, JL, MC, JO provide greater participation in the household experience. Inclusion of the question is meant to show that experience. The last three survey questions in the table represent the group with the lesser interaction in collaboration and lesser involvement in daily experience. If there is an association between daily household experience and open collaboration, there may be a topic for future study.

Table 4.3. Portion of the Pre-Pilot Study

JL	Do you have a part-time job at least 6 months out of a year? Do you have a credit card or debit card in your name? Do you do your own laundry or regularly cook family meals?
MC	Do you have a part-time job at least 6 months out of a year? Do you have a credit card or debit card in your name? Do you contribute directly to household expenses?
JO	Do you have a part-time job at least 6 months out of a year? Do you have a credit card or debit card in your name? Do you have a savings account that you contribute to regularly? (Monthly, weekly deposits), Do you contribute directly to household expenses? Do you do your own laundry or regularly cook family meals?
SB	Do you do your own laundry or regularly cook family meals?
BV	Do you do your own laundry or regularly cook family meals?
DT	Do you do your own laundry or regularly cook family meals?

4.5 Task #5 Columns E, H & I on the Spreadsheet

The following are two of the questions in Task #5 that are imported to the KBDeX software for analysis:

- So now you have a 15-year loan. Does it make sense that after half of the payments are made, you should owe 50% of the balance?
- Summarize what you have collectively discovered in this task. It is important to realize the amount owing after the anniversary years of payments may not be what you think they should be. The next tasks hopefully will give you further clarity about how loan obligations work.

The objective of Task #5: within the two groups, the connection between outstanding amount owed (balance due) on a loan after a payment is made, column E, and the percentage of the loan that is still due, column H, versus the expected percentage due, column I. Students will conclude by applying the spreadsheet in GeoGebra, that there is a difference between percentage of the loan outstanding and the expected percentage of the loan outstanding. By examining both percentages, after one-half of the payments are made to a loan, more than half of the loan

balance is still outstanding. Students are also asked to notice the difference in percent owing to percent expected owing for 75% of payments made. After continued observations, students are asked to notice in the spreadsheet column I, when is the difference between percentage owing and percentage expected owing the same and the greatest. Lastly, what can they conclude?

Students in both groups were given the following conditions in GeoGebra: 135, 4.03 and 15, which correspond to $135000 borrowed at 4.03% for 15 years. To confirm that both groups have moved the sliders to the correct position, the monthly payment should be $1000.60.

Figures 4.15 and 4.16 are screenshots taken from the KBDeX software that captures the discourse for the two questions of Task #5, and the Closeness Centrality of Discourse (Oshima et al., 2012, p. 74). In the first screenshot, the discourse is separated by a space between the two groups. The two questions enable the students to build on prior knowledge as they navigate through the tasks. The highlighted “red” denotes the selected words. As per Oshima et al. (2012), the second screenshot quantifies the closeness of understanding by noting the "closeness" of the nodes of discourse, within and between both groups as the centrality values are all very close to one. The visual panel supports those results.

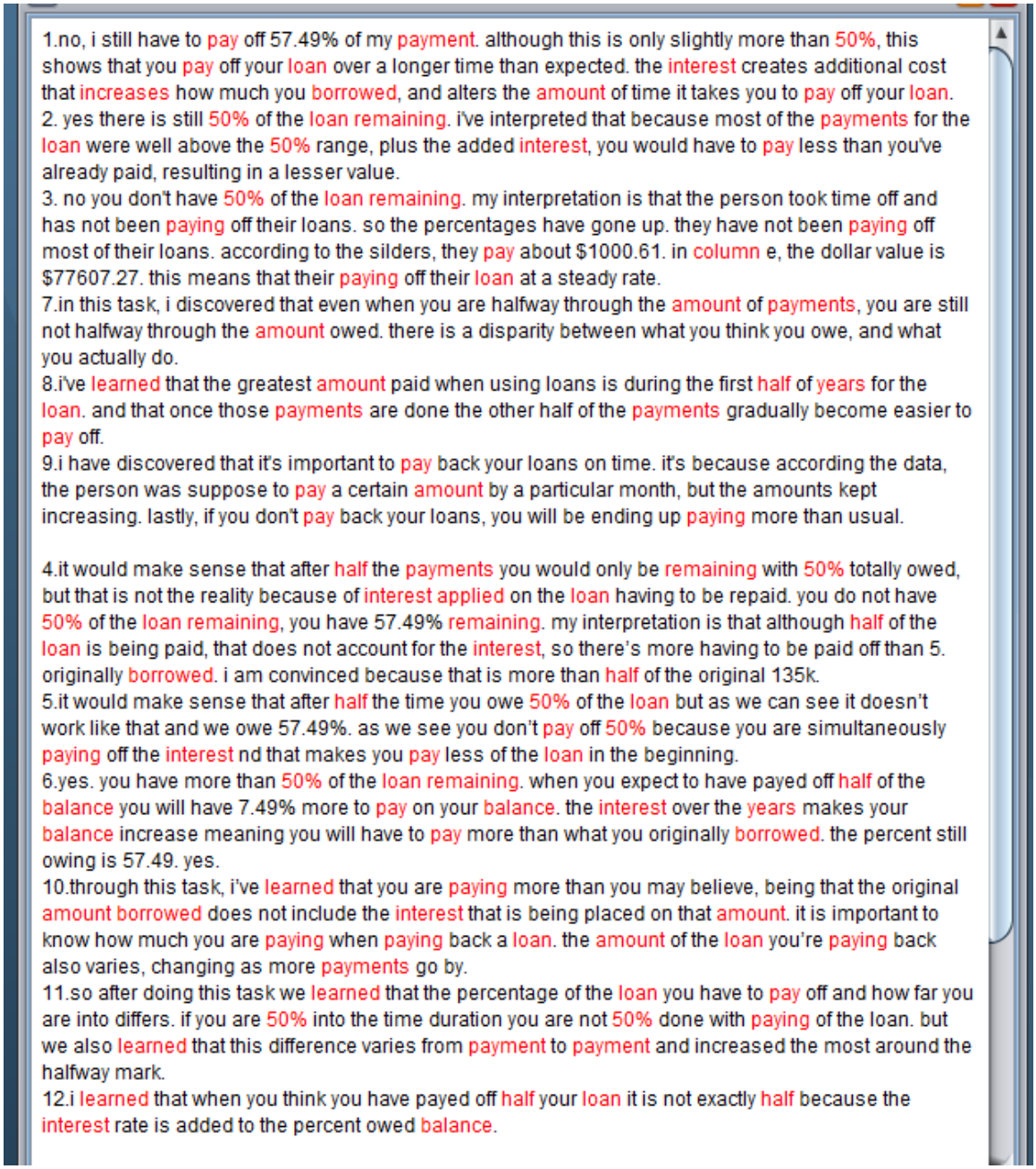


Figure 4.15. Discourse panel for the two questions Task #5.

Discourse #10 above is a prime example supporting significant growth in understanding that once a loan is half paid, there is still more than 50% of the balance due:

> through this task, I've learned that you are paying more than you believe, being that the original amount borrowed does not include the interest that is being placed on that amount.

> it is important to know how much you are paying when paying back a loan. the amount of the loan you are paying back also varies, changing as more payments go by.

As the tasks continue to support the two groups construction of new knowledge built with the experience of the previous tasks, it can be seen from Figure 4.16 and the measure of closeness centrality approaching one for each of the discourse units, the students are able to manipulate and understand the complete set of variables that contribute to the stages and outcomes of borrowing money from a financial institution.

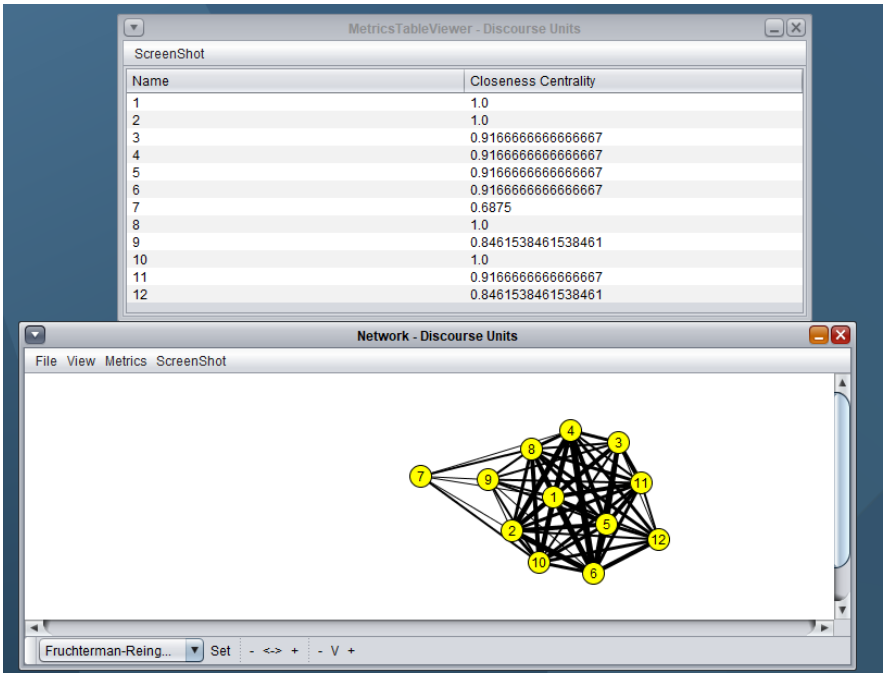


Figure 4.16. Closeness Centrality.

4.6 Task #6: Columns H, I and K on the Spreadsheet

For the final task, students create a graph representing the relationship between the payment number and the gap between the percent-owing and the percent expected-owing. By moving each slider, students are noticing the change in the steepness of the curve as each slider increases or decreases. The goal is to investigate and interpret the meaning of the gap. Instructions were as follows:

Using GeoGebra, we can create a graphic representation of our noticings. And it can change as we change our sliders for a 15-year loan.

Below are the instructions:

a. Highlight columns J and K from Payment # and %Owing-%Expected Owing all the way down to payment #180 where your balance owing is $0.

b. Next, in the toolbar go to View and click on Graphics 2. To the right of your spreadsheet, a graph should appear. Click on the toolbar where is says {1,2} Create list. In drop down go to create list of point and select.
A small screen should pop up and select Create.

c. Minimize the spreadsheet and all you should see is the graph.

d. Hold the control button and using your mouse ball you can adjust the graph view.

e. Next right click and select x-Axis: y-Axis and select 50:1, use your control button and mouse ball to best have the graph show in your screen.

The x-axis is the payment number. The y-axis is the difference between the %owing and the expected %owing. At the 3.2% interest rate, the greatest gap appears right after the 90th payment. The greatest gap is just under 6 on the y-axis.

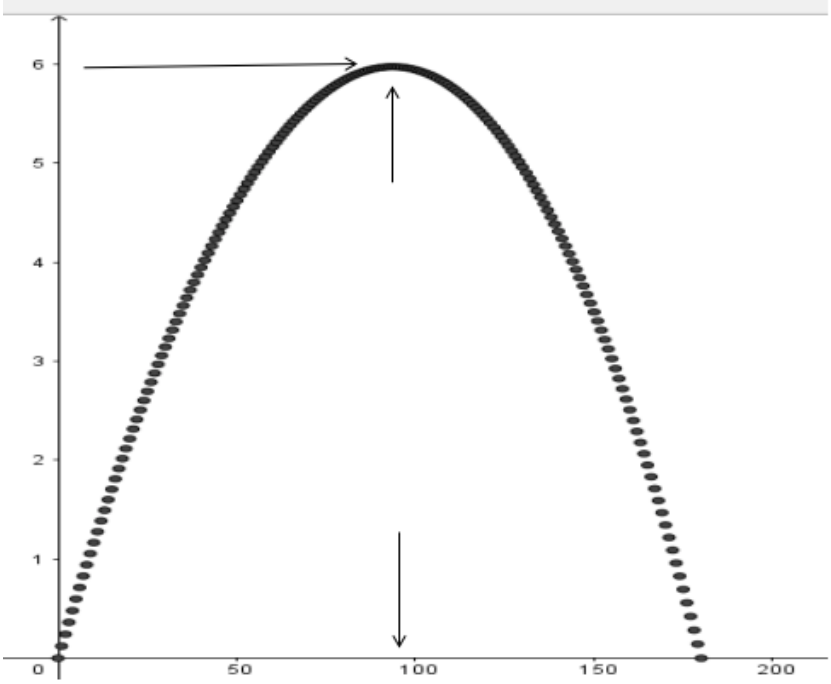


Figure 4.17. The gap between percent owing and expected percent owing.

The following are questions f, g and h in Task #6 in investigating the gap and the following discourse from the students:

f. Now here is the fun part. Bring back the slider rectangle. We are going to move each slider separately and comment on what you notice. But first, move the BorrowK slider first. Hint: when you move the BorrowK slider what do you notice? Your loan payment changes but comment on the changes in the graph between % Owing - %Expected.

Table 4.4. The discourse exported from KBDeX software for question f

Note. There is consensus within both groups that the graph does not change when the amount borrowed is increased or decreased.

DT	the graph doesn't change when the amount borrowed increases.
BV	there is no change, as you move in slider with the % owing - % expected.
SB	nothing changes on the graph
	Second group discourse
MC	when you move the borrowk the percent owing, and percent expected remains the same.
JO	when we move the borrowk slider we noticed that the graph doesn't really change.

JL	when you move the borrowk slider, I notice that the graph does not move at all. the percent owing, and percent expected remains untouched when changing what's borrowed.

g. Now move the interest Rate percent slider. What happens to the graph as the interest rate increases? What is your interpretation?

The screen shot in Figure 4.18 is exported from the discourse units in the KBDeX software. The students are now continuing to build their knowledge of how the interest rate affects the difference between %owing and expected %owing; noticing the increase in the gap at the approximate half-way time of payments as the interest rate increases.

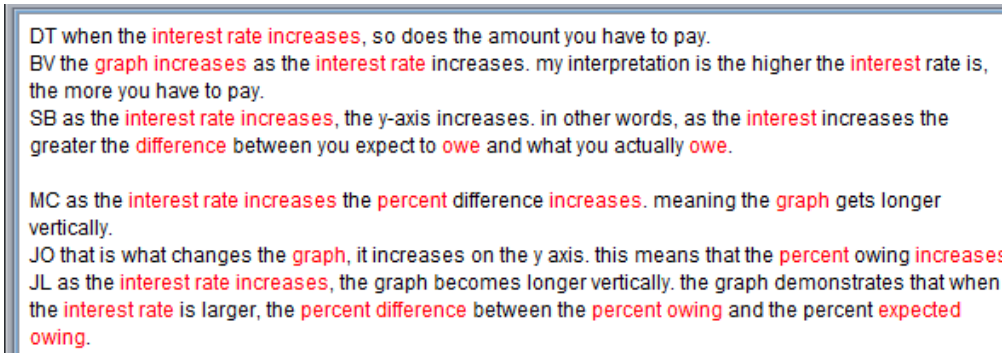


Figure 4.18. The effect of interest on %owing - %expected owing.

As the interest rate is moved to 5.14%, the gap at the 90th payment or half-way mark approaches the 10 percent difference in expected %owing to % owing. This signifies the "slowing-down" effect on loan amortization as the rate of interest increases. Figure 4.19 compares the gap between 3.2% versus 5.14% interest rate.

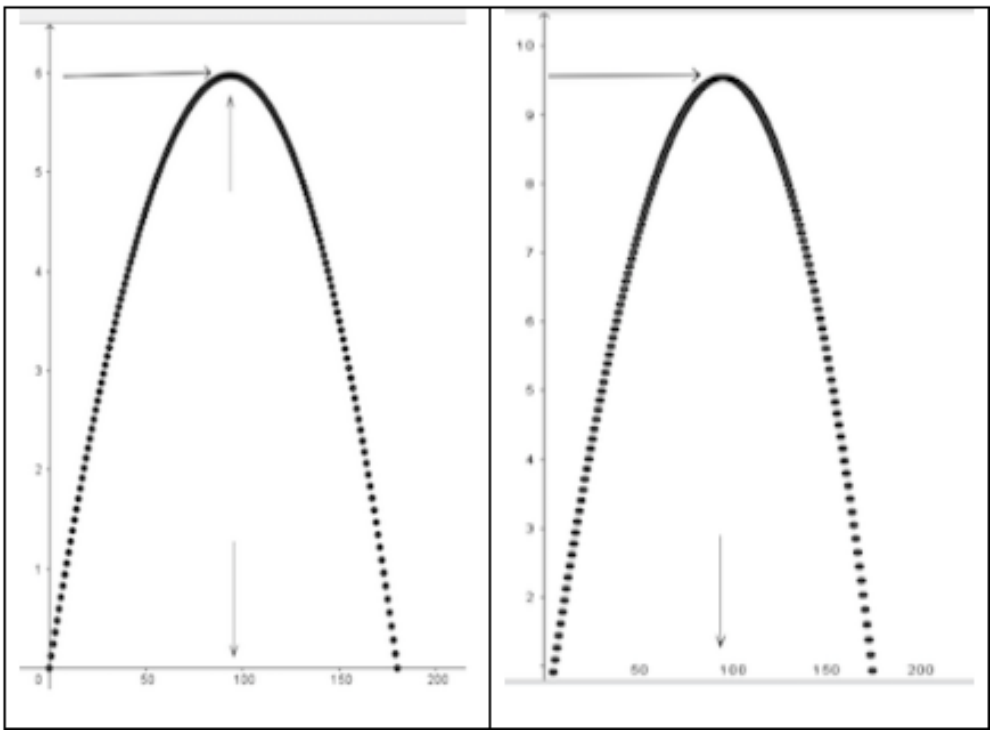


Figure 4.19. The gap as the interest rate is increased from 3.2% to 5.14% for 15-year loan(Left graph: Gap is 6%; Right graph: Gap is 10%)

h. Lastly move the Years but not past the 15-year mark and what is your interpretation? Hint: looking at the graph, do you benefit from taking a shorter term on a loan or longer term?

In Figure 4.20, taken from the GeoGebra Loan app, the term of the loan is reduced from 15 years to 10 years.

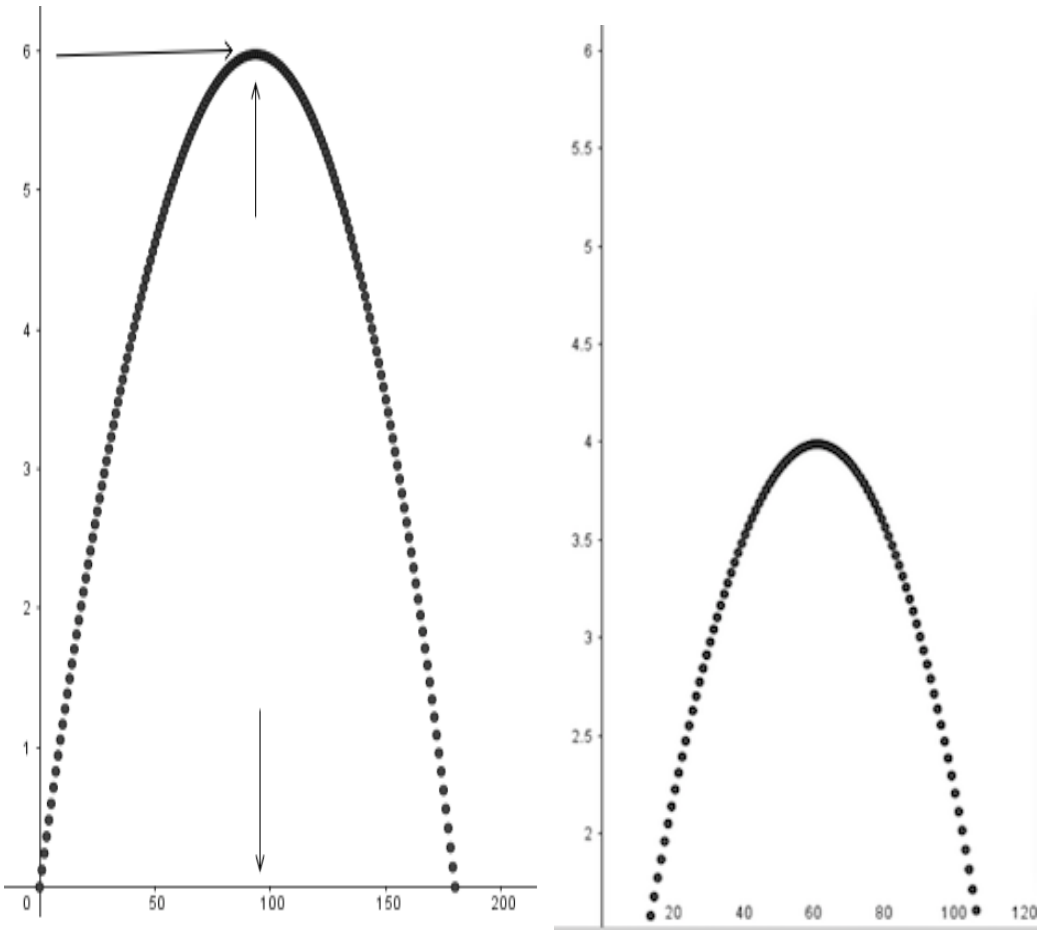


Figure 4.20. The gap is reduced from 15 to 10 years at 3.2% at the half-way term of each loan.(Left graph: Half-way point is 90 months; Right graph: Half-way point is 60 months)

Two students agree that the gap between %owing and expected %owing is reduced with the given original interest rate of 3.2%, as the term of the loan is shortened:

JO: when we change the years it changes the x axis, so the amount of years increases the amount of payments increases with it. there still is a difference in percent owing but you benefit because the percent owing is lower which means that what you owe is closer to the expected.

JL: as the amount of years increase, so do the amount of payments having to be paid, but the faster it is paid back, the less amount of percent difference you will see. you benefit from taking a shorter-term loan rather than a longer-term loan because there will be less percent interest and there will be a lower difference between what you actually owe versus what you are expected to owe.

Reviewing the results from the final task, students are now understanding the effect of the variables on loan repayment, noticing that the amount borrowed is invariant to loan amortization, but the interest rate and numbers of years are. The gap between %owing and expected % owing is greatest surrounding the half-way mark and the gap increases as the interest rate increases and decreases as the length of the term of the loan decreases or the interest rate decreases.

The six tasks in conjunction with the loan app in GeoGebra have provided an instrument for students in an urban setting to now manipulate and understand the complete set of variables that contribute to the stages and outcomes of borrowing money from a financial institution. The KBDeX software which applies social network analysis rather than the subjective approach to content analysis provides a quantitative analysis of the growth of knowledge.

Chapter 5 Reflective Question Results

Upon the completion of the six tasks in the pilot study, the six students from Rutgers Future Scholars, were asked:

> *Finally, since each of you is the foundation of future research, please take a few moments to offer your input on how to improve the tasks, add to the tasks. In other words, if this were your research, what would you change to the existing or add to the existing.*

SB: Overall, these tasks were pretty simple. I like how there was a slow progression from the easier tasks to the harder ones near the end. However, I have to say that the instructions for the last task were not very clear. Since we were not aware of the way this software worked, I feel like the instructions had to be much more specific, or perhaps there should even be visuals added to the instructions that show the way that you should do things for the last task. Despite this, once my group figured out how to solve things, it all worked out well. I like that this was a collaborative effort, although I feel like it would be best if people worked in pairs instead of threes. I think that in groups of two people are able to work and share their input equally, so that both students grasp a full understanding of the lesson. In larger groups, there is more room for confusion. I also think that when students in a classroom are completing these tasks, it is important for their teachers to know how to work with the sliders and how to do things.

BV: The things I like about this is it's very computerized and electronic tasks. Seeing how loans work physically on a computer, helps me understand how they work better. Freshman year I learned a lot about loans and my teacher always said if you're going to take out loans, after you're 18 years old. He told us make sure you keep paying it off, and not save money. If you save then, the interest rate will continue to go up. I think to add and improve to the task, you can give us each an individual scenario, how much loans we plan to take out and see for ourselves how it shows the trend of how much money we are expected and are paying per month. Overall, each task was helpful to understand how loans work.

DT: An improvement that I believe would help benefit this research would be to have the subjects be a little more diversified, instead of them all being from a similar organization. That way, we could fully grasp the concept that is both how educated people are on the topic of financial aid, or financial literature for that matter, and how we can help make this transition simpler. You should also have larger group studies to catch the amount of interaction to see how these sources of information may change the outlook of finances. If this was a course, I would like to learn more about the financial world and how business rise from the bottom of the stock market to the top of their industries. Having taken courses such as Advanced Algebra with Financial Applications and Financial Literacy, most of this knowledge was well known to me. But now I see that loans are a lot to bargain for. Especially the long term and short-term values of loans.

MC: Maybe consider using more specific task bars and have the drop drown bars labeled to make it easier for anyone to use. Maybe include a tutorial pop up that can explain some functions

or tools that are not self-explanatory. Color coding the task bars could also be helpful to students so that they can recognize each different tool bar easier. If I were to take this course, I would want to learn how manage credit cards and save money for the future. I feel that this generation is going to struggle in the transition from high school to college because they have not been taught how to manage their money and how to properly take out a loan. So, this course will offer that extra cushion to help students with that transition.

JL: I really appreciated the research being done, being that it will aid future generations in understanding situations that are never necessarily talked about within an educational environment. The tasks proved effective, broadening my understanding of loans, something which I had never thought about until participating in the research. Some things I would recommend changing in order to aid in the further development of the project would be to make the program a little bit simpler to use, creating more concise steps that will help with clarity. To make this into a course, you could include credit cards, debit cards, and the entire process of banking, although loans are the ones that most people know the least about. In order to extend this to a full course, some steps could go into further details which allow the student to create their own inquiries. A lot of learning comes from allowing students to make choice in their education, so an interactive course will benefit students tremendously. Thank you for allowing me to participate in this research, I appreciate the work you are doing for urban communities.

JO: This was very informative to start with, it helped bring more information for loans. In high school I already had taken an economics and financial literacy class which helped me be prepared in this applet. But it is better to learn in a hands-on manner than in a reading off a book, this could be very beneficial to people. One thing that can improve it is making it a little more colorful, like dividing the columns up with different colors so people can actually see the differences between the loan you took out and the percent's you owe. Also making it a little simpler to work through it would be better since somethings are a little confusing.

Chapter 6 Discussion

As a former high school teacher of senior mathematics students in a suburban school district, I became aware that students were lacking in their understanding of financial literacy and specifically in the content area of loans. My first undertaking was to "relocate" the financial education course to the mathematics department from the business/economics group and rewrite the curriculum to emphasize the financial obligations the students were about to embark on. Through my research and with the guidance of Dr. Arthur B. Powell, I investigated school districts of different socio-economic experiences and more specifically urban districts whose majority populations are African American and Hispanic students and noticed the significant gap in scores on national financial literacy surveys. I began to examine my own priorities to see in what ways, as a teacher, I can contribute to improving the obvious inequity in our society. With further research into international studies, specifically PISA results, I became aware that the United States scored only in the middle of the 19 nations that participated in the first study of the PISA financial literacy test in 2012. In addition, statistically, the study showed that variation across socio-economic regions was not equal. With my teaching experience accompanied by the investigations of knowledge building classroom environments that I gained from Dr. Carolyn Maher, I decided that paper and pencil assessments were not the method I would apply to my population of interest in closing the equity gap.

The goal of this dissertation is to create a methodology that serves the needs of high school students in their junior and senior years of school as they are faced with the task of defining their individual future. Public education establishes an educational map for the collective group. Urban districts have not met the levels of white suburban students in the area of financial literacy. Students graduating from high school are responsible for financial decisions

they may not be prepared to take on and yet have to live with the consequences for many years. As stated in the document, there are data that establishes poverty levels with race. Opportunities for success may be equal (based on law) across the socio-economic boundaries, but not necessarily equitable.

Directed intervention with supportive pedagogy must be established in urban centers. Textbooks only provide "static" information accompanied by paper and pencil assessments that grade on a dichotomous scale. Textbooks provide equal access across socio-economic borders but not equitable levels of academic intervention. The internet is more fluid with interactive lessons but not specifically directed towards urban experiences. Assessment is built on accumulative points of the "game" output. To this end, my proposal which is supported by the results creates a student-centered learning environment in small group settings combined with artifacts that establish both knowledge creation and knowledge building. In addition, to reduce researcher bias, I have incorporated software that quantifies discourse based on keywords pre-selected prior to students negotiating through the six tasks.

The students in the Rutgers Future Scholars confirmed their personal growth in understanding of the variables that contribute to the stages and outcomes of borrowing money from a financial institution. Their suggestions in the post-pilot study question located in the conclusion chapter, are the guidelines for my future research and more importantly, my personal in-service with urban centers.

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Appendix A: 2008 JUMP$TART High School Senior Questionaire Parts 1 - 31

6,856 High School Seniors, Mean Score = 48.3%

Part 1 - 31 Jump$tart Questions
Note: Numbers to the Left of Answers are Proportion Giving Response
* indicates correct answer

1. Inflation can cause difficulty in many ways. Which group would have the greatest problem during periods of high inflation that last several years?
10.6 a) Older, working couples saving for retirement.
40.0 b) Older people living on fixed retirement income.*
7.2 c) Young couples with no children who both work.
41.7 d) Young working couples with children.

2. Which of the following is true about sales taxes?
27.2 a) The national sales tax percentage rate is 6%.
25.5 b) The federal government will deduct it from your paycheck.
4.9 c) You don't have to pay the tax if your income is very low.
41.9 d) It makes things more expensive for you to buy. *

3. Rebecca has saved $12,000 for her college expenses by working part-time. Her plan is to start college next year and she needs all of the money she saved. Which of the following is the safest place for her college money?
3.7 a) Locked in her closet at home.
3.7 b) Stocks.
4.8 c) Corporate bonds.
87.7 d) A bank savings account.*

4. Which of the following types of investment would best protect the purchasing power of a family's savings in the event of a sudden increase in inflation?
19.2 a) A 10-year bond issued by a corporation.
26.2 b) A certificate of deposit at a bank.
17.4 c) A twenty-five year corporate bond.
35.8 d) A house financed with a fixed-rate mortgage.*

5. Under which of the following circumstances would it be financially beneficial to you to borrow money to buy something now and repay it with future income?
55.8 a) When you need to buy a car to get a much better paying job.*
5.1 b) When you really need a week vacation.
5.8 c) When some clothes you like go on sale.
33.4 d) When the interest on the loan is greater than the interest you get on your savings.
6. Which of the following statements best describes your right to check your credit history for accuracy?
47.7 a) Your credit record can be checked once a year for free.*
5.3 b) You cannot see your credit record.

13.8 c) All credit records are the property of the U.S. Government and access is only available to the FBI and Lenders.
33.2 d) You can only check your record for free if you are turned down for credit based on a credit report.

7. Your take home pay from your job is less than the total amount you earn. Which of the following best describes what is taken out of your total pay?
9.5 a) Social security and Medicare contributions.
21.2 b) Federal income tax, property tax, and Medicare and social security contributions.
56.4 c) Federal income tax, social security and Medicare contributions*.
12.9 d) Federal income tax, sales tax, and social security contribution.

8. Retirement income paid by a company is called:
37.4 a) 401 (k).
36.2 b) Pension.*
3.6 c) Rents and profits.
22.8 d) Social Security.

9. Many people put aside money to take care of unexpected expenses. If Juan and Elva have money put aside for emergencies, in which of the following forms would it be of LEAST benefit to them if they needed it right away?
40.1 a) Invested in a down payment on the house.*
13.2 b) Checking account.
32.1 c) Stocks.
14.6 d) Savings account.

10. David just found a job with a take-home pay of $2,000 per month. He must pay $900 for rent and $150 for groceries each month. He also spends $250 per month on transportation. If he budgets $100 each month for clothing, $200 for restaurants and $250 for everything else, how long will it take him to accumulate savings of $600.
20.9 a) 3 months.
60.2 b) 4 months.*
6.7 c) 1 month.
12.2 d) 2 months.
11. Sara and Joshua just had a baby. They received money as baby gifts and want to put it away for the baby's education. Which of the following tends to have the highest growth over periods of time as long as 18 years?
4.7 a) A checking account.
16.8 b) Stocks.*
37.3 c) A U.S. Govt. savings bond.
41.3 d) A savings account.

12. Barbara has just applied for a credit card. She is an 18-year-old high school graduate with few valuable possessions and no credit history. If Barbara is granted a credit card, which of the following is the most likely way that the credit card company will reduce ITS risk?

7.2 a) It will make Barbara's parents pledge their home to repay Karen's credit card debt.
32.7 b) It will require Barbara to have both parents co-sign for the card.
14.1 c) It will charge Barbara twice the finance charge rate it charges older cardholders.
45.9 d) It will start Barbara out with a small line of credit to see how she handles the account.*

13. Chelsea worked her way through college earning $15,000 per year. After graduation, her first job pays $30,000. The total dollar amount Chelsea will have to pay in Federal Income taxes in her new job will:
47.1 a) Double, at least, from when she was in college.*
36.4 b) Go up a little from when she was in college.
10.0 c) Stay the same as when she was in college.
6.5 d) Be lower than when she was in college.

14. Which of the following best describes the primary sources of income for most people age 20-35?
9.1 a) Dividends and interest.
75.3 b) Salaries, wages, tips.*
9.1 c) Profits from business.
6.5 d) Rents.

15. If you are behind on your debt payments and go to a responsible credit counseling service such as the Consumer Credit Counseling Services, what help can they give you?
7.0 a) They can cancel and cut up all of your credit cards without your permission.
17.8 b) They can get the federal government to apply your income taxes to pay off your debts.
70.5 c) They can work with those who loaned you money to set up a payment schedule that you can meet.*
4.7 d) They can force those who loaned you money to forgive all your debts.

16. Rob and Mary are the same age. At age 25 Mary began saving $2,000 a year while Rob saved nothing. At age 50, Rob realized that he needed money for retirement and started saving $4,000 per year while Mary kept saving her $2,000. Now they are both 75 years old. Who has the most money in his or her retirement account?
24.8 a) They would each have the same amount because they put away exactly the same
11.7 b) Rob, because he saved more each year
12.5 c) Mary, because she has put away more money
51.1 d) Mary, because her money has grown for a longer time at compound interest*

17. Many young people receive health insurance benefits through their parents. Which of the following statements is true about health insurance coverage?
18.4 a) You are covered by your parents' insurance until you marry, regardless of your age.
40.4 b) If your parents become unemployed, your insurance coverage may stop, regardless of your age. *
8.2 c) Young people don't need health insurance because they are so healthy.
33.0 d) You continue to be covered by your parents' insurance as long as you live at home, regardless of your age.

18. Don and Bill work together in the finance department of the same company and earn the same pay. Bill spends his free time taking work-related classes to improve his computer skills; while Don spends his free time socializing with friends and working out at a fitness center. After five years, what is likely to be true?
11.5 a) Don will make more because he is more social.
9.8 b) Don will make more because Bill is likely to be laid off.
67.9 c) Bill will make more money because he is more valuable to his company.*
10.8 d) Don and Bill will continue to make the same money.

19. If your credit card is stolen and the thief runs up a total debt of $1,000, but you notify the issuer of the card as soon as you discover it is missing, what is the maximum amount that you can be forced to pay according to Federal law?
17.3 a) $500
16.9 b) $1000
52.8 c) Nothing.
13.0 d) $50*

20. Which of the following statements is NOT correct about most ATM (Automated Teller Machine) cards?
8.8 a) You can generally get cash 24 hours-a-day.
14.0 b) You can generally obtain information concerning your bank balance at an ATM machine.
68.0 c) You can get cash anywhere in the world with no fee.*
9.2 d) You must have a bank account to have an ATM Card.
21. Matt has a good job on the production line of a factory in his home-town. During the past year or two, the state in which Matt lives has been raising taxes on its businesses to the point where they are much higher than in neighboring states. What effect is this likely to have on Matt's job?
14.4 a) Higher business taxes will cause more businesses to move into Matt's state, raising wages.
18.7 b) Higher business taxes can't have any effect on Matt's job.
57.3 c) Matt's company may consider moving to a lower-tax state, threatening Matt's job.*
9.7 d) He is likely to get a large raise to offset the effect of higher taxes.

22. If you have caused an accident, which type of automobile insurance would cover damage to your own car?
16.1 a) Comprehensive.
40.0 b) Liability.
7.1 c) Term.
36.8 d) Collision.*

23. Scott and Eric are young men. Each has a good credit history. They work at the same company and make approximately the same salary. Scott has borrowed $6,000 to

take a foreign vacation. Eric has borrowed $6,000 to buy a car. Who is likely to pay the lowest finance charge?
43.1 a) Eric will pay less because the car is collateral for the loan. *
18.7 b) They will both pay the same because the rate is set by law.
13.3 c) Scott will pay less because people who travel overseas are better risks.
24.9 d) They will both pay the same because they have almost identical financial backgrounds.

24. If you went to college and earned a four-year degree, how much more money could you expect to earn than if you only had a high school diploma?
21.9 a) About 10 times as much.
8.6 b) No more; I would make about the same either way.
22.0 c) A little more; about 20% more.
47.6 d) A lot more; about 70% more. *
25. Many savings programs are protected by the Federal government against loss. Which of the following is not?
13.4 a) A U. S. Savings Bond.
43.8 b) A certificate of deposit at the bank.
28.4 c) A bond issued by one of the 50 States.*
14.4 d) A U. S. Treasury Bond.

26. If each of the following persons had the same amount of take home pay, who would need the greatest amount of life insurance?
31.6 a) An elderly retired man, with a wife who is also retired.
10.0 b) A young married man without children.
51.1 c) A young single woman with two young children*.
7.2 d) A young single woman without children.

27. Which of the following instruments is NOT typically associated with spending?
6.7 a) Debit card.
82.1 b) Certificate of deposit.*
6.7 c) Cash.
4.5 d) Credit card.

28. Which of the following credit card users is likely to pay the GREATEST dollar amount in finance charges per year, if they all charge the same amount per year on their cards?
16.8 a) Jessica, who pays at least the minimum amount each month and more, when she has the money.
17.1 b) Vera, who generally pays off her credit card in full but, occasionally, will pay the minimum when she is short of cash
18.2 c) Megan, who always pays off her credit card bill in full shortly after she receives it
48.0 d) Erin, who only pays the minimum amount each month.*
29. Which of the following statements is true?
53.7 a) Banks and other lenders share the credit history of their borrowers with each other and are likely to know of any loan payments that you have missed.*

14.8 b) People have so many loans it is very unlikely that one bank will know your history with another bank
18.8 c) Your bad loan payment record with one bank will not be considered if you apply to another bank for a loan.
12.7 d) If you missed a payment more than 2 years ago, it cannot be considered in a loan decision.

30. Dan must borrow $12,000 to complete his college education. Which of the following would NOT be likely to reduce the finance charge rate?
32.5 a) If he went to a state college rather than a private college. *
19.2 b) If his parents cosigned the loan.
28.8 c) If his parents took out an additional mortgage on their house for the loan.
19.5 d) If the loan was insured by the Federal Government.
31. If you had a savings account at a bank, which of the following would be correct concerning the interest that you would earn on this account?
40.6 a) Earnings from savings account interest may not be taxed.
27.3 b) Income tax may be charged on the interest if your income is high enough.*
17.8 c) Sales tax may be charged on the interest that you earn.
14.3 d) You cannot earn interest until you pass your 18th birthday.

Appendix B: Classification Questions Parts 32 - 49

Note: Numbers in Bold at Left are Mean Scores
Numbers not in Bold, to Right of Bold Numbers, are Percent in Sample

32.Does your family rent or own your home?

Score %

44.0 22.7 a)Rent

49.7 77.3 b)Own

33.What is your gender?

49.0 44.7 a) Male

48.0 55.3 b) Female

34.What are your educational plans after high school?

34.9 2.2 a) No further education is planned.

44.6 18.7 b) Attend a 2-year college or junior college.

50.9 67.2 c) Attend a 4-year college oruniversity.

44.2 6.8 d) Other plans for training or education.

39.2 5.1 e) Don't know.

35.What is your best estimate of your parents' total income last year? Consider annual income from all sources before taxes.

43.4 10.7 a) Less than $20,000.

47.3 20.1 b) $20,000 to $39,999.

50.3 26.5 c) $40,000 to $79,999.

52.3 23.0 d) $80,000 or more.

44.8 19.7 e) Don't know.

36.How do you describe yourself?

52.5 55.0 a) White or Caucasian.

41.3 13.6 b) Black or African-American.

45.1 20.1 c) Hispanic American.

47.2 3.7 d) Asian-American.

37.7 2.2 e) American Indian, Alaska Native, or Native Hawaiian

41.1 5.4 f) Other.

37.What is the highest level of schooling your father or mother completed?

44.2 11.5 a) Neither completed high school

47.2 24.4 b) Completed high school.

49.0 21.6 c) Some college.

51.4 36.8 d) College graduate or more than college.

36.9 5.9 e) don't know.

38.What type of work do you intend to do when you finish school?

36.9 2.8 a) Manual work such as truck driver, laborer, farm worker.

43.8 6.5 b) Skilled trade such as plumber, electrician.

44.6 12.1 c) Service worker such as secretary, food service worker, office worker, police officer, firefighter.

51.7 48.6 d) Professional worker such as nurse, computer programmer.

46.6 30.0 e) Other or don't know.

39.When you start to work full-time, after you finish your education, how much do you expect to make per year before deductions for taxes and other items?

38.5 3.4 a) Under $15,000.

42.2 6.7 b) $15,000 to $19,999.

46.8 10.6 c) $20,000 to $29,999.

50.7 20.5 d) $30,000 to $39,999.

50.2 41.6 e) 40,000 or more.

46.4 17.2 f) Don't know.

40.Whose credit card do you use.

44.2 14.9 a) My own.

45.9 14.2 b) My parents'.

45.2 5.6 c) Both my own and my parents'.

50.1 65.3 d) None, I don't use a credit card.

41.How do you use your debit (or ATM) card?

49.9 40.6 a) For getting cash from an ATM and for buying things directly.

45.4 12.6 b) For getting cash from an ATM only.

47.8 46.7 c) I don't have a debit card.

42.Which of the following best describes your automobile driving?

46.0 26.8 a) I don't have a driver's license.

42.6 4.3 b) I have a driver's license, but no car in the family that I can drive.

44.2 4.9 c) I drive the family car, which is used by others, and help pay for the insurance.

50.9 12.7 d) I drive the family car, which is used by others, and don't help pay for the insurance.

49.7 21.5 e) I drive my own car and help pay for the insurance.

50.0 29.9 f) I drive my own car and don't help pay for the insurance.

43.How would you describe your employment history?

48.8 24.5 a) I work full time in the summers and part time during the school year.

48.6 6.3 b) I work full time in the summers and don't work during the school year.

48.9 33.8 c) I work part time in the summers and part time during the school year.

48.9 11.8 d) I work part time in the summers and don't work during the school year.

46.6 23.6 e) I have never been formally employed outside the home.

44.What kind of bank account do you have?

43.7 24.9 a) I don't have a bank account.

49.7 29.1 b) I have a savings account but no checking account.

49.1 11.8 c) I have a checking account but no savings account.

50.3 34.3 d) I have both a savings and a checking account.

45.Which of the following is true about your ownership of stocks and mutual funds (circle **all** that apply)?

49.1 73.0 a) I own no stocks or mutual funds.

47.1 7.8 b) I own stocks in my own name.

48.8 8.8 c) I own stocks in my parents' name.

47.7 6.0 d) I own mutual funds in my own name.

47.7 6.3 e) I own mutual funds in my parents' name.

46.What is your high school class level?

48.3 100 a) Senior

47.Which of the following classes have you had in high school (circle **all** that apply)?

47.5 21.4 a) An entire course in money management or personal finance.

48.9 26.2 b) A portion of a course where at least a week was focused on money management or personal finance.

48.8 44.7 c) An entire course in economics.

49.4 23.7 d) A portion of a course where at least a week was focused on economics.

51.0 24.0 e) A course in which we played a stock market game.

48.If you have taken a full semester course in money management or personal finance, did you take it as a:

47.1 52.4 a) Senior

48.5 26.1 b) Junior

49.2 12.7 c) Sophomore

44.7 8.8 d) Freshman

49.Approximately what was your **total** score on the college entrance exam?

45.5 10.4 a) SAT under 1,500

54.1 17.3 b) SAT 1,500 to 2,000

52.2 4.3 c) SAT over 2,000

43.3 10.7 d) ACT under 20

51.3 17.4 e) ACT 21-26

58.8 5.9 f) ACT 27 or higher

44.0 34.5 g) I didn't take a college entrance exam or don't remember my score

Appendix C: Amortization Payments Calculated Mathematically

A loan of *P* dollars at interest rate *i* per period may be amortized in *n* equal periodic payments of *R (monthly payment)* dollars made at the end of each period, where

$$\boldsymbol{R = \frac{Pi}{1-(1+i)^{-n}}}$$

for example, a 15-year mortgage for $220,000 carrying an interest rate of 3.5%.

$$\boldsymbol{R = \frac{220000 * \frac{.035}{12}}{1-(1+\frac{.035}{12})^{-180}} = \$1572.74}$$

Now calculate the balance due of a loan after *x* payments. By solving the equation above for *P (present value):* $\boldsymbol{P = \frac{R(1-(1+i)^{-(n-x)})}{i}}$

$$\boldsymbol{P = \frac{1572.74(1-(1+\frac{.035}{12})^{-(180-90)})}{\frac{.035}{12}} = \$124{,}334.38}$$

as with the tasks, note the balance due after half of the payments are made is greater than $110,000 which is half of what is borrowed.

Appendix D: Exposure To Consumer and Financial Education

Retrieved from Bernheim, Garrett and Maki (2001, p. 445)

Independent Variable	(1) Median regression	(2) Percentile rank, OLS	(3) Median regression	(4) Percentile rank, OLS	(5) Median regression	(6) Percentile rank, OLS	(7) Median regression	(8) Percentile rank, OLS	(9) Median regression	(10) Percentile rank, OLS
Constant	-2.00	9.96	-1.97	6.28	-2.09	5.76	-1.99	6.08	State	State
	(0.71)	(7.22)	(0.68)	(7.25)	(0.69)	(7.25)	(0.73)	(7.25)	constants	constants
State ever imposed mandate	-0.205	-1.29	-0.297	-1.79	-0.316	-1.88	-0.266	-1.86		
	(0.341)	(2.64)	(0.316)	(2.63)	(0.303)	(2.62)	(0.306)	(2.62)		
Exposed to mandate	1.02	9.09	1.15	9.00						
	(0.475)	(4.05)	(0.50)	(4.03)						
Exposed to mandate * parents not frugal					1.26	13.8	1.41	19.7	0.690	9.78
					(0.55)	(4.7)	(0.87)	(6.2)	(0.517)	(5.16)
Exposed to mandate * frugal parents					0.272	1.51	0.265	7.00	0.135	-1.45
					(0.861)	(5.63)	(0.946)	(6.77)	(0.723)	(5.87)
Years since mandate							-0.036	-1.07		
							(0.103)	(0.74)		
Frugal parents			0.692	7.27	0.781	8.63	0.766	8.60	0.516	7.69
			(0.266)	(2.07)	(0.280)	(2.19)	(0.296)	(2.18)	(0.264)	(2.23)
Married	-0.159	-1.99	-0.262	-1.85	-0.125	-1.82	-0.168	-1.79	-0.301	-2.46
	(0.283)	(2.11)	(0.276)	(2.10)	(0.274)	(2.10)	(0.255)	(2.10)	(0.257)	(2.13)
College educated	0.038	3.13	-0.109	2.12	-0.127	2.30	-0.143	2.45	0.015	2.04
	(0.218)	(2.03)	(0.213)	(2.04)	(0.216)	(2.04)	(0.213)	(2.04)	(0.224)	(2.10)
Age/10	0.824	9.27	0.814	9.79	0.841	9.83	0.296	9.73	0.775	9.16
	(0.180)	(1.78)	(1.65)	(1.77)	(0.172)	(1.77)	(0.179)	(1.77)	(0.161)	(1.82)
Total earnings/10^5	0.771	5.30	0.811	5.07	0.632	4.95	0.857	4.97	0.714	4.76
	(0.426)	(1.67)	(0.442)	(1.66)	(0.442)	(1.66)	(0.415)	(1.66)	(0.414)	(1.70)
Observations	911	911	911	911	911	911	911	911	911	911

Standard errors are in parentheses. For median regressions, standard errors are bootstrapped based on 500 replications.

Appendix E: Invoice Used in PISA 2012 To Serve As Basis For Assessing Student Knowledge Based On A Real-Life Environment

INVOICE

Sarah receives this invoice in the mail.

BC

Breezy Clothing

Invoice
Invoice Number: 2034
Date issued: 28 February

Sarah Johanson
29 Worthill Rd
Kensington
Zedland 3122

Breezy Clothing
498 Marple Lane
Brightwell
Zedland 2090

Product code	Description	Quantity	Unit cost	Total (excluding tax)
T011	T-shirt	3	20	60 zeds
J023	jeans	1	60	60 zeds
S002	scarf	1	10	10 zeds

Total Excluding Tax:	130 zeds
Tax 10%:	13 zeds
Postage:	10 zeds
Total Including Tax:	153 zeds
Already Paid:	0 zeds
Total due:	153 zeds
Date due:	31 March

Figure 6.1. Invoice.

Appendix F: INVOICE QUESTIONS

Invoice - Question 1

Why was this invoice sent to Sarah?

A. Because Sarah needs to pay money to Breezy Clothing.
B. Because Breezy Clothing needs to pay money to Sarah.
C. Because Sarah paid money to Breezy Clothing.
D. Because Breezy Clothing has paid money to Sarah.

Question type: *Multiple choice*
Description: *Recognize the purpose of an invoice*
Content: *Money and transactions*
Process: *Identify financial information*
Context: *Individual*
Difficulty: ***360 (level 1)***

Invoice - Question 2

How much has Breezy Clothing charged for delivering the clothes?

Question type: *Constructed response*
Description: *Identify the cost of postage on an invoice*
Content: *Money and transactions*
Process: *Identify financial information*
Context: *Individual*
Difficulty: ***461 (level 2)***

Invoice – Question 3

Sarah notices that Breezy Clothing made a mistake on the invoice.
Sarah ordered and received two T-shirts, not three.
The postage fee is a fixed charge.
What will be the total on the new invoice?

Question type: *Constructed response*
Description: *Find a new total on an invoice, taking into account several factors (or demonstrate process required*)
Content: *Money and transactions*
Process: *Apply financial knowledge and understanding*
Context: Individual
Difficulty: *Full credit:* ***660 (Level 5)****; Partial credit:* ***547 (Level 3)***